TORONTO SHELTER & SUPPORT SERVICES
4222 KINGSTON ROAD

FOR

CITY OF TORONTO

ISSUED FOR TENDER
03 SEPTEMBER 2024

TABLE OF CONTENTS

26 05 34	Conduits, Conduit Fastenings and Conduit Fittings
26 05 36	Cable Trays for Electrical Systems
26 05 37	Wireways and Auxiliary Gutters
26 05 43.01	Installation of Cables in Trenches and Ducts
26 05 73	Short Circuit Coordination Study & Arc Flash Risk Assessment
26 09 23.01	Metering and Switchboard Instruments
26 12 16.01	Dry Type Transformers up to 600V Primary
26 23 00	Low Voltage Switchgear
26 24 16.01	Panelboards Breaker Type
26 27 16	Electrical Cabinets and Enclosures
26 27 26	Wiring Devices
26 28 13.01	Fuses – Low Voltage
26 28 16.02	Molded Case Circuit Breakers
26 28 23	Disconnect Switches – Fused and Non-Fused

Division 31

31 05 16	Aggregate Base Courses
31 11 00	Site Clearing
31 22 13	Rough Grading
31 23 33	Excavation Trenching and Backfill
31 32 19.16	Geotextiles

Division 32

32 14 29	Rubber Surface Paving
32 16 13	Cast-In-Place Concrete for Sidewalks and Curbs
32 31 19	Decorative Metal Fences
32 33 00.01	Play Equipment
32 37 00	Exterior Site Furnishings

Division 33

33 40 00	Surface Drainage Systems
33 41 16	Subdrainage Piping

1 General

1.1 DESCRIPTION OF WORK INCLUDES

.1 Work under this Contract covers the following:

Work includes, but is not limited to:

- New ceilings & lighting, floor finishes, millwork and corporate furniture in Area 1 – Offices. Area 1 construction phasing by contractor.
- New commercial kitchen, enclosed offices, enclosed computer area, toddler playroom, millwork and furniture in Area 2 - Family Resource Centre
- New plumbing, drainage, HVAC and controls in Area 1 – Offices & Area 2 - Family Resource Centre
- New service and distribution, lighting and devices in Area 1 – Offices & Area 2 - Family Resource Centre
- New fence, playground equipment and rubberized flooring, bike racks, planting and outdoor furniture in Area 3 - Landscape

1.2 RELATED SECTIONS

SECTION		# PAGES
01 11 00	Summary of Work	7
01 14 00	Work Restrictions	3
01 21 00	Allowances	2
01 25 00	Alternatives and Substitutions	3
01 26 00	Contract Modification Procedures	2
01 29 00	Payment Procedures	1
01 31 13	Coordination	2
01 32 00	Construction Progress Documentation	3
01 33 00	Submittal Procedures	3
01 40 00	Quality Requirements	2
01 51 00	Temporary Utilities	2
01 52 00	Temporary Construction Facilities	1
01 56 00	Temporary Barriers and Enclosures	1
01 61 00	Common Product Requirements	1
01 71 00	Examination and Preparation	1
01 73 00	Execution	2
01 73 29	Cutting and Patching	2
01 74 00	Cleaning and Waste Management	2
01 77 00	Close Out Procedures	2
01 78 00	Close Out Submittals	2
01 79 00	Demonstration and Training	1
01 91 00	General Commissioning Requirements	1

1.3 CONTRACTS

.1 Construction Work under single Construction Agreement Contract and Supplemental Conditions if applicable.

1.4 GENERAL REQUIREMENTS

.1 The requirements of the Articles of Agreement, Conditions of the Contract, Division 1 apply to and form all Sections of the Contract Documents and the Work.

.2 Work in this Specification is divided into descriptive sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and their Subcontractors. The Contractor is responsible for organizing division of labour and supply of materials essential to complete the Contract. The Consultant assumes no liability to act as an arbiter to establish subcontract limits between Sections or Divisions of Work.

.3 Specifications, Schedules and Drawings are complementary and items mentioned or indicated on one may not be mentioned or indicated on the others.

.4 Contractor shall be responsible for materials, products, operations, or methods mentioned in the specifications or indicated on the drawings and shall provide to the quality or subject to the qualifications noted. Perform, according to the conditions stated, each operation prescribed and provide labour, materials, products, equipment and services to complete the Work.

.5 Where the singular or masculine is used in the Contract Documents, it shall be read and construed as if the plural, feminine or neuter had been used when the context or the statement so requires and as required to complete the Work, and the rest of the sentence, clause, paragraph, or Article shall be construed as if all changes in grammar, gender or terminology thereby rendered necessary had been made.

.6 The terms “exposed” or “exposed to view” refers to surfaces that are within the line of vision of persons from any accessible viewpoint, both within and without the building. Where any part of a surface is exposed to view, all other portions of that surface shall also be considered as exposed to view.

1.5 WORK SEQUENCE

.1 Cooperation with The Owner in scheduling operations to minimize conflict and to facilitate The Owner’s ongoing usage.

.2 All of the Work is to proceed to the schedule submitted by the awarded Construction Manager (hereby referred to as the Contractor or GC) and accepted by the Owner. The Contractor’s schedule will recognize the following restrictions:

.1 The Contractor must perform their activities respecting the requirements set forth in the specifications Division 01 - Section 01 11 00 “Summary of Work” and will safeguard the operations of The Owner. All services are to be left in good repair and operating while the Work is undertaken.

.2 Safe access through the intended Project access route and fire/emergency routes must be maintained. Throughout the construction period, the Contractor is to include for any hoarding, covered walkway, etc., necessary for this purpose. The construction activities are to be scheduled so as to minimize any complete shutdown of the manufacturing/production and delivery areas.

1.6 CONTRACTOR’S USE OF PREMISES

.1 The Contractor shall maximize use of premises as much as possible to allow for:

.2 Assume full responsibility for protection from construction hazards of The Owner’s staff at all times when they are on the site.

.3 Assume full responsibility for the protection of the existing buildings, systems and services, and utilities from damage due to the Work of the Contractor or any Subcontractors employed on the site. After obtaining the approval of the

Consultant, make good all damage to Owner's satisfaction and at no cost to Owner.

.4 Site storage:

.1 Allocate an area on site within the limits of the Work acceptable to The Owner for storage of Products brought to the site by all trades. Materials and equipment to be stored on site in storage containers (i.e. C Can Containers) or on site in a weatherproof storage enclosure.

.2 Do not encumber site with materials or equipment items are stored on site.

.3 Keep storage area tidy at all times and do not use other parts of the property for storage.

.4 Assume full responsibility for protection and safekeeping of products stored on premises.

.5 Move any stored products or equipment which interfere with operations of The Owner at no cost to the Owner.

.5 Refer to Section 01 14 00 for additional work restrictions relevant to the Work.

1.7 DOCUMENTS AT THE SITE

.1 Keep the following documents on Site, stored securely and in good order and available to The Owner and Consultant in hard copy:

.1 Current Contract Documents, including Drawings, Specifications and addenda.

.2 Change Orders, Change Directives, and Supplementary Instructions.

.3 Reviewed Shop Drawings, Product data and samples.

.4 Field test reports and records.

.5 Construction progress schedule.

.6 Meeting minutes.

.7 Manufacturer's certifications.

.8 Permits, inspection certificates and other documents required by authorities having jurisdiction.

.9 Current as-built drawings.

.10 Material Safety Data Sheets (MSDS) for all controlled Products.

1.8 OCCUPANCY AND USE OF PREMISES

.1 The Contractor and all Subcontractors are expected to understand that all areas of the building remain occupied during the Work and that the Work is to be executed in such a manner as to provide the minimum interference with the partial use of the premises by the occupants, and the maximum safety of the occupants during the Work. The Contractor and all Subcontractors will take reasonable measures for the control of noise during working hours.

.2 The Contractor shall maintain normal building operation and traffic flow, with minimum inconvenience from noise and dust to the tenants of the facilities.

.3 The Contractor shall organize the work at each facility so as to minimize any disruption in the ordinary use of the facility by the tenants, ensure minimum interference with the occupation, use and enjoyment of the facility by the tenants and minimize any reduction in comfort at the facility.

.4 All noise and vibration generating operations, such as jack hammering, drilling, compacting and the use of other such equipment, that will interfere with the occupied portions of the building shall be confined to the hours as stipulated in Section 01 14 00.

.5 The Work shall be confined to the area defined on the drawings except that services connections, sanitary and storm connections, and certain portions of landscaping, hard paving and curb work shall be executed on Municipal property under regulations of authorities having jurisdiction

.6 It is essential that the existing building be maintained weather tight at all times. The Contractor shall therefore furnish all temporary protection, enclosures, tarpaulins, etc., as may be required to weatherproof any openings made by the Work. The Contractor and all Subcontractors must seal off or temporarily dam all open roof edges, etc. to prevent any water present on existing roof areas, from entering the occupied floor(s).

.7 The Contractor is to ensure that throughout the duration of the construction, the Owner's power requirements must not be affected by the service of the construction. Provide at minimum, 7 business day advance notice there is any planned utilities shut down in accordance with requirements of Section 01 14 00.

1.9 SETTING OUT

.1 Be responsible for setting out the Work. Prior to setting out the Work, verify dimensions and elevations shown on the Contract Documents and report to Consultant any unsatisfactory conditions that may adversely affect the proper completion of the Work.

.2 Accurately set out the Work from levels and lines. Where Work of this Contract is dependent upon grades and elevations of existing structures or facilities, such grades or elevations shall take precedence over those determined by reference to established elevations. Advise Consultant of any discrepancies.

.3 During any activity of the Work, layout and check all features, including but not limited to the following:

.1 Establish and maintain temporary bench marks set required to perform the Work..

.2 Provide general dimensions, lines and elevations required to perform the Work.

1.10 BUILDING DIMENSIONS

.1 Report any inconsistencies, ambiguities, discrepancies, omissions, and errors between Site conditions and Contract Documents to Consultant prior to the commencement of Work. If inconsistencies, ambiguities, discrepancies, omissions, and errors are not reported and clarified, the most stringent requirement shall govern, as determined by Consultant.

.2 Check all dimensions at the site before fabrication and installation commences and report discrepancies to the Consultant.

.3 Where dimensions are not available before fabrication commences, ensure that dimensions required are agreed upon between the parties concerned.

.4 Prior to commencing work, ensure that clearances required by jurisdictional authorities can be maintained.

.5 Ensure that the necessary job dimensions are taken and Subcontractors are coordinated for the proper execution of the Work. Assume complete responsibility for the accuracy and completeness of all dimensions, and for coordination of all elements of the Project.

.6 Verify that the Work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearance to adjacent Work, as set out by requirements of the Contract Documents, and ensure that Work installed in error is rectified without extra cost to the Owner before construction continues.

.7 Verify dimensions of shop fabricated portions of the Work at the site before shop drawings and fabrications are commenced. The Owner will not accept claims for extra expense by reason of non-compliance with this requirement.

.8 Check and verify dimensions referring to Work and interfacing of services. Dimensions, when pertaining to the Work of other Sections (Subcontractors), shall be verified with the Section (Subcontractor) concerned. Ensure that Subcontractors performing various Sections cooperate for the proper performance of the Work.

.9 Do not scale directly from the Drawings. If there is ambiguity or lack of information, immediately inform Consultant. Any change through the disregarding of this clause shall be the responsibility of the Contractor.

.10 All details and measurements of any Work which is to fit or conform to Work installed shall be taken at the site.

.11 Leave areas clear where space is indicated to be reserved for future equipment, including access to such future equipment.

.12 Whether shown on the Drawings or not, leave adequate space and provision for servicing of equipment and removal and reinstallation of replaceable items such as motors, coils and tubes as recommended by equipment manufacturer.

1.11 EXISTING SITE CONDITIONS

.1 Make a careful examination of the site and investigate and be satisfied as to all matters relating to the nature of the Work to be undertaken, as to the means of access and egress thereto and therefrom, as to the obstacles to be met with, as to the extent of the Work to be performed and any and all matters which are referred to in the Contract Documents. Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection prior to tender closing.

.2 Report any inconsistencies, ambiguities, discrepancies, omissions, and errors between Site conditions and Contract Documents to the Consultant prior to the commencement of Work. If inconsistencies, ambiguities, discrepancies, omissions, and errors are not reported and clarified, the most stringent requirement shall govern, as determined by the Consultant.

1.12 SUPPLEMENTARY DEFINITIONS

.1 In the Specifications, references such as “shown on the Drawings”, “specified”, “scheduled”, “called for” and the like shall be deemed to include work required by any of the Contract Documents.

.2 In the Specifications the expression Section(s) is synonymous with Subcontractor(s) if the context permits. The expression “all Sections” shall be deemed to include the Contractor.

1.13 EXAMINATION

.1 Each Section (Subcontractor) shall examine surfaces prepared by other Sections (Subcontractors) which affect its work and shall ensure that defects are corrected. Commencement of Work shall imply acceptance of prepared Work.

.2 All Sections (Subcontractors) shall check and verify with the Contractor all dimensions, especially those pertaining to work of more than just their Section (Subcontractors work).

.3 All details and measurements of any work which is to fit to, or conform with, work already installed by other Sections (Subcontractors, shall be taken at the job site by the Sections (Subcontractors) concerned.

1.14 SUPPLY AND/OR INSTALLATION

.1 Unless the word “only” suffixes “supply” or “install” or other variations of those words according to the Section wherein they are used, it is the express intent of this Contract that “supply and install” is implied.

.2 Unless otherwise specified, Work shall be installed in accordance with the manufacturer’s printed directions and recommendations.

1.15 SATISFACTION / APPROVAL

.1 The expression “to the satisfaction or approval of The Owner” shall be implied throughout the Specifications in regard to all materials and workmanship.

.2 “Submit for approval” means that the item in question is to be submitted to The Owner for approval and that a written acceptance of it is authorization for its use in the Work shall be obtained before it is incorporated in the Work. Sections (Subcontractors) shall submit items for approval to The Owner via the Contractor.

.3 The terms “approved”, “review”, “reviewed”, “accepted”, “acceptance”, “acceptable”, “satisfactory”, “selected”, “directed”, “instructed”, “required”, “submit”, “permitted”, “approved alternative”, “approved equal”, or similar words or phases are used in standards or elsewhere in Contract Documents, it shall be understood, that words “by (to) The Owner” follow, unless context provides otherwise.

.4 The term ‘or approved alternate’ or similar language following a list of products, systems, or manufacturers used in the Contract Documents shall be construed to mean approved by Consultant. Specified products to be Base Bid. Contractor to follow substitution procedures specified in this Section for submitting proposed products, systems, and manufacturers and obtain Consultant’s approval of the same prior to proceeding with ordering proposed products and systems or engaging manufacturers. Contractors who purchase products and systems or engage manufacturers prior to Consultant’s review and acceptance do so at their own risk.

.5 An “approved method” means that which has the manufacturer’s recommendation or which is generally accepted as good trade practice.

1.16 EXISTING SERVICES

.1 The Contractor is responsible for ensuring all “Existing Services” (including but not limited to structural elements, water pipes, drains, electrical cables and fixtures, communications cables and fixtures, security cables and fixtures, HVAC ducting, cables and fixtures, etc.) are not interrupted and / or damaged by the construction work. The Contractor must take all precautions to ensure that services buried underground or contained in a floor or contained in other elements are identified on the drawings provided by The Owner and have been clearly identified on the Work Site.

.2 The Owner will not be liable for any loss, damage, delay or claim whatsoever resulting or arising from the absence in whole or part of services not shown on drawings.

1.17 EMERGENCIES

.1 Notify The Owner's Project Team immediately should an emergency arise on the Site, including personal injuries and accidents. This notification shall be by telephone or email immediately after the occurrence.

.2 Provide an incident report including complete details on extent of emergency, cause and the action being taken.

1.18 FIELD MARKING

.1 Do not use wick pen to mark face of products to be installed in the Work. Such pen marks will show through applied paint or vinyl coatings and the like in due course. The Contractor will be held responsible and required to remedy such defects, classified as "latent defects" regardless of when they occur.

1.19 SECURITY

.1 Be responsible for security of all areas affected by Work of this Contract until taken over by The Owner. Take steps to prevent entry to the Work by unauthorized persons and guard against theft, fire and damage by any cause. Provide safe and secure access to and egress from existing premises at all times.

.2 Take acceptable precautions to guard Work site, premises, materials and the public during and after working hours due to the Work of this Contract.

END OF SECTION

1 GENERAL

1.1 NORMAL BUSINESS HOURS

.1 The building is occupied and is to be considered “fully operational” from 6am Monday to 6am Friday, 24 hours per day. Contractor to confirm with operator.

1.2 PROJECT DELIVERIES

.1 All deliveries are to be communicated to The Owner’s Staff for coordination purposes.

1.3 NOISY, PAINTING, GLUING, SUBSTANCES WITH VOC’S AND / OR STRONG ODOURS AND TARING (SEALANTS, ROOFING, ETC.)

.1 The Contractor shall minimize any reduction in comfort at the facility.

1.4 PARKING

.1 The existing 3 parking spaces on site will be available to the Contractor. Location of parking spaces will be confirmed with Owner.

.2 Determine and make arrangement as required for loading and unloading of equipment and products at times that will not affect public traffic flow and that will be permitted by the City of Toronto. Conform to City by-laws with regard to parking restrictions and other conditions.

1.5 SITE PROTECTION

.1 Dust barriers must be used at all times during dusty work. Poly sheet dust barriers are to be sealed tight to floor and ceiling and / or to the filter mediums on return air grills etc.

.2 Clean up after all work must be performed immediately and the area(s) are to be left in a clean and safe manner. Failure to clean properly may result in the Contractor being charged for cleaning services obtained by the Building Management and the Building Management may terminate the Contractor’s access.

1.6 ADVANCE NOTIFICATION

.1 Seven (7) business days advance notification is required for any work affecting the building occupants such as the following:

- .1 Mold remediation (removal) work / asbestos abatement (removal) work.
- .2 Scanning and core drilling.
- .3 Notification of start time for painting.
- .4 Notification of exterior work.
- .5 Notification of any building system shutdown (i.e. power, water, etc.).
- .6 Notification of any loss of use area (i.e. washroom shutdown, lunchroom, etc.).

1.7 BREAKER PANELS

.1 Electrical panels must not be touched without first informing and obtaining written permission from Consultant and the Building Management.

.2 Whenever electrical power is shut off the Contractor must “Lock Out” and “Tag Out” any electrical panels or electrical breakers affected.

.3 Panel schedules to be updated each time a change to it is made.

1.8 DOORS

.1 For security purposes the building doors are to be close at all times.

.1 Exit doors must not be propped open for any reason.

.2 All fire doors must be kept closed at all times.

1.9 PROTOCOL FOR SCANNING, CORE DRILLING

.1 Prior to starting the scan work the contractor hired to carry out the work must provide a copy of their health and safety plan to The Owner.

.2 The plan must include a copy any of required license(s), a description of the process to be used and any information needed to design safety limits of the work zone. In addition, the plan must include a process to protect the work zone from inadvertent entry, a list of potential hazards that may be encountered by the workers, training and / or instruction that the workers have received to address the hazards and a contingency plan in case of an emergency.

.3 X-Raying is not allowed without prior authorization.

1.10 CORE DRILLING

.1 If dry core drilling will be performed appropriate dust control measure must be identified and used. If wet core drilling will be performed, water control measures must be identified and must be used.

.2 Before commencing the core drilling operation, the Contractor must ensure that it is safe to start drilling. The area must be secured, dust controls are in place, the equipment is set up as intended by the manufacturer, and all safety devices are present and functioning. The location selected to perform the core drilling must be appropriate and will not impact on the structural integrity of the building. The intended path of the coring unit must be free of all embedded power or communication wires, conduits, rebar, pipes and / or structures that could be damaged or disabled.

.3 All sources of asbestos are not to be disturbed. If this is not possible, the appropriate precautions must be taken to prevent the asbestos from becoming airborne which may include the use of either, a type 1, type 2 or type 3 process to comply with the asbestos designated substance regulations O. Reg 838 as am. O. Reg 510/92.

.4 All coring debris must be cleaned up and disposed of and the site returned to its original state after the coring is completed.

.5 If the coring debris contains asbestos, it must be cleaned up following the requirements of the designated substance specifications included in the Contract Documents.

1.11 DESIGNATED SUBSTANCES

.1 Handling and removal of any designated substances shall follow all applicable legislative requirements. Refer to project specific Designated Substances Report.

1.12 MAINTANING LIFE SAFETY SYSTEMS IN OCCUPIED FACILITIES

.1 Maintain operational life safety systems and public access to exits in occupied areas during all stages of the Work.

.2 Determine nature and exact locations of existing fire and smoke sensors prior to the commencement of the Work. Avoid direct or indirect jarring while working in adjacent areas and exercise caution to avoid triggering these devices.

.3 Be responsible for costs incurred by Owner on account of false fire alarms activated as a result of the execution of the Work, without adequate precautions.

1.13 PROJECT CONDITIONS, GENERAL

.1 Most of the project will be performed during regular business hours in an operational business setting. Areas will be occupied during normal business hours. At end of each shift, broom clean and leave areas clean and in normal working condition.

.2 All items removed shall be replaced / returned / reinstalled during same shift.

.3 The Contractor shall not be responsible for moving furniture and equipment in areas of Work unless specifically specified in the Scope of Work. The Contractor shall be responsible for repairs or replacements of any damaged furniture.

.4 The Contractor shall cooperate / coordinate with moving contractors retained by St. Fleix, and / or agencies.

1.14 CONTINUITY OF SERVICE

.1 Where equipment and systems are normally required to operate through the course of the Work, notify The Owner at least 2 weeks prior to the necessary interruption of mechanical or electrical service throughout course of Work

.2 Keep duration of interruptions to a minimum not to exceed 4 hours. Interruptions lasting longer than 4hrs will require approval from the Owner.

END OF SECTION

1.1 CASH ALLOWANCES

.1 Refer to the Construction Agreement Contract Paragraph GC 6.1 Cash Allowances

.2 Progress payments for Work and Products authorized under allowances will be made in accordance with the payment terms set out in Conditions of the Contract.

.3 Progress payments on accounts of Work authorized under cash allowances shall be included in the Consultant's monthly certificate for payment.

.4 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation where indicated, and other authorized expenses incurred in performing the Work. Cash allowances shall not be included by a Subcontractor in the amount for their Sub-contract work.

.5 Supply only allowances shall include:

.1 Net cost of products.

.2 Delivery to Site.

.3 Applicable taxes and duties, excluding HST.

.6 Supply and install allowances shall include:

.1 Net cost of products.

.2 Delivery to Site.

.3 Unloading, storing, handling or products on Site.

.4 Installation, finishing and commissioning of products.

.5 Applicable taxes and duties, excluding HST.

.6 The 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.

.7 Inspection and testing allowances shall include:

.1 Net cost of inspection and testing services.

.2 Applicable taxes and duties, excluding HST.

.8 Other costs related to work covered by cash allowances are not covered by the allowance but shall be included in the Contract Price.

.9 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.

.10 The , through Consultant, may request Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.

.11 Submit, before application for final payment, copies of all invoices and statements from suppliers and Subcontractors for work which has been paid from cash allowances.

.12 The Owner, through the Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain The Owner’s prior written approval in the form of a Cash Allowance Disbursement Authorization (CADA) before entering into a subcontract, amending an existing subcontract, or performing own forces work included in a cash allowance. Upon issuance of the CADA, the Contractor’s responsibilities for a cash allowance item shall be the same as for work of the Contract.

.13 The “Cash Allowances” expected and the amount of each allowance is listed on the Rate Bid Form included in the Bid package.

END OF SECTION

1 GENERAL

1.1 ALTERNATIVES AND SUBSTITUTIONS

.1 Refer to the Rate Bid Form included in the Bid package - Alternate Prices.

.2 Requests for substitutions will not be accepted prior to the Notification of Award. Where the Specifications include the “or approved alternate” clause, substitutions will be considered by The Owner and Consultant provided that:

.1 The materials and / or products specified are not available.

.2 Substitute products to those specified, which are brought to the attention of, and considered by Project Team after the Contract Award as "equivalent" to those specified will result in a credit to the Contract Price.

.3 Substitute products to those specified which are brought to the attention of, and considered by Project Team after the Contract Award as "superior" to those specified will result in a change to the Contract Price.

.4 The proposed substitutions have been investigated and complete data are submitted in accordance with the Specifications. Proposed substitutions to show the material and product names and complete data and specifications and state what difference, if any, will be made to the Contract Price for each substitution, should it be accepted.

.5 Data relating to changes in the Contract Schedule, if any, and relation to other Work have been submitted.

.6 Same warranty is given for the substitution as for the original product specified.

.7 All claims are waived for additional costs related to the substitution which may subsequently arise. Installation of the accepted substitution is coordinated into the Work and that full responsibility is assumed when substitutions affect other work. Make any necessary changes required to complete the Work. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.

.8 Should the proposed substitution be accepted either in part or in whole, the Contractor will assume full responsibility when the substitution affects any other work or work of other Sections (Subcontractors). Drawing changes required as a

.9 result of the substitution will be executed by the Consultant at the Contractor's expense.

.10 Proposed substitutions must satisfy all design conditions and other specified requirements. Properties included but not limited to the following as applicable, will be considered:

.1 Physical dimension requirements must satisfy the space limitations,

.2 Static and dynamic weight limitations,

.3 Structural properties,

.4 Audible noise levels,

.5 Vibration generation,

.6 Interchangeability of parts and / or components,

.7 Accessibility for maintenance,

.8 Possible removal or replacement,

.9 Colours,

.10 Textures,

.11 Compatibility with other materials, products, assemblies and components.

.3 Substitutions to methods or process described in the Specifications or drawings, may be proposed for the consideration of the Consultant.

.4 Ensure that such substitutions are in accordance with the following requirements:

.1 Time spent by the Consultant in evaluating the substitution shall not be the basis for a claim by the Contractor for extensions;

.2 Clearly indicate how the proposed substitutions would be advantageous to the Owner or in the opinion of the Contractor would improve the operation of the installation;

.3 The cost of all changes in the work of Other Contractors, necessitated by the substituted methods or processes, if accepted, is borne by the Contractor;

.4 The substituted methods or processes fit into space allotted for the specified methods or processes. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.

.5 Substitutions will not be considered if:

.1 They are indicated or implied on shop drawings or product data without formal request;

.2 Acceptance will require substantial revision of the Specifications and Drawings.

.3 Contractor fails to order a specified Product or order a Product by a specified manufacturer in adequate time to meet Contractor's construction schedule

.6 Do not substitute products or methods or processes into the Work unless such substitutions have been specifically approved for the Work by the Consultant.

.7 Approved substituted products shall be subject to Consultant's sole discretion. Approved substituted products shall only be installed after receipt of the Consultant's written approval.

.8 The cost of changes in the Work of a Contractor necessitated by the use of proposed material and / or product substitution is to be borne by the Contractor proposing the substitution.

.9 The Contract Price will be adjusted accordingly to any and all credits arising from the substitutions mentioned above.

1.2 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 warrant) 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 summarized 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.

1.3 METHODS OR PROCESSES SUBSTITUTIONS

.1 The Contractor may suggest, for the consideration of the Project Team, substitutions to methods or processes described in the Specifications and / or shown on the Drawings. Any application for such substitutions must indicate how such substitutions are advantageous to the Owner or to the better fulfillment of the Contract. There shall be no obligation on the parties concerned to accept any such suggestions. Requests for alternatives must be made in duplicate and be accompanied by catalogue cuts, specifications and methods of installation.

.2 Time spent by the Consultant in evaluating the substitution shall not be the basis for a claim by the Contractor for extensions to the Contract Time.

.3 The Contractor will be responsible for substitutions to methods or processes concerning such work, and the warranty covering all parts of the Work shall not be affected.

.4 The cost of all changes in the work of other Sections (Subcontractors) necessitated by the use of substituted methods or processes, is to be borne by the Section (Subcontractor) proposing the substitution.

.5 Said methods or processes must fit into the space allotted for the specified methods or processes.

1.4 CREDITS ARISING FROM SUBSTITUTIONS

.1 Any and all credits arising from the substitutions mentioned will be credited to the Contract and the Contract Price will be adjusted accordingly.

1.5 RELATED CHANGES

.1 The Contractor will advise Subcontractors and suppliers and make all necessary changes to the related Work occasioned by Owner’s acceptance of alternatives.

END OF SECTION

1 GENERAL

1.1 MODIFICATIONS TO CONTRACT

.1 Supplemental Instruction: As issued by the Consultant, consistent with the intent of the Contract Documents, and will not involve an adjustment in Contract Price or Contract Time.

.2 Proposed Change: As issued by the Consultant, will notify the Contractor of an impending or proposed change to the Work, and will require submission of a quotation from the Contractor and all affected Subcontractors for each item noted. Submit quotation within the time period stipulated on the form, and indicate separate line item for labour and materials in each case. Work outlined in a Proposed Change must not proceed without the issuance of a Change Order signed by The Owner.

.3 Change Directive: Will be issued by the Consultant where an immediate response is required to an on-site condition. This form will authorize the Contractor to proceed with the change, with the stipulation that accurate accounts of costs be recorded, and may contain an upset cost, as agreed upon in advance by The Owner and the Contractor.

.4 Change Order: Will be issued by the Consultant upon review and approval of quotations for a Proposed Change, or a Change Directive, and authorizes the Contractor to proceed with the change(s) proposed. A Change Order will amend the Contract Price, and/or the Contract Time.

.5 Extras shall not be granted due to the Contractor’s unfamiliarity with the site or due to the Contractor’s lack of thorough investigation prior to bid submission.

.6 Any additions to the Work under this contract shall conform to all construction standards and conditions laid out herein, whether or not such conditions are expressly stated in The Owner's acceptance of the addition(s).

.7 The Contractor shall not proceed with Work in addition to the Contract Documents until the formal change process has been completed.

.8 Any request for additional time submitted with a Change Order shall be substantiated with supporting documentation and analysis, such as time impact analysis and critical path analysis. The Contractor shall establish how the critical path has shifted. The Contractor shall also submit a recovery plan demonstrating how the Contractor will recover the schedule.

1.2 CHANGE ORDER PROCEDURES

.1 Upon issuance by the Consultant to the Contractor of a proposed change in the Work, and unless otherwise requested in the proposed change or unless otherwise agreed:

.1 Submit to the Consultant a fixed price quotation for the proposed change in the Work within 5 days after receipt of the proposed change in the Work.

.2 If requested in the proposed change, provide a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:

.1 Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.

.2 Estimated Product costs, including Supplier quotations, estimated quantities and unit prices.

.3 Estimated Construction Equipment costs.

.4 Enumeration of all other estimated costs included in the price quotation.

.5 Estimated credit amounts for labour and Products not required on account of the proposed change.

.6 Where applicable, Subcontractor quotations, also including a detailed

breakdown of all of the above.

.7 Include in the quotation the increase or decrease to the Contract Time, if any, for the proposed change, stated in number of days.

.8 Include in the quotation the number of days for which the quotation is valid.

.2 The quotation will be evaluated by the Consultant and The Owner and, if accepted by The Owner, be documented in the form of a signed Change Order.

1.3 FEES FOR OVERHEAD AND PROFIT – CHANGE ORDERS

.1 Refer to the Construction Agreement Contract Paragraph GC 7.2 Change Order.

1.4 CHANGE DIRECTIVE PROCEDURES

.1 Refer to the Construction Agreement Contract Paragraph GC 7.3 Change Directive.

1.5 FEES FOR OVERHEAD AND PROFIT – CHANGE DIRECTIVES

.1 Refer to the Construction Agreement Contract Paragraph GC 7.3 Change Directive.

END OF SECTION

1.1 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 the Consultant.

.4 A work breakdown structure that is sufficiently detailed and comprehensive to facilitate Consultant's evaluation of applications for payment at an appropriate level of detail.

.5 Provisions for approved Change Orders [allowances,] [unit price work] [and] [assignable contracts] 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.

.6 For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:

.1 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.

.2 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.

.3 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.

.4 Balance to Complete: The value of Work not yet performed and Products not yet delivered to Place of the Work, stated in dollars.

1.2 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 when required due to significant changes in rate of progress of the *Work* or significant changes in the *Contract Price*.

1.3 WORKERS' COMPENSATION CLEARANCE

.1 Submit proof of workers' compensation clearance with each application for payment.

1.4 STATUTORY DECLARATIONS

.1 Submit a statutory declaration in the form of CCDC 9A – Statutory Declaration of Progress Payment Distribution by Contractor with each application for payment except the first.

END OF SECTION

1 GENERAL

1.1 COORDINATION

.1 Coordination of the work of all Sections of the specifications as required to complete the Project is the responsibility of the Contractor.

.2 Cooperation:

.1 Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted into work and set in place or instruct separate Sections (Subcontractors) as to their locations.

.2 Supply items to be “Built-In” as and when required together with templates, measurements, shop drawings and other related information and assistance.

.3 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” in adequate time.

.3 Coordination:

.1 Ensure that Subcontractors cooperate with each other including Other Contractors employed by The Owner, so that Work will be carried out expeditiously and will be satisfactory in all respects at completion.

.2 Ensure that Subcontractors examine Contract Documents with particular emphasis to work of other Sections which may affect the performance of their own work.

.3 Ensure Subcontractors cooperate with other Sections whose work attaches to or is affected by their own work, and ensure that minor adjustments are made to make adjustable work fit to fixed work.

.4 Ensure that Subcontractors requiring foundations or openings to be left for the installation of their Work furnish the necessary information to the Sections concerned in ample time so that proper provisions can be made.

.5 Pay particular attention to applied fireproofing requirements. Coordinate work to remove/reinstate services that may impede the application of continuous applied fireproofing to the required thickness for the scheduled fire resistance rating.

.6 Where supports or openings are to be left for the installation of various parts of the Work furnish the necessary information to those concerned in ample time so that proper provision can be made for such items. Have cutting, drilling and other remedial work, and the subsequent patching or other work required for failing to comply with this requirement, performed at a later date at no additional cost to the Owner.

.7 Ensure that items to be “Built-In” are supplied as and when required by Sections (Subcontractors) building in the items together with templates, measurements or shop drawings and other related information and assistance.

.8 Ensure coordination of products supplied in metric and imperial units into the overall layout.

.9 Placing, installation, application and connection of work by The Owner’s own forces or by Other Contractors on and to the Contractor's work shall not relieve the Contractor of their responsibility to provide and maintain the specified warranties.

.10 Ensure that setting drawings, templates, and all other information necessary for the location and installation of materials, fixtures, equipment, holes, sleeves, inserts, anchors, accessories, fastenings, connections, and access panels are provided by each Section whose work requires cooperative location and installation by other Sections, and that such information is communicated to the

applicable installer. Have cutting, fixing and making good to the work of Other Contractors, Sub-trades required for, and make up time lost as result of, failure to comply with this requirement, at no additional cost to the Owner.

.11 Coordinate with removals/installations specified in other Divisions and Other Contracts.

.12 Properly coordinate the work of the various Sections and trades to assure the best arrangement of pipes, conduits, ducts and mechanical, electrical and other equipment, in the available space. Under no circumstances will any extra payment be allowed due to the failure by the Contractor to coordinate the Work. If required, in critical locations, prepare interference and/or installation drawings showing the work of the various Sections as well as the existing installation, and submit these drawings to the Consultant for review before the commencement of Work.

.13 In case of damage to active services or utilities, notify Consultant and respective authorities immediately and make all required repairs under direction of Consultant and respective authorities. Carry out repairs to such damaged services and utilities continuously to completion, including working beyond regular working hours.

.14 Under no circumstances will any extra payment be allowed due to the failure by the Contractor to coordinate the Work. If required, in critical locations, prepare interference and/or installation drawings showing the work of the various Sections as well as the existing installation, and submit these drawings to The Owner’s Project Team and Consultant for review before the commencement of Work.

.4 Other Contractors:

.1 The Contractor is responsible to correlate and coordinate all work with that of Other Contractors having separate contracts with The Owner in order to complete the Work as expeditiously as possible.

.2 Prior to commencement of work, ensure that all Sections (Subcontractors) are fully conversant with the extent of the work, the conditions and materials on the project, the schedule of completion, restrictions to safety, and access.

.3 Inform all Sections (Subcontractors) that each is responsible for checking all Sections of the specification for work pertaining to their Section (Subcontractor's work).

.5 Authorities and inspectors:

.1 City Inspector: Coordinate and cooperate with City Inspector as required to review specific site work to meet Building Permit requirements.

.6 Administrative Coordination:

.1 Coordinate work of this section to ensure information and material are promptly provided to ensure orderly and expeditious progress of the work, and to comply with schedule for completion.

END OF SECTION

1.1 SUMMARY

.1 This Section specifies Contractor's responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.

.2 The purpose of submitting progress schedules is to:

.1 Inform Owner and Consultant of actual progress versus planned progress, and

.2 Provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.2 CONSTRUCTION PROGRESS SCHEDULE

.1 Format and Content:

.1 Prepare schedule in the form of a Critical Path Method (CPM) Gantt chart using Microsoft Project or equivalent software as agreed.

.2 Provide a work breakdown structure identifying key activities, work packages, and major milestones, including long delivery Products, inspection and testing activities, preparation and review of mock-ups, Owner decisions for cash allowances, shutdown or closure activities, delivery of Owner supplied Products, Owner performed work, demonstration and training activities, and similar items, at a sufficient level of detail to effectively manage construction progress.

.3 Indicate milestone dates for Ready-for-Takeover and Substantial Performance of the Work.

.2 Submission:

.1 Submit initial schedule to *Owner* and *Consultant* within 15 *Working Days* after *Contract* award via email as .pdf file.

.2 Submit updated progress schedule monthly to Owner and Consultant, indicating actual and projected start and finish dates with report date line and progress, critical path, float, and baseline comparison to current progress.

1.3 SUBMITTALS SCHEDULE

.1 Format and Content:

.1 Prepare schedule identifying all required *Shop Drawing*, *Product* data, and sample submissions, including samples required for testing.

.2 Prepare schedule in electronic format.

.3 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.

.4 For each required submittal, show planned earliest date for initial submittal, earliest date for return of reviewed submittal by *Consultant* and latest date for return of reviewed submittal without causing delay.

.5 Allow time in schedule for resubmission of submittals, should resubmission be necessary.

.2 Submission:

.1 Submit initial schedule to Consultant within 15 Working Days after Contract award via email.

.2 Submit updated submittals schedule monthly to Owner and Consultant.

1.4 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.

1.5 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

.1 Obtain from *Consultant* an electronic copy of the construction *Drawings* for the purpose of creating as-built drawings. Record information in electronic form, clearly identifying as-built deviations from the originally obtained construction *Drawings*.

.2 Clearly label each drawing as “AS-BUILT DRAWING”. Record information concurrently with construction progress. Do not conceal *Work* until required information is recorded.

.3 Record actual construction including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by Change Orders and Supplemental Instructions

.6 References to Shop Drawings, where Shop Drawings show more detail.

.4 Do not use as-built drawings for construction purposes.

1.6 PROGRESS PHOTOGRAPHS

.1 Arrange for periodic digital photography to document and provide a photographic record of the progress of the *Work*.

.2 Identify each photograph by project name and date taken.

.3 Submission: Submit .jpg format files in standard resolution via project web site monthly.

.4 Do not use progress or any other *Project* photographs for promotional purposes without *Owner*'s written consent.

END OF SECTION

1.1 ADMINISTRATIVE

.1 Submit specified submittals to Consultant for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time or for Product substitutions or other deviations from the Drawings and Specifications.

.2 Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.

.3 Do not proceed with Work affected by a submittal until review is complete.

.4 Present Shop Drawings, Product data, and samples in SI metric units. Where items or information is not produced in SI Metric, converted values are acceptable.

.5 Review submittals, provide verified field measurements where applicable, and affix Contractor's review stamp prior to submission to Consultant. Contractor's review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the Work and Contract Documents.

.6 Verify field measurements and that affected adjacent work is coordinated.

.7 Submittals not meeting specified requirements will be returned with comments.

.8 Reproduction of construction Drawings to serve as background for Shop Drawings is not permitted.

.9 Do not propose Substitutions or deviations from Contract Documents via Shop Drawing, Product data and sample submittals. Proposed alternates must follow the procedures outlined in Section 01 25 00.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate Products, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work.

.2 Where Products attach or connect to other Products, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and Installed. Indicate cross-references to Drawings, Specifications and other already reviewed Shop Drawings.

.3 Accompany submittals with a transmittal information including:

- .1 Date.
- .2 *Project* title and number.
- .3 *Contractor*'s name and address.
- .4 Identification of each submittal item and quantity.
- .5 Other pertinent data.

.4 *Shop Drawing* submittals shall include:

- .1 Date and revision dates.
- .2 *Project* title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 *Contractor*'s stamp, date, and signature of *Contractor*'s authorized representative

responsible for *Shop Drawing* review, indicating that each *Shop Drawing* has been reviewed for compliance with *Contract Documents* and, where applicable, that field measurements have been verified.

.5 Details of appropriate portions of the *Work* as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationships to other parts of the *Work*.

.6 *Product* data submittals shall include material safety data sheets (MSDS) for all controlled Products.

.7 Submit electronic copy of *Shop Drawings* where specified in the technical *Specifications*

.8 Submit electronic copy of Product data sheets or brochures where specified in the technical *Specifications*.

.9 Where a submittal includes information not applicable to the *Work,* clearly identify applicable information and strike out non-applicable information.

.10 Supplement standard information to include details applicable to *Project*.

.5 Allow 5 *Working Days* for *Consultant*'s review of each submittal and incorporate in submittals schedule specified in Section 01 32 00 – Construction Progress Documentation. Allow additional 3 *Working Days* where sub-*Consultant r*eview is required.

.6 If upon *Consultant*'s review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of *Work* may proceed.

.7 If upon *Consultant*'s review significant errors or omissions are discovered, a so noted copy will be returned for correction and resubmission. Do not commence fabrication or installation.

.8 *Consultant*'s notations on submittals are intended to ensure compliance with *Contract Documents* and are not intended to constitute a change in the *Work* requiring change to the *Contract Price* or *Contract Time*. If *Contractor* considers any *Consultant*'s notation to be a change in the *Work*, promptly notify *Consultant* in writing before proceeding with the *Work*.

.9 Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the *Work* proceeds. When resubmitting, notify *Consultant* in writing of any revisions other than those requested by *Consultant*.

1.3 SAMPLES

.1 Submit samples for *Consultant*'s review in triplicate where specified in the technical *Specifications*. Label samples as to origin, *Project* name, and intended use.

.2 Deliver samples prepaid to *Consultant*'s business address.

.3 Notify *Consultant* in writing of any deviations in samples from requirements of *Contract Documents*.

.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 as required by *Consultant* to comply with *Contract Documents*.

.7 Reviewed and accepted samples will establish the standard against which installed *Work* will be reviewed.

END OF SECTION

1.1 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. However if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.

.3 Reference standards establish minimum requirements. If Contract Documents call for requirements that differ from a referenced standard, the more stringent requirements 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.

.5 Within the Specifications, reference may be made to the following standards writing, testing, or certification organizations by their acronyms or initialisms:

.1 AA - Aluminum Association

.2 ACI - American Concrete Institute

.3 AISC - American Institute of Steel Construction

.4 ANSI - American National Standards Institute

.5 ASME - American Society of Mechanical Engineers

.6 ASTM - American Society for Testing and Materials

.7 AWMAC - Architectural Woodwork Manufacturers Association of Canada

.8 AWPA - American Wire Producers Association

.9 CaGBC - Canadian Green Building Council

.10 CGSB - Canadian General Standards Board

.11 CISC - Canadian Institute of Steel Construction

.12 CPCI - Canadian Prestressed Concrete Institute

.13 CSA - Canadian Standards Association

.14 CSSBI - Canadian Sheet Steel Building Institute

.15 CWB – Canadian Welding Bureau

.16 ICEA - Insulated Cable Engineers Association

.17 IEEE - Institute of Electrical and Electronics Engineers

.18 IGMAC – Insulating Glass Manufacturers Association of Canada

.19 LEED - Leadership in Energy and Environmental Design

.20 MPP – Master Painters Institute

.21 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry

.22 NAAMM - National Association of Architectural Metal Manufacturers

.23 NEMA - National Electrical Manufacturers Association

.24 NFPA - National Fire Protection Association

.25 NHLA - National Hardwood Lumber Association

.26 NLGA - National Lumber Grades Authority

.27 SSPC – The Society for Protective Coatings

.28 TTMAC - Terrazzo, Tile and Marble Association of Canada

.29 ULC - Underwriters' Laboratories of Canada

1.2 INDEPENDENT INSPECTION AND TESTING AGENCIES

.1 Except as otherwise specified, Owner will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the Work.

.2 Retain and pay for inspection and testing that is for Contractor's own quality control or is required by regulatory requirements.

.3 Section 01 21 00 – Allowances specifies a cash allowance for independent inspection and testing services to be retained and paid for by Contractor. Cash allowance excludes any inspection and testing that is for Contractor's own quality control or is required by regulatory requirements.

.4 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.

.5 Allow and arrange for inspection and testing agencies to have access to the Work, including access to off site manufacturing and fabrication plants.

.6 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.

.7 Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00 – Construction Progress Documentation.

.8 Provide labour, Construction Equipment and temporary facilities to obtain and handle test samples on site.

1.3 INSPECTION AND TESTING AGENCY REPORTS

.1 For inspection and testing required by *Contract Documents* or by regulatory requirements, and performed by *Contractor* retained inspection and testing agencies, submit to *Consultant* copies of reports. Submit within 3 days after completion of inspection and testing.

.2 For inspection and testing performed by *Owner* retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to *Contractor*.

1.4 MOCK-UPS

.1 Prepare mock-ups of *Work* as specified in the technical *Specifications*. If a mock-up location is not indicated in the *Drawings* or *Specifications*, locate where directed by *Consultant*.

.2 Modify mock-up as required until *Consultant* approval is obtained.

.3 Approved mock-ups establish an acceptable standard for the *Work*.

.4 Protect mock-ups from damage until the *Work* they represent is complete.

.5 Unless otherwise specified in the technical *Specifications*, approved mock-ups forming part of the *Work* may remain as part of the *Work*.

.6 Remove mock-ups only when the *Work* they represent is complete or when otherwise directed by *Consultant*.

END OF SECTION

1 GENERAL

1.1 TEMPORARY WORK

.1 Accept responsibility for all temporary structures and comply with applicable rules and regulations. Pay all taxes and all other charges.

.2 The expression "provide" shall be deemed to include the provision, installation and finishing, maintenance, servicing and removal of the work described. All Work damaged by temporary installations shall be repaired and made good at no expense to the Owner.

1.2 TEMPORARY UTILITIES - GENERAL

.1 Provide temporary utilities as specified and as otherwise necessary to perform the Work expeditiously.

.2 Remove temporary utilities after use.

1.3 TEMPORARY WATER SUPPLY

.1 Separate from water required for fire protection with adequate pressure at every floor, except hose extensions which shall be provided by Subcontractors requiring them.

.2 Water supply shall be potable, available from existing service. Be responsible for the careful and reasonable use of any Owner supplied water.

.3 If large quantity of water is required for the Work, a water meter shall be provided to monitor Contractor's water usage. Provide proof to Consultant of no drop in water pressure in water supply for affected tenant (s) (i.e. Contractors using hydrodemolition method to remove concrete in a project or similar instances).

1.4 TEMPORARY HEATING AND VENTILATION

.1 *Contractor* may connect to and use *Owner*'s existing supply of natural gas for temporary use during construction, subject to existing available volume and pressure. Usage at no cost to *Contractor*.

.2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.

.3 Provide temporary heat for the *Work* as required to:

.1 Facilitate progress of *Work*.

.2 Protect the *Work* against dampness and cold.

.3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored *Products*.

.4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of *Products*.

.5 After building is enclosed, maintain interior temperature of minimum 10 degrees C.

.4 Provide temporary ventilation for the *Work* as required to:

.1 Prevent accumulations of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.

.2 Ensure that hazardous, noxious, or volatile substances do not migrate to *Owner* occupied spaces.

.3 Ventilate temporary sanitary facilities.

.4 New permanent building heating and ventilation systems may be used during

construction, at Contractor's option. If used during construction:

.1 *Owner* will pay utility costs resulting from the use of permanent systems.

.2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.

.3 Just prior to *Substantial Performance of the Work*, replace filters, and perform other required maintenance to ensure systems are in as near as new condition as possible. Refer also to Division 15 requirements.

.4 Ensure that systems manufacturers' warranties do not commence until the date of *Substantial Performance of the Work* or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under *Contractor*'s warranty.

END OF SECTION

1.1 CONTRUCTION FACILITIES - GENERAL

.1 Provide temporary construction facilities as necessary for performance of the *Work* and in compliance with applicable regulatory requirements.

.2 Maintain temporary construction facilities in good condition for the duration of the *Work*.

.3 Remove temporary construction facilities from *Place of the Wor*k when no longer required.

1.2 CONSTRUCTION PARKING

.1 Limited parking will be permitted at *Place of the Work* for up to 3 vehicles during normal working hours, provided it does not disrupt continuing operation of the facility.

1.3 VEHICULAR ACCESS

.1 Provide and maintain adequate access to Place of the Work.

.2 Existing roads at Place of the Work may be used for access to Place of the Work, provided Contractor assumes responsibility for any damage caused by construction traffic, and prevents or promptly cleans up any mud tracking or material spillage.

1.4 SANITARY FACILITIES

.1 The Contractor will be granted access to a dedicated sanitary facility within the existing building. It shall be the Contractor's responsibility to clean and maintain their dedicated sanitary facility, and return to Owner at project completion in the same condition it was originally granted.

1.5 FIRE PROTECTION

.1 Provide and maintain temporary fire protection systems and equipment during construction. Contractor shall provide firewatch as required; costs for firewatch shall be included in base bid price.

1.6 ELEVATORS

.1 Permanent elevators may be used by construction personnel and for transporting Products, at *Contractor*'s option. If used during construction:

.1 Provide protective coverings for finish surfaces of cars and entrances.

.2 Just prior to *Substantial Performance of the Work*, perform required maintenance to ensure elevators are in as near as new condition as possible.

.3 Ensure that elevator manufacturer's warranty does not commence until the date of *Substantial Performance of the Work* or, if manufacturer's warranty does commence earlier when elevators are put into use, arrange for necessary extension of manufacturer's warranty or provide equivalent coverage under *Contractor*'s warranty.

END OF SECTION

1.1 BARRIERS AND ENCLOSURES - GENERAL

.1 Provide temporary barriers and enclosures necessary to protect the public and building occupants and to secure *Place of the Wor*k during performance of the *Work*.

.2 Comply with applicable regulatory requirements.

.3 Maintain temporary barriers and enclosures in good condition for the duration of the *Work*.

.4 Remove temporary barriers and enclosures from *Place of the Work* when no longer required.

1.2 FENCING

.1 Erect temporary security and safety site fencing, minimum 1.8m high, using self-supporting wire fence sections enclosing applicable portions of site as necessary to maintain safety and security. Maintain site fencing in good repair until removed.

1.3 WEATHER ENCLOSURES

.1 Provide weather tight enclosures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Provide weather enclosures to protect floor areas where walls are not finished and to enclose work areas that require temporary heating.

.3 Design weather enclosures to withstand wind pressure and snow loading requirements.

1.4 DUST TIGHT PARTITIONS

.1 Provide dust tight wood stud and plywood and/or steel stud and gypsum board partitions to localize interior building areas from dust and noise generating activities.

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

1.5 FIRE ROUTES

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

1.6 PROTECTION OF BUILDING FINISHES

.1 Provide necessary temporary barriers and enclosures to protect [existing and] completed or partially completed finished surfaces from damage during performance of the *Work*.

END OF SECTION

1.1 TEMPORARY CONTROLS - GENERAL

.1 Provide temporary controls as necessary for performance of the *Work* and in compliance with applicable regulatory requirements.

.2 Maintain temporary controls in good condition for the duration of the *Work*.

.3 Remove temporary controls and *Construction Equipment* used to provide temporary controls from *Place of the Work* when no longer required.

1.2 DUST AND PARTICULATE CONTROL

.1 Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.

.2 Execute *Work* by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.

.3 Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Use appropriate covers on trucks hauling fine, dusty, or loose materials.

1.3 DEWATERING

.1 Provide temporary drainage and pumping as necessary to dewater excavations, trenches, foundations, and other parts of the *Work*. Maintain such areas free of water arising from groundwater or surface run-off, as required to keep them stable, dry, and protected from damage due to flooding.

.2 Maintain standby equipment necessary to ensure continuous operation of dewatering system.

.3 Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface drainage systems. Treat or dispose of such water in accordance with applicable regulatory requirements

1.4 SITE DRAINAGE

.1 Maintain grades to ensure proper site drainage.

.2 Prevent surface water runoff from leaving the site.

.3 Prevent precipitation from infiltrating or from directly running off stockpiled materials. Cover stockpiled materials with an impermeable liner during periods of work stoppage including at end of each *Working Day*.

.4 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas as required to prevent erosion and sedimentation.

.5 Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

1.5 EROSION AND SEDIMENT CONTROL

.1 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and watercourses, and repair damage caused by soil erosion and sedimentation.

.2 Provide and maintain appropriate temporary measures such as silt fences, straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping,

sedimentation basins, vegetative cover, dikes, and other measures that may be required to prevent erosion and migration of silt, mud, sediment, and other debris.

.3 Do not disturb existing embankments or embankment protection.

.4 Periodically inspect erosion and sediment control measures to detect evidence of erosion and sedimentation. Promptly take corrective measures when necessary.

.5 If soil and debris from site accumulate in ditches or other low areas, remove accumulation and restore area to original condition.

1.6 POLLUTION CONTROL

.1 Take measures to 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, and

.3 *Owner* and *Consultant*.

.4 Contact manufacturer of pollutant, if known and applicable, to obtain material safety data sheets (MSDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.

.5 Take immediate action to contain and mitigate harmful effects of the spill or release.

END OF SECTION

1.1 GENERAL

.1 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.

.2 Unless otherwise specified, maintain uniformity of manufacture for like items throughout.

.3 Permanent manufacturer's markings, labels, trademarks, and nameplates on *Products* are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.

1.2 PRODUCT AVAILABILITY AND DELIVERY TIMES

.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 *Consultant*. *Consultant* will take action as required.

.3 If delivery delays are foreseeable, for any reason, promptly notify *Consultant*.

.1 If a delivery delay is beyond *Contractor*'s control, *Consultant* will provide direction.

.2 If a delivery delay is caused by something that was or is within *Contractor*'s control, *Contractor* shall propose actions to maintain the construction progress schedule for *Consultant*'s review and acceptance.

1.3 STORAGE, HANDLING, AND PROTECTION

.1 Store, handle, and protect *Products* during transportation to *Place of the Work* and before, during, and after installation in a manner to prevent damage, adulteration, deterioration and soiling.

.2 Comply with manufacturer's instructions for storage, handling and protection.

.3 Store packaged or bundled *Products* in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in *Work*.

.4 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of material safety data sheets (MSDS).

.5 Store *Products* subject to damage from weather in weatherproof enclosures.

.6 Store sheet *Products* on flat, solid, supports and keep clear of ground. Slope to shed moisture.

.7 Remove and replace damaged *Products*.

END OF SECTION

1.1 SURVEYOR QUALIFICATIONS

.1 If required, engage a registered land surveyor, licensed to practice in *Place of the Work*.

1.2 SUBMITTALS

.1 Submit name and address of registered land surveyor performing survey work.

.2 Submit to *Owner* and *Consultant* the survey of the *Work* prepared and issued by a registered land surveyor on completion of the building footings and foundations and on completion of the *Work*.

1.3 SURVEY REFERENCE POINTS

.1 Locate and confirm permanent reference points prior to starting site work. Preserve and protect permanent reference points on site during construction.

.2 Do not change or relocate reference points without prior written notice to *Consultant*.

.3 Report to *Consultant* when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations. Require registered land surveyor to replace reference points in accordance with original survey.

1.4 SURVEY REQUIREMENTS

.1 Establish sufficient permanent benchmarks on site, referenced to established benchmarks by survey control points.

.2 Confirm that existing survey reference points are in accordance with *Owner*'s survey and property limits.

.3 Establish initial lines and levels for building layout.

.4 Maintain a complete, accurate log of control and survey work as it progresses. Record locations with horizontal and vertical data in project record documents.

1.5 EXISTING UTILITIES AND STRUCTURES

.1 Before commencing excavation, drilling or other earthwork, establish or confirm location and extent of all existing underground utilities and structures in work area.

.2 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.

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

1.6 VERIFICATION OF EXISTING CONDITIONS

.1 Where work specified in any Section is dependent on the work of another Section or Sections having been properly completed, verify that work is complete and in a condition suitable to receive the subsequent work. Commencement of work of a Section that is dependent on the work of another Section or Sections having been properly completed, means acceptance of the existing conditions.

.2 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.

.3 Ensure that substrate surfaces are clean, dimensionally stable, cured and free of contaminants.

.4 Notify *Consultant* in writing of unacceptable conditions.

END OF SECTION

1.1 SUMMARY

.1 Except where otherwise specified in technical *Specifications* or otherwise indicated on *Drawings*, comply with requirements of this Section.

1.2 MANUFACTURER'S INSTRUCTIONS

.1 Install, erect, or apply *Products* in strict accordance with manufacturer's instructions.

.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 Do not rely on labels or enclosures provided with *Products*. Obtain written instructions directly from manufacturers.

.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.

1.3 CONCEALMENT

.1 Conceal pipes, ducts, and wiring in floors, walls and ceilings in finished areas:

.1 after review by *Consultant* and authority having jurisdiction, and

.2 where locations differ from those shown on *Drawings*, after recording actual locations on as-built drawings.

.2 Provide incidental furring or other enclosures as required.

.3 Notify *Consultant* in writing of interferences before installation.

1.4 FASTENINGS - GENERAL

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials.

.2 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.

.3 Use non-corrosive fasteners and anchors for securing exterior work [and in spaces where high humidity levels are anticipated].

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.

1.5 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Bolts shall not project more than one diameter beyond nuts.

1.6 FIRE RATED ASSEMBLIES

.1 When penetrating fire rated walls, ceiling, or floor assemblies, completely seal voids with fire-stopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

1.7 LOCATION OF FIXTURES, OUTLETS AND DEVICES

.1 Consider location of fixtures, outlets, and devices indicated on *Drawings* as approximate.

.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.

.3 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.

1.8 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS

.1 Adequately protect parts of the *Work* completed and in progress from any kind of damage.

.2 Promptly remove, replace, clean, or repair, as directed by *Consultant,* work damaged as a result of inadequate protection.

.3 Do not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety or integrity of the *Work*.

1.9 REMEDIAL WORK

.1 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.

END OF SECTION

1.1 REQUEST FOR CUTTING, PATCHING AND REMEDIAL WORK

.1 Submit written request in advance of cutting, coring, or alteration which affects or is likely to affect:

.1 Structural integrity of any element of the 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 Work of *Owner* or other contractors.

.6 Warranty of *Products* affected.

.2 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 work of *Owner* or other contractors.

.7 Written permission of affected other contractors.

.8 Date and time work will be executed.

1.2 PRODUCTS

.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 - Substitution Procedures.

1.3 PREPARATION

.1 Inspect existing conditions in accordance with Section 01 71 00 - Examination and Preparation.

.2 Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of the *Work* from damage.

.3 Provide protection from elements for areas that may be exposed by uncovering work.

1.4 EXISTING UTILITIES

.1 When breaking into or connecting to existing services' utilities, execute the Work at times directed by local governing authorities, with a minimum of disturbance to the Work, pedestrian and vehicular traffic, and ongoing Owner operations.

.2 Maintain excavations free of water.

.3 Keep duration of interruptions to a minimum.

.4 Carry out interruptions after regular working hours of occupants, preferably on weekends, unless Owner’s prior written approval is obtained.

.5 Protect and maintain existing active services. Record location of services, including depth, on as-built drawings.

.6 Construct or erect barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures as required to protect pedestrian and vehicular traffic.

1.5 CUTTING, PATCHING, AND REMEDIAL WORK

.1 Coordinate and perform the *Work* to ensure that cutting and patching work is kept to a minimum.

.2 Perform cutting, fitting, patching, and remedial work [including excavation and fill,] to make the affected parts of the *Work* come together properly and complete the *Work*.

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

.4 Perform cutting by methods to avoid damage to other work

.5 Provide proper surfaces to receive patching, remedial work, and finishing.

.6 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*.

.7 Do not use pneumatic or impact tools without *Consultant*’s prior approval.

.8 Ensure that cutting, patching, and remedial work does not jeopardize manufacturers’ warranties.

.9 Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection. For an assembly, refinish entire unit.

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

.11 Maintain fire ratings of fire rated assemblies where cutting, patching, or remedial work is performed. Completely seal voids or penetrations of assembly with firestopping material to full depth or with suitably rated devices.

END OF SECTION

1.1 REGULATORY REQUIREMENTS

.1 Comply with applicable regulatory requirements when disposing of waste materials.

.2 Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

1.2 GENERAL CLEANING REQUIREMENTS

.1 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.

.2 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.3 Prevent cross-contamination during the cleaning process.

.4 Notify the *Consultant* of the need for cleaning caused by *Owner* or other contractors.

1.3 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

.1 Maintain the *Work* in a tidy and safe condition, free from accumulation of waste materials and construction debris.

.2 Provide appropriate, clearly marked, containers for collection of waste materials and recyclables. Location of containers to be agreed with Owner.

.3 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.

.4 Remove waste materials and recyclables from *Place of the Work* at regular intervals.

.5 Clean interior building areas prior to start of finish work and maintain free of dust and other contaminants during finishing operations.

.6 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.

1.4 FINAL CLEANING

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

.3 Remove dust from lighting reflectors, lenses, lamps, bulbs, and other lighting surfaces.

.4 Vacuum clean and dust exposed wall, floor, and ceiling surfaces, behind grilles, louvres and screens, above suspended ceiling tiles.

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

equipment if equipment is used during construction.

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

.7 Remove stains, spots, marks, and dirt from exterior facades.

.8 Clean exterior and interior window glass and frames.

.9 Clean and sweep roofs, clear roof drains and downspouts.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements.

.2 Do not burn or bury waste materials at Place of the Work.

.3 Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from Place of the Work, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.

.4 Cover or wet down dry waste materials to prevent blowing dust and debris.

END OF SECTION

1.1 READY-FOR-TAKEOVER

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

1.2 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.

1.3 PREREQUISITES TO FINAL PAYMENT

.1 After Ready-for-Takeover of the Work and before submitting an application for final payment in accordance with the General Conditions of Contract:

.1 Correct or complete all remaining defective, deficient, and incomplete work.

.2 Remove from the Place of the Work all remaining surplus Products, Construction Equipment, and Temporary Work.

.3 Perform final cleaning and waste removal necessitated by the Contractor's work performed after Ready-for-Takeover, as specified in Section 01 74 00 – Cleaning and Waste Management.

1.4 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.

1.5 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 lien legislation applicable to the Place of the Work, shall be:

.1 independent of those for attaining Ready-for-Takeover of the Work, and

.2 in accordance with the lien legislation applicable to the Place of the Work.

END OF SECTION

1.1 OPERATION AND MAINTENANCE MANUAL

.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 final version to *Owner* in electronic format.

1.2 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Provide electronic copy of manual in PDF format.

.2 Provide electronic copy of Shop Drawings in manual as CAD files in.dwg format on electronic media acceptable to Owner.

1.3 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT

.1 Table of contents for each volume.

.2 Introductory information including:

.1 Date of manual submission.

.2 Complete contact information for *Consultant*, subconsultants, other consultants, and *Contractor*, with names of responsible parties.

.3 Schedule of *Products* and systems indexed to content of volume.

.3 For each *Product* or system, include complete contact information for *Subcontractors*, *Suppliers* and manufacturers, including local sources for supplies and replacement parts.

.4 *Product* Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.

.5 Reviewed *Shop Drawings*.

.6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.

.7 Warranties.

.8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.

.9 Training materials as specified in Section 01 79 00 - Demonstration and Training.

1.4 OPERATION AND MAINTENANCE MANUAL - EQUIPMENT AND SYSTEMS CONTENT

.1 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.

.2 Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 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.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include testing and balancing reports.

.15 Include additional content as specified in technical Specifications sections.

1.5 OPERATION AND MAINTENANCE MANUAL - PRODUCTS AND FINISHES CONTENT

.1 Include *Product* data, with catalogue number, options selected, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured *Products*.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

.4 Include additional content as specified in technical *Specifications* sections.

1.6 OPERATION AND MAINTENANCE MANUAL - WARRANTIES CONTENT

.1 Separate each warranty with index tab sheets keyed to Table of Contents listing.

.2 List each warrantor with complete contact information.

.3 Verify that documents are in proper form and contain full information. Ensure that warranties are for the correct duration and are in *Owner*'s name.

1.7 CONTRACTOR'S AS-BUILT DRAWINGS

.1 Submit final as-built drawings in the form specified in Section 01 32 00 – Construction Progress Documentation to Consultant.

1.8 PROJECT RECORD DRAWINGS

.1 Transfer all information marked up on the as-built drawings during the progress of the *Work* to a master set of record drawing files provided by *Consultant*, in CAD format.

.2 Mark revised drawings as "RECORD DRAWINGS".

.3 Submit completed record drawings in electronic form to *Owner*.

1.9 SPARE PARTS, MAINTENANCE MATERIALS, AND SPECIAL TOOLS

.1 Supply spare parts, maintenance materials, and special tools in quantities specified in technical *Specifications* sections.

.2 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*.

.3 Provide tags for special tools identifying their function and associated *Product*.

.4 Deliver to and store items at location directed by *Owner* at *Place of the Work*. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.

.5 Catalogue all items and submit to *Consultant* an inventory listing organized by *Specifications* section. Include *Consultant* reviewed inventory listing in operation and maintenance manual.

END OF SECTION

1.1 SUMMARY

.1 Demonstrate and provide training to *Owner*'s personnel on operation and maintenance of equipment and systems prior to scheduled date of *Ready-for-Takeover of the Work*.

.2 *Owner* will provide list of personnel to receive training and will coordinate their attendance at agreed upon times.

.3 Coordinate and schedule demonstration and training provided by *Subcontractors* and *Suppliers*.

1.2 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*.

.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, and

.3 including a list of attendees.

1.3 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*.

1.4 DEMONSTRATION AND TRAINING

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment and system.

.2 Review operation and maintenance manual in detail to explain all aspects of operation and maintenance.

.3 Prepare and insert additional information in operation and maintenance manual if required.

END OF SECTION

1.1 GENERAL

.1 The Contractor must provide all labour, materials, products, equipment and services for commissioning of all building systems to ensure building is operating according to requirements of Contract Documents.

1.2 CONTRACTOR RESPONSIBILITIES

.1 Prepare each system ready for commissioning. Verify systems installation is complete and in operation.

.2 Coordinate commissioning with and assist commissioning agency.

.3 Perform and document verification, performance testing, adjusting, and balancing operations.

.4 Cooperate with commissioning agency and provide access to equipment and systems.

.5 Provide personnel and operate systems at designated times, and under conditions required for proper commissioning.

.6 Make instruments available to commissioning agency to facilitate spot checks during commissioning.

.7 Participate in commissioning meetings.

.8 Complete commissioning forms as requested by commissioning agency.

.9 Correct deficiencies identified in commissioning process.

.10 Incorporate commissioning data into operation and maintenance manual.

.11 Ensure that commissioning agency participates in demonstration and training as specified in Section 01 79 00 – Demonstration and Training.

END OF SECTION

1 General

1.1 SUMMARY

.1 Review drawings, site conditions, and other specification sections to ascertain the extent and nature of work of this section.

.2 The Work of this Section includes, but is not limited to the following:

.1 Demolish and removal of the following where indicated on the Drawings:

.1 Concrete slabs;

.2 Masonry

.3 Structural steel;

.4 Drywall/steel stud partitions/assemblies and interior finishes;

.5 Doors, frames and associated hardware;

.6 Exterior mechanical equipment and cap weather tight.

.2 Disconnect/cap existing service in areas of demolition.

.3 Trace, demolish and remove decommissioned mechanical and electrical services found during demolition. Remove decommissioned services to the area of demolition to the source, leaving no buried services in walls and floors, unless otherwise approved by written notice from the Owner.

.4 Dispose of demolished materials except where required to be salvaged or reused.

.5 Refer to demolition notes indicated on all disciplines Drawings.

.3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI):

.1 ANSI A10.8-2011, Scaffolding Safety Requirements

.2 Canadian Standards Association (CSA):

.1 CSA S350- M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.3 National Fire Protection Association (NFPA):

.1 NFPA 241-09, Standard for Safeguarding Construction, Alteration, and Demolition Operations

.4 Provincial Legislation:

.1 Legislation specific to Authority Having Jurisdiction for work governed by this Section.

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.

1.4 EXAMINATION

.1 Visit and examine the site and note all characteristics and irregularities affecting Work of this Section. Submit a pre-demolition inspection report. Ensure the Owner of premises being inspected is represented at inspection.

.2 Where appropriate prepare a photographic or video record of existing conditions, particularly of existing work scheduled to remain.

.3 Where applicable, examine adjacent tenancies not part of the scope of work. Determine extent of protection required to areas and related components not subject to demolition.

1.5 SUBMITTALS

.1 Provide required information in accordance with Division 01.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Prepare schedule in conjunction with overall project schedule, and outline proposed methods in writing. Obtain approval before commencing demolition work, and indicate the following:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity

.2 Interruption of utility services

.3 Coordination for shutoff, capping, and continuation of utility services

1.6 QUALITY ASSURANCE

.1 Conform to requirements of all authorities having jurisdiction.

.2 Comply with applicable requirements of CSA S350-M "Code of Practice for Safety in Demolition of Structures".

.3 Work of this Contract shall be executed by an approved company having a minimum of five (5) years continuous experience and able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.

.4 Perform cutting and coring, where applicable, by a firm specializing in this type of work, able to produce evidence of successful completion of similar work over a period of at least five (5) years immediately prior to date of contract.

.5 Apply for, secure, arrange and pay for all permits, notices and inspections necessary for proper execution and completion of work in this Section.

.6 Professional Engineer Qualifications: Procure the services of a professional engineer who is experienced in providing relevant engineering services to perform the following:

.1 Review portions of the Work requiring structural performance, prepare plan of action, engineer temporary shoring and bracing, and Provide site administration and inspection for work of this Section.

1.7 PROTECTION

.1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.

.2 Cease operations and notify Consultant if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Consultant.

.3 Prevailing weather conditions and weather forecasts shall be considered. Demolition work shall not proceed when weather conditions constitute a hazard to the workers and site.

.4 Prevent damage of surrounding vegetation by construction. Install tree protection barriers to trees that are scheduled to remain.

.5 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems which remain in operation.

.6 Temporarily suspended work that is without continuous supervision shall be closed to prevent entrance of unauthorized persons.

1.8 REMAINING AND ADJACENT STRUCTURES

.1 Do not interfere with, encumber, endanger or create nuisance, from any cause due to demolition work, to public property or any adjacent attached and/or detached structures in possession of Owner or others, which are to remain, whether occupied or unoccupied during this work.

.2 Make good damage to such structures resulting from work under this Section at no cost to Owner. Make good adjacent building surfaces damaged by work of this Section.

1.9 PROTECTION OF SERVICES AND STRUCTURES

.1 Take necessary precautions to guard against movement, settlement or collapse of existing adjacent utility services, public property and/or structures, whether to remain or not. If these or other unforeseen conditions develop, take immediate emergency measures, report to Consultant, confirm in writing, and await instructions before proceeding with any further related demolition work.

.2 Prior to saw cutting or core drilling of existing concrete slabs, use ground penetrating radar (GPR) to detect utilities and structural reinforcing. Concrete X-Rays can be used when access to both sides of concrete slab is accessible for placement of required x-ray film.

1.10 EXISTING SERVICES

.1 Prior to start of demolition disconnect all electrical service lines in the areas to be demolished. Post warning signs on all electrical lines and equipment which must remain energized to serve other areas during period of demolition. Disconnect electrical service lines in demolition areas to the requirements of local authority having jurisdiction.

.2 In each case, notify the affected utility company in advance and obtain approval where required before commencing with the work on main services.

.3 Arrange with utility companies for locating of such services and for disconnection of existing services owned by utility companies and which will be disconnected by said utility companies, provided such services do not interfere with adjacent tenancy operators.

.4 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.

.5 Existing services are to be maintained where required for normal tenant operation during regular hours of operation and/or as deemed necessary by Owner.

1.11 DECOMMISSIONED SERVICES

.1 Remove fully decommissioned electrical and mechanical service lines, plumbing, ducting, fixtures and all fasteners and supports for decommissioned items.

.1 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.

.2 Patch and repair surfaces affected by this selective demolition to match existing adjacent surfaces, as approved by the Consultant.

1.12 EXISTING WARRANTIES

.1 Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

2 Products

2.1 DEBRIS, SALVAGED MATERIAL AND EQUIPMENT DISPOSAL

.1 All materials and or equipment salvaged from demolition work becomes property of demolition Contractor unless designated otherwise.

.2 At no cost to Owner repair or replace material and/or equipment scheduled to remain which is damaged by demolition work. Do not sell any salvaged material or equipment directly from project site.

.3 Remove waste debris continually and entirely from project site during demolition work. Do not load vehicles transporting such debris beyond their safe capacity or in a manner which might cause spillage on public or private property. If spillage does occur, clean up immediately to prevent traffic hazards or nuisance.

2.2 PROTECTION

.1 Temporary Protection:

.1 Erect temporary hoarding protection, to enclose openings in exterior walls, and/or provide security to partially occupied interior spaces, as indicated in Division 01.

.2 Erect temporary dust screens to prevent dust and debris to enter areas of the building which are not scheduled for demolition. Remove temporary dust screens when no longer required.

2.3 REPAIR MATERIALS

.1 Use repair materials identical to existing materials:

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

.2 Use a material whose installed performance equals or surpasses that of existing material.

.3 Comply with material and installation requirements specified in individual Specification Sections.

.2 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes; as indicated in Section 03 35 00.

.3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.

.4 Gypsum Board Patching Compounds: Joint compound to ASTM C475, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 29 00.

.5 Fireproofing: Patch and repair all fireproofing damaged during demolition of adjacent surfaces with compatible fireproofing materials. Provide test reports from fireproofing

manufacture warranting installation, adhesion and compatibility between existing and new fireproofing materials.

2.4 EXISTING MATERIALS

.1 Items to be retained for re-use in new construction include, but are not limited to the following:

.1 Confirm with Consultant any materials that appear to be in re-usable condition prior to disposal.

.2 Confirm with Consultant any materials scheduled for re-use that are not in re-usable condition prior to installation.

3 Execution

3.1 GENERAL

.1 Exercise caution in dismantling, disconnecting of work adjacent to existing work designated to remain.

.2 Carry out demolition in a manner to cause as little inconvenience to the adjacent properties as possible.

.3 Carry out demolition in an orderly and careful manner.

.4 Demolition by explosives is not permitted.

.5 Selling or burning of materials on site is not permitted.

.6 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated run-off or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.7 Lower waste materials in a controlled manner; do not drop or throw materials from heights.

.8 At end of each day's work, leave in safe condition so that no part is in danger of toppling or falling.

3.2 PREPARATION

.1 Although possible (with additional precautions), openings through existing concrete columns and beams are generally not permitted; the structural engineer must be contacted for such proposed openings for specific additional requirements.

.2 For all openings to be located through existing structural components, the following requirements for coring or sawcutting openings through existing reinforced concrete floor slabs, roof slab and shear walls for mechanical and electrical services must be followed:

.1 Prior to installation of openings, a testing agency is to be engaged to accurately scan the areas of the proposed openings to locate existing reinforcing steel, electrical conduit and cast-in mechanical services (i.e. pipes). Electromagnetic scanning or ground-penetrating radar are acceptable methods of scanning for these purposes. Note that x-ray technology will not be permitted as this will be an occupied building during construction.

.2 During/after conducting the scanning procedures, the testing agency is to clearly and accurately mark the surfaces of the concrete elements identifying individual existing reinforcing bars and electrical/mechanical services.

3.3 SAFETY AND SECURITY

.1 Maintain security of the building at all times during demolition work.

.2 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.4 ACCESS ROUTES

.1 Restrict operations to designated access routes.

.2 Do not obstruct roads, parking lots, sidewalks, hydrants and the like.

3.5 SELECTIVE DEMOLITION

.1 Provide necessary shoring and supports to assure safety of structure prior to cutting and coring.

.2 Where practical, sawcut and remove material as required.

.3 Where sawcutting is not appropriate, use suitable hand tools.

.4 Demolish, cut-out and remove from site all other work noted on drawings or required to permit new construction.

.5 Do not allow water to accumulate or flow beyond work area. Provide receptacles and mop-up as work proceeds.

.6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.

.1 Provide bond beams in new openings cut into existing concrete masonry unit walls.

.2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.

.7 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.

.8 Demolish existing flooring and wall finishes, and adhesive remnants as follows:

.1 Floor and wall substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through new flooring and wall finishes.

.9 Demolish completely all ceiling panels and grid as indicated.

.10 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.1 Prepare existing surfaces schedule to receive new finish by grinding, filling, over-coating, stripping, washing, etching, shot blasting or other chemical or mechanical means, as required to ensure satisfactory installation of new finish.

3.6 PATCHING AND REPAIRING

.1 Floors and Walls:

.1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.

.2 Provide an level and smooth surface having uniform finish colour, texture, and appearance.

.3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Patch with durable seams that are as invisible as possible.

.5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

.6 Patch any existing areas adjoining / adjacent to new construction in good workmanship, filling and finishing gaps between finishes to allow new work to blend seamlessly with existing work.

.7 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface

containing patch. Provide additional coats until patch blends with adjacent surfaces.

.8 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

.2 Exterior Walls:

.1 Where existing doors and/or windows are schedule to be removed during demolition, patch and repair exterior walls using similar wall construction techniques as adjacent wall construction. Ensure compatibility between insulation, air barrier and vapour retarder, providing continuous air and vapour control and wall R-Value between existing and new construction. Provide exterior and interior finish materials, matching existing adjacent materials, to provide an even-plane surface of uniform appearance.

.3 Parging:

.1 Patch and repair existing parging damaged or spalling, in areas identified on the Drawings, using single-component, sand/cement blend designed for coating or parging vertical surfaces.

3.7 EQUIPMENT

.1 The Testing Agency shall provide and operate all necessary equipment for conducting accurate scans of existing reinforced concrete components for which openings are required.

.2 Equipment and methodology to be capable of scanning concrete elements to a maximum of 400 mm thickness.

3.8 EXCESSIVE DEMOLITION

.1 Where excessive demolition occurs, be responsible for cost of replacing such work.

.2 Consultant shall determine extent of such 'over-demolition' and method of rectification.

3.9 COMPLETION

.1 Leave project site as directed, reasonably clean and presentable, free from above grade debris, any salvaged material and/or equipment except those designated to remain.

.2 Maintain access to exits clean and free of obstruction during removal of debris.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

.1 Surface preparation.

.2 Application of clear, colourless, liquid concrete hardener and densifier.

.3 Grind and polish of floor to desired finish.

.4 Application of water-based concrete enhancer.

1.2 REFERENCES

.1 ASTM C779 - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.

.2 ASTM F609 - Standard Test Method for Using a Horizontal Pull Slipmeter (HPS).

.3 ACI 302.1R-04, Guide for Concrete Floor and Slab Construction.

.4 ASTM C805-02, Rebound Number of Hardened Concrete.

.5 ASTM G23-81, Ultraviolet Light and Water Spray.

1.3 SUBMITTALS

.1 Comply with Section 01 33 00 - Submittal Procedures.

.2 Submit manufacturer's product data and application instructions.

.3 Provide documentation showing finisher is certified by the polishing and densifier manufacturer.

.4 Contact manufacturer or supplier for a list of certified applicators.

.5 Submit letter of certification from concrete finish manufacturer stating that installer is certified applicator of special concrete finishes, and is familiar with proper procedures and installations requirements required by the manufacturer.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications

.1 Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the floor treatment.

.2 Mock-Ups

1. Apply mock-up of required finish to demonstrate surface finish, color variations and to determine a level of workmanship.
2. Build mock-up in the location and dimensions as directed by the architect or owner’s representative.
3. Prior to proceeding, ensure that mock-up meets all requirements of the architect or owner’s representative.
4. Maintain mock-up during construction in an undisturbed condition as a standard for judging the work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

.2 Store materials in a clean dry area in accordance with manufacturer's instructions.

.3 Keep products from freezing.

.4 Protect materials during handling and application to prevent damage or contamination.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do not apply product when air, surface, or material temperatures are expected to fall below 4° C (40° F) within four hours of expected application.

.2 Do not apply to frozen concrete.

.3 Do not use on highly dense or non-porous surfaces.

.4 Limit and control damage from excessive dust caused by grinding/polishing procedure.

.5 Properly dispose of collected dry dust from polishing.

1.7 Scheduling

.1 Do not commence application until at least 30 days after placing concrete or as directed by the manufacturer.

.2 Complete the polishing *Work* at least 10 days prior to installation of any equipment and fitments.

.3 Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer

PART 2 - PRODUCTS

2.1 Sealer

.1 MasterProtect H1000 Sealer, by Sika Flooring manufactured by Master Builders Solutions, 889 Valley Park Drive, Shakopee MN (tel. 1-800-243-6739).

2.2 RELATED MATERIALS

.1 Water: Potable water.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrate, with installer present, for conditions affecting performance of finish. Notify architect if surfaces are not acceptable. Do not begin application until unacceptable conditions have been corrected.

.2 Verify base slab meets finish and surface profile requirements

.3 Verify that floor surfaces are free of laitance.

.4 Final sheen shall be equivalent to that as accepted on the mock-up.

3.2 APPLICATION

.1 Depth of desired grind: cream finish (no/minimal aggregate exposure)

.2 Start floor finish application with coarse grinding process as required to achieve the depth of grind as specified in 3.2.1.

.3 Apply specified densifier in strict accordance with system manufacturer’s directions and to match approved mock-up. Achieve increased impermeability, hardening, dust-proofing and abrasion resistance of the surface without changing the natural appearance of the concrete except for the sheen and aggregate exposure.

.4 Continue grinding process using manufacturers recommended progressive sequence of grits to achieve desired sheen level and leaving the finish free of scratches. Ensure edges are ground and polished with the same sequence of grits to achieve a consistent finish from edge to edge.

.5 Polishing: polish concrete surface to achieve sheen level, matching approved mock up.

.1 Level 1 sheen: Satin Gloss (400 grit)

3.3 CONCRETE ENHANCER

.1 Allow 24 hours before proceeding with concrete enhancer application.

.2 Apply concrete enhancer, undiluted, according to manufacturer's instructions.

.3 Spray concrete enhancer using industrial sprayer delivering 1/10th of a gallon per minute.

.4 Pre-wet micro-fiber applicator with concrete enhancer prior to use.

.5 Uniformly spread concrete enhancer with a micro-fiber applicator, ensuring that the product is not allowed to dry before spreading is complete.

.6 Allow concrete enhancer to set up for two hours, then burnish with a 3000-grit diamond pad at 2000 RPM.

.7 For optimum performance, apply a second coat at a 90° (right) angle to the first coat, after the first coat is thoroughly dry.

3.4 PROTECTION

.1 Keep surface dry for a minimum of 48 hours after application.

.2 Allow 72 hours before heavy traffic.

3.5 CLEANING

.1 The premises shall be kept clean and free of debris at all times.

.2 Remove spatter from adjoining surfaces.

.3 Repair damages to surface caused by cleaning operations.

.4 Remove from building site excess and waste materials, mock-up panels, test areas, and debris resulting from *Work* of this Section. Leave premises in a condition acceptable to *Consultant*.

3.5 DEFECTIVE WORK

.1 Failure of materials or workmanship to meet requirements of this specification, and which cannot be repaired by approved methods, will be considered defective *Work* performed by this Section.

.2 Replace defective *Work*, as directed by *Consultant*.

.3 Testing and replacement of non-compliant *Work* in place:

.1 When initial inspection and tests indicate non-compliance with the *Contract Documents*, subsequent re-inspection and re-testing shall be performed by the same inspection and testing company and the costs thereof will be deducted by the *Owner* from the amounts owing to the *Contractor.*

.2 *Contractor* shall pay for additional inspection and testing, redesign, corrective measures and related expenses if *Work* has proven to be deficient.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply and install all miscellaneous metal work indicated on drawings and not included in the work of other Sections in addition to items listed in this Section.

.2 Section includes the supply and installation of decorative steel railings, complete with intermediate stanchions, as detailed on the Drawings for use in the following locations:

.1 Steel pan stairs/stringers

.2 Guardrail/Handrails at stairs;

1.2 RELATED REQUIREMENTS

.1 Read carefully all other Sections and review drawings to determine extent of metal work supplied and installed, or installed by others.

.2 Be responsible for co-ordinating this section with all related sections.

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless

.2 ASTM A325-10, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

.3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.4 ASTM C939-10, Standard Test Method for Flow of Grout for Preplaced Aggregate Concrete (Flow Cone Method)

.5 ASTM A1011/A1011M-12b, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with improved Formability, and Ultra-High Strength

.6 ASTM C1107/C1107M-11, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

.2 Canadian Standards Association (CSA):

.1 CSA G40.20-04/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel

.2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing or Irregularly Shaped Articles

.3 CSA-S16-09, Design of Steel Structures

.4 CSA-S136-07, North American Specification for the Design of Cold Formed Steel Structural Members

.5 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel

.6 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum

.7 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding)

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating

.2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type

.3 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base

.4 The Society for Protective Coatings (SSPC):

.1 SSPC1 Solvent Cleaning - 2004

.2 SSPC2 Hand Tool Cleaning - 2004

.3 SSPC-3 Power Tool Cleaning - 2004

.4 SSPC-6 Commercial Blast Cleaning - 2007

1.4 QUALITY ASSURANCE

.1 All Codes and Standards referred to in this Specification shall be current editions including all latest revisions and addenda.

.2 Conform to requirements of CSA-S16, Design of Steel Structures and CAN/CSA-S136, Cold Formed Steel Structural Members.

.3 Architectural metals work shall be of the highest architectural quality, free of scratches, pitting, roughness, marring, discolouration, staining and other imperfections.

.4 Work of this Section to be executed by firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturer's specializing in this work.

.5 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the site to direct the work of this Section.

.6 Where required by authorities having jurisdiction, have work of this Section designed by a professional engineer licensed to design structures and registered in the Province of the Work.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Division 01, bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Shop Drawings:

.1 Make thorough examination of drawings and details, determine the intent, extent, and materials, and be fully cognizant of requirements when preparing shop drawings.

.2 Submit shop drawings showing and describing in detail all work of this Section including large scale detail of members and materials, of connection and interfacing with work of other Sections, jointing details, and of anchorage devices, dimension, gauges, thicknesses, description of materials, metal finishing, as well as other pertinent data and information.

.3 Digital files of design drawings shall not be used in the preparation of shop drawings.

1.6 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any area beyond the design limits.

.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather during delivery and storage. Damaged materials shall not be used and shall be replaced by approved material.

.3 Cover and protect the work of other Sections in the area of work from damage. Make good all damage to the satisfaction of the Consultant.

.4 Protect the installed work of this Section and on completion the work shall be examined and damage shall be remedied to the complete satisfaction of the Consultant.

2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Delegated Design: Engage a qualified professional engineer, to design railings, including attachment to building construction.

.2 Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

.1 Handrails and Top Rails of Guards:

.1 Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.

.2 Concentrated load of 200 lbf (0.89 kN) applied in any direction.

.3 Uniform and concentrated loads need not be assumed to act concurrently.

.2 Infill of Guards:

.1 Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).

.3 Infill load and other loads need not be assumed to act concurrently.

2.2 MATERIALS

.1 Structural Steel Sections and Steel Plate: New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.

.2 Hollow Structural Sections (HSS): New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.

.3 Sheet Steel (Structural Quality): Conforms to ASTM A1011/A1011M.

.4 Sheet Steel (Commercial Quality): Conforms to ASTM A653/A653M, stretcher levelled or temper rolled.

.5 Tube: Conforms to ASTM A53.

.6 Galvanized Sheet Steel (Commercial Quality): Galvanized coating G90 (Z275) in accordance with ASTM A653/A653M, minimized spangle, stretch levelled or temper rolled. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.7 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M.

.8 Stainless Steel: Type 304, Blend S Finish, analysis 18-8.

.1 All countertops to be 16ga (1.5mm) thick

.9 Aluminum Plate and Sheet: ASTM B209M, Alloy 6061-T6.

.10 Aluminum Extrusions: ASTM B221M, Alloy 6063-T6.

.11 Non-Shrink Grout: Premixed, high strength, maximum bearing, impact resistant, non-shrink non-metallic aggregate grout having minimum 76 Mpa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, 'Embeco Premixed Grout' by Master Builders Technologies Ltd., or 'Tartan Grout Iron' by Webster & Sons Ltd., or 'Sika Grout 212 HP' by Sika Canada Inc., or approved equivalent.

.12 Galvanizing: All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot dip process according to CAN/CSA-G164, with minimum coating of 2 oz./sq.ft. Galvanize after all welding is complete. Welding of galvanized material will

not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.13 Primer Paint: CISC/CPMA 2-75.

.14 Bolts, Nuts, Washers: Conforms to ASTM A325.

.15 Welding Materials: Conforms to CSA W59.

.16 Metal Filler: Polyester based type.

.17 Painting:

.1 Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equivalent. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.

.2 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Sealtight Galvafroid Zinc-Rich Coating by W.R. Meadows of Canada Limited or Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equivalent.

.3 Touch-up Primer (On Site): Procryl Universal Acrylic Primer by Sherwin Williams Company of Canada Ltd, or approved equivalent. Touch-up primer shall be no less than 3 mil dft.

.4 Refer to Section 09 90 00, and coordinate with the above.

.18 Isolation Coating: Acid and alkali resistant bituminous paint.

.19 Building Paper: Conforms to CAN/CGSB-51.32.

.20 Butyl Tape: Extruded, high grade, macro-polyisobutylene tape of size, width and shore hardness to suit conditions.

2.3 FABRICATION

.1 Fit and assemble work in shop where possible. Execute work according to details and reviewed shop drawings.

.2 Take measurements at the building for work which is to fit or be connected to steel or concrete before commencing fabrication.

.3 Where shop fabrication is not possible, make trial assembly in shop.

.4 Do all welding in accordance with requirements of CSA W59, CSA W55.3 and CSA W47.1 including all supplements. Weld stainless steel electric arc process. Grind welds smooth and flush with surface of parent metal, where exposed to view and where specifically indicated on drawings. Welds shall be continuous seam welds unless specified otherwise. Maintain sharp arises.

.5 Fit joints and intersecting members accurately in true planes, square, plumb, straight with tight joints and intersections.

.6 Provide adequate reinforcing, fastenings, anchors, accessories required for fabrication and erection of work of this Section. Such items occurring on or in an exterior wall or slab shall be hot-dip galvanized. Make thread dimensions such that nuts and bolts will fit without rethreading or chasing threads.

.7 Fabricate, drill and tap members to accommodate attachments, anchorage and work of other Sections where located and directed by them.

.8 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, weld marks, burrs, rust and scale.

.9 Gauges and sizes of metal shall be adequate for various conditions.

.10 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep

exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.

2.4 SHOP PAINTING AND PROTECTION

.1 As per SSPC2 Hand Tool Clean and SSPC1 Solvent Clean, clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.

.2 Prepare steel as per SSPC-3 Power Tool Cleaning for Interior or SSPC-6 Commercial Blast Cleaning for exterior members. Remove rust, mill scale, oil, dirt, and other foreign matter before commencing shop painting.

.3 Apply shop coat of primer to all surfaces except areas requiring field welding. Apply by brush, working paint well into surfaces, interstices and cavities.

.4 Primer is to be free of runs, sags, or other collections of primer due to dipping of members into primer.

.5 Steel work shall be painted under cover, and shall remain under cover, until the paint protection is dry.

.6 Prime field welded areas after erection and touch up shop coat where damaged and barred by erection and handling.

.7 Prime steel with two full coats of paint in strict accordance with paint manufacturer's directions.

.8 Give the parts which are inaccessible after assembly two coats of primer coat paint, of different colours, when members are noted to be painted.

2.5 HOT DIP GALVANIZING

.1 Hot dip galvanize, after fabrication, steel metal fabrication items. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with brush or spray-applied anti-corrosion coating containing 92-95% zinc, in accordance with manufacturer's printed directions.

.1 Members exposed to elements when in final location.

.2 Members embedded on exterior side of exterior walls.

.3 Members imbedded in concrete.

.4 Members specified in this Section or indicated on Drawings.

.2 Hot-dip galvanize members in accordance with CAN/CSA G164 and requirements of the following ASTM standards, with minimum coating weights or thicknesses as follows, unless otherwise indicated that high performance organic finish is required:

.1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating of actual surface

.1 4.8 mm (3/16”) and less member thickness: 600 g/sq.m.

.2 6 mm (1/4”) and heavier members: 640 g/sq.m.

.2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in gram per square meter of surface, in accordance with Table 1 for the various classes of materials used in the Work.

3 Execution

3.1 GENERAL

.1 Verify at site that the Work to receive the work of this Section is free of irregularities detrimental to the installation and performance of the work and that it is located correctly and at proper levels before delivery and installation.

.2 Erection: To meet specified requirements of CAN/CSA-S16.

.3 Bearing Plates and Anchors: Standard.

.4 Anchors: Anchors to structural concrete shall be approved inserts set into concrete or approved self-drilling expansion insets drilled and placed afterwards.

3.2 INSTALLATION

.1 Assemble and erect work plumb, true, square, straight, level and accurate to sizes detailed, to reviewed shop drawings, free from distortion and defects detrimental to appearance and performance.

.2 Isolate metals where necessary to prevent corrosion due to contact between dissimilar metals and between metals and masonry, concrete or plaster. Use bituminous paint or butyl tape.

.3 Supply adequate instructions, templates, and if necessary, supervise installation of the fastenings or accessories requiring to be built-in by other Sections of the Work.

3.3 SCHEDULES

.1 Where items are required to be built into masonry, concrete or other work, supply such items to respective Sections with all anchors and accessories for building in.

.2 Itemized List: Supply and install metal work listed below unless specifically designated to be supplied only. Each item shall be as shown on drawings and as detailed on reviewed shop drawings.

.3 Miscellaneous Steel Framing, Channels, Angles, Plates and Brackets: As required and indicated on drawings.

.4 Metal grating: refer to structural drawings.

.5 Steel Pan Staircase:

.1 Cranked C-Channel stringer, treads, risers, platforms/landings as detailed on Drawings.

.2 Form risers, subtread pans from sheet steel of thickness needed to comply with performance requirements; directly weld metal pans to stringers.

.6 Guardrails and Handrails:

.1 Guardrail (GR-01) at Mezzanine/Landing (interior):

.1 Steel guardrail, complete with top rail, bottom toe board, intermediate stanchions and vertical pickets.

.2 Mounting: mechanically fastened to mezzanine structure

.3 Finish: paint finish per Spec 09 99 00

.2 Guardrail (GR-02) at Stairwell (interior):

.1 Galvanized steel guardrail, complete with top and bottom rail, continuously graspable handrail, intermediate stanchions and vertical pickets.

.2 Continuous bottom rail welded to stair stringer

.3 Finish: paint finish per Spec 09 99 00

.3 Posts at Terrace (exterior): Refer to Structural drawings

.4 Handrail (HR-01) at Stairs (interior):

.1 Tubular steel, 38mm (1-1/2”) dia. pipe rail with mounting flange as detailed on Drawings.

.2 Finish: paint finish per Spec 09 99 00

.7 Loose Lintels:

.1 Provide and install loose lintels if not by structural steel.

.2 Finish: Hot-dip galvanized after fabrication.

.8 Masonry Lateral Supports:

.1 Install deflection space and lateral support for non-load-bearing masonry walls and partitions in accordance with specified requirements of CAN/ULC-S304-M, where not provided on Structural Drawings.

.2 At walls with concealed tops:

.1 3" x 2" x 1/4" angles 8" long on both sides of walls. Anchor to structure above wall.

.3 At walls with tops exposed to view:

.1 3" x 2" x 1/4" angles, continuous on both sides of wall. Anchor to structure above wall.

.4 Finish: Prime paint.

.9 Other Miscellaneous Metal Components:

.1 As required and indicated on drawings.

.2 Finish: Prime paint for interior components, ready for finishing by Section 09 90 00 and hot-dip galvanized after fabrication for exterior components.

END OF SECTION

PART 1 - GENERAL

1.1 Definition

.1 Architectural woodwork: Shall mean custom fabricated cabinetry, counters/countertops, wood door frames, custom fabricated wall/ceiling panels.

1.2 Quality Assurance

.1 The "Quality Standards" of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), Edition 3.1, 2017 together with authorized additions and amendments, shall be used as a reference standard and shall form part of this Project Specification.

.2 Where modifications to the AWMAC Quality Standards contained within the Manual are included in this Project Specification, then such modifications shall govern in case of conflict.

.3 Any reference in Custom or Premium grade in this Specification shall be as defined in the AWMAC Quality Standards.

.4 Any 'item not given a specific quality grade shall be Premium grade as defined in the AWMAC Quality Standards.

.5 All architectural woodwork to be used in the Project shall meet the requirements of the AWMAC Quality Standards for the particular grade specified.

.6 References in this Specification to part and item numbers mean those parts and items contained within the AWMAC Quality Standards Manual.

1.3 Submittals

.1 Shop Drawings:

.1 Prepare and submit to the Consultant for review Shop Drawings for architectural woodwork in accordance with 01 33 00.

.2 Shop Drawings shall show wood and metal construction details of all architectural details of all general arrangements, locations of all service outlets: typical and special installation conditions; materials being supplied and all connections, attachments, anchorage and location of exposed fastenings, as applicable, field measured dimensions and coordination with other trade Contractors.

.3 Shop Drawings shall incorporate plans, elevations, sections and details for all architectural woodwork included in this Section.

.4 No Work shall be fabricated until the Shop Drawings have been reviewed and all other related submittals, and samples as required by the Specifications, have been approved by the Consultant.

.5 Submission of Consultant’s Drawings for Shop Drawings is not acceptable.

.2 Samples:

.1 Provide 3 samples of each plastic laminate, wood veneer and solid polymer surface to Consultant for review.

.3 Brochures:

.1 Submit manufacturer's descriptive literature of specialty items not manufactured by the architectural woodwork manufacturer as required by the Consultant.

1.4 Product Handling and Storage

.1 The architectural woodwork manufacturer and the Contractor shall be jointly responsible to make certain that architectural woodwork are not delivered until the building and storage areas are

sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content.

.2 Architectural woodwork delivery, storage, and handling shall be in accordance with AWMAC Quality Standards.

.3 Delivered, materials which are damaged in any way or do not comply with these Specifications will be rejected by the Consultant and shall be removed from the job site and replaced with acceptable materials.

1.5 Warranty

.1 Warrant labour, materials and Workmanship against defects and deficiencies for a period of two (2) years after the date of Substantial Performance.

PART 2-PRODUCTS

2.1 Millwork

.1 General: Use clean stock only and comply with AWMAC Quality Standards grades as indicated.

.2 **Plastic Laminate (PLAM-01)**: 1.6 mm thick, (allow for up to 4 colours)

.1 Manufacturer: Abet Laminati or equivalent

.2 Colour: to be selected by Consultant from full colour range

.3 **Plastic Laminate Magnetic Markerboard (PLAM-02)**: 1.6 mm thick, (allow for up to 4 colours)

.1 Manufacturer: Formica or equivalent

.2 Colour: to be selected by Consultant from full colour range

.4 **Solid Polymer Fabrication (SO-01/QZ-01)**: Solid, mineral based, non porous surfacing material, acrylic; not coated, laminated or of composite construction; in accordance with ANSI Z124 Type 6 and meeting the following:

.1 Properties:

.1 Tensile strength (ASTM D638-84): 6000psi.

.2 Tensile modulus (ASTM D638-84): 1.5 x 10 psi.

.3 Elongation (ASTM D638-84): 0.4%

.4 Hardness (Rockwell “M” Scale): 94.

.5 Hardness (Barcol Impressor): 60.

.6 Gloss – 60 deg. Gardner 9ANSI Z124-80, HUD Bulletin UM-73-84): 5 – 20.

.7 Colour stability (NEMA LD3): no change 200 hours.

.8 Wear, cleanability (ANSI Z124-80, HUD Bulletin UM-73-84): pass.

.9 Fire hazard (ASTM E84):

.1 Flame spread: maximum 15.

.2 Smoke developed: maximum 25.

.10 Water absorption (ASTM D570-81): 0.04% @ 24 hours/0.4% @ long term for 19 mm thickness sample.

.11 Stain resistance (ANSI Z124).

.2 Acceptable Manufacturers:

.1 Quartz by Corian, Solid surface by Corian or equivalent.

.3 Colour: To be selected from Consultant from manufacturer’s standard colour range (allow for 3 colours from price group 1 or 2).

.5 Hardwood lumber: moisture content 12 % or less in accordance with National Hardwood Lumber Association (NHLA) and AWMAC premium grade.

.1 Species: poplar where scheduled to receive paint finish, white oak where scheduled to receive stain finish.

.6 Plywood: veneer core, softwood, 19 mm thick typical unless otherwise indicated.

.1 Softwood: to CSA 0151.

.2 Fir to CSA0121-M1978.

.3 Hardwood plywood: to CSA O115.

.4 Poplar plywood (PP): to CSA O153, standard construction

.5 Where plywood is used for wall construction, the Flame Spread rating must be 150 or less on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

.6 Where plywood is used in ceiling construction, the Flame Spread rating must be 25 or less on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

.7 Particle board: not permitted

.8 Medium density fibreboard (MDF): to ANSI A208.2, density 769 kg/m. Medium density fibreboard must:

.1 meet the performance requirements of ANSI A208.2.

.2 be manufactured such that formaldehyde emissions do not exceed [0.15] ppm (180 g/m) when tested in accordance with ASTM E 1333.

.3 contain at least [15] % recycled materials by weight.

.4 Where MDF is used for wall construction, the Flame Spread rating must be 150 or less on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

.5 Where MDF is used in ceiling construction, the Flame Spread rating must be 25 or less on any exposed surface, or any surface that would be exposed by cutting through the material in any direction.

.9 Sealant: As per 07 92 00.

.10 Tempered Glass:

.1 Glass for all millwork shown on drawings to be tempered and typically ¼" thick unless noted otherwise.

2,2 Millwork Hardware

.1 As per Drawings/details.

2.3 Millwork Finishing - General

.1 Finish all interior millwork surfaces in plastic laminate, unless otherwise indicated.

2.4 Fabrication - General

.1 Obtain all on-Site dimensions before fabricating items. Obtain all relevant data and incorporate provisions for items of equipment enclosed by millwork.

.2 Verify wall alignment prior to proceeding with fabrication. Site conditions at variance with reviewed Shop Drawings shall be specifically noted on reviewed Drawings and forwarded to Consultant. Variances, due to Site conditions necessitating revisions to Shop Drawings shall be accepted prior to fabrication.

.3 Fabricate running members in maximum standard lengths obtainable for the particular species wherever possible.

.4 Fit all joints tight. Locate joints at points which will not interfere with, affect strength or detract from appearance of materials.

.5 Securely fasten intersecting framing members together at corners in an approved manner. Reinforce as required for rigid assembly designed for applicable loads.

.6 Wherever practicable, install, fit and adjust all hardware specified, in shop.

.7 Incorporate adequate provisions for scribing and fitting to adjoining surfaces in a manner acceptable to Consultant.

.8 Provide for and incorporate provisions to recognize inherent shrinkage characteristics of materials specified.

.9 Casework core material: 19 mm veneer core plywood.

.10 Casework edge trim: Plastic laminate with plastic laminate millwork and solid wood lippings with wood veneer millwork.

.11 Plastic laminate finish at all exposed surfaces, including cabinet/drawer interiors unless noted otherwise.

2.5 Fabrication/Retrieval – Owner Supplied Items

.1 Contractor shall be responsible for assembling and installing Owner supplied cabinets, drawers, doors and all related accessories as scheduled.

.2 Contractor shall be responsible for retrieving the owner supplied cabinets, drawers, doors and all related accessories from Owner's warehouse

2.6 Accessories

.1 Nails and staples: to CSA B111; galvanized to CAN/CSA-G164 for exterior work, interior humid areas and for treated lumber; stainless steel finish elsewhere.

.2 Wood screws: to CSA B35.4 stainless steel, type and size to suit application.

.3 Splines: wood.

.4 Adhesive: recommended by manufacturer.

.5 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this section.

PART 3 - EXECUTION

3.1 Job Conditions

.1 Job conditions for installation of architectural woodwork shall be as specified under AWMAC Quality Standards.

3.2 Installation

.1 Cabinet and Casework: Install in accordance with Section 705 of the AWMAC Quality Standards.

.2 Paneling and Trim: Install in accordance with Section 706 of the AWMAC Quality Standards.

.3 Finish Hardware: Install finish hardware in accordance with Section 711 of the AWMAC Quality Standards.

.4 All cutting and fitting of trim around fixtures and receptacles to be done as no extra cost to Contract.

.5 Scribe countertops to wall during installation. Install silicone sealant at backsplash/wall junction at time of installation. Colour to Consultant's selection.

END OF SECTION

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUMMARY

.1 Section Includes: Furnishing of all labour, materials, services and equipment necessary for the supply and installation of firestopping as indicated on drawings and as specified.

1.3 REFERENCES

.1 CAN4-S115-M85, "Standard Method of Fire Tests of Firestop Systems".

1.4 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittals Procedures.

.2 Product Data: Submit three copies of manufacturer's specification and installation instructions for each type of material required. Include data substantiating that materials comply with specified requirements.

.3 Shop Drawings: Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

.4 Samples: Submit duplicate 300 mm x 300 mm (12" x 12") samples showing actual firestop material proposed for project.

1.5 DELIVERY, STORAGE, & HANDLING

.1 Comply with manufacturer's recommendations for handling, storage and protection during installation.

.2 Do not allow materials to become wet or soiled, or covered with ice or snow.

1.6 JOB CONDITIONS

.1 Examine substrate and the conditions under which the insulation work is to be performed. Do not proceed with firestopping work until unsatisfactory conditions have been corrected.

1.7 FIRE-RESISTANCE RATINGS

.1 Ratings of firestop systems shall be not less than the fire-resistance ratings noted on drawings and required by authorities having jurisdiction for firestopping of the floor, wall, ceiling and roof assemblies involved.

.2 Ratings of firestop assemblies for service penetrations shall be not less than the fire resistance rating of the floor, wall, ceiling or roof assembly being penetrated.

.3 Use only ULC tested firestopping assemblies as approved by the Consultant prior to firestop installations.

2.0 PRODUCTS

2.1 MATERIALS

.1 Firestopping Systems: In accordance with CAN4-S115-M85. All firestopping systems installed shall be from single manufacturer. Trade Contractors shall coordinate with General Contractor.

.1 Accepted Products:

.1 "Fire & Smoke Containment Systems" by Tremco Ltd., Construction Division.

.2 "Fire barrier Firestop Systems" by A/D Fire Protection Systems Inc.

.3 "Fire Protection Products" by Electrical Products Division/3M.

.4 "Firestop Systems" by Hilti (Canada) Limited.

.5 Equivalent products per Specification 01 25 00.

.2 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115-M85 and not to exceed opening sizes for which they are intended.

.3 Firestop System Rating: Equal to fire separation rating as noted on drawings.

.2 Service Penetration Assemblies: Certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40 U19.

.3 Service Penetration Firestop Components: Certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.

.5 Firestopping at openings intended for ease of re-entry such as cables: Elastomeric or resilient seal; do not use cementitious or rigid seal at such locations.

.6 Firestopping at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: Elastomeric or resilient seal; do not use a cementitious or rigid seal at such locations.

.7 Primers: To manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: Non-sagging.

3.0 EXECUTION

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with firestopping materials to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

.1 Install firestopping material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

.1 Firestop at:

.1 Edges of floor slabs and rated roof slabs at slab edge covers, aluminum windows/curtain wall.

.2 Deflection space at top of fire-resistance rated masonry and gypsum board walls.

.3 Intersections of fire-resistance rated masonry walls to concrete and to gypsum board walls and of fire-resistance rated gypsum board walls to concrete and to masonry.

.4 Penetrations through fire-resistance rated masonry, concrete and gypsum board walls.

.5 Penetrations through fire-resistance rated floors, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.8 Firestopping around mechanical and piping assemblies penetrating fire separations by Division 20 - Mechanical. Firestopping systems and products to be coordinated with this specification section.

.9 Firestopping around electrical assemblies penetrating fire separations by Division 26 - Electrical. Firestopping systems and products to be coordinated with this specification section.

3.5 CLEAN-UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION.

1 General

1.1 SUMMARY

.1 Read other Sections of the Specification for extent of sealant specified in those Sections. Do all other sealing indicated, specified or required.

.2 Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labour, materials, equipment and incidentals necessary and required for the completion of the sealant.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C509-06(2011), Standard Specifications for Elastomeric Cellular Performed Gasket and Sealing Material

.2 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants

.3 ASTM C-1382-11, Standard Test Method for Determining Tensile Adhesion Properties of Sealants when Used in Exterior Insulation and Finish Systems (EIFS) Joints

.4 ASTM D2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.

.2 Samples: Submit for approval and colour selection sample of each type of compound, recommended primers and joint filler or fillers proposed to be used.

.3 Mock-Up:

.1 If requested by the Consultant, construct mock-ups where directed to show location, size, shape, colour and depth of joints complete with back-up material, primer and sealant. Mock-up may be part of finished work.

.2 Allow 24-hours for inspection of work before proceeding with work.

.4 Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

1.4 QUALITY ASSURANCE

.1 Adhere to Manufacturer's recommendations for mixing or preparation of materials listed in this Section.

.2 Pot life or installation times shall not be exceeded.

.3 Integral materials which compose a joint detail shall be compatible.

.4 Component parts, where possible, shall have the same manufacturer.

.5 A representative of sealant material manufacturer shall visit the site during application to ensure that all Work is carried out according to the manufacturer's printed instructions.

1.5 SITE CONDITIONS

.1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

1.6 DELIVERY, STORAGE HANDLING AND PROTECTION

.1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.

.2 Receive and store materials as recommended by materials manufacturer.

.3 Maintain containers and labels in undamaged condition.

1.7 WARRANTY

.1 Provide a written warranty endorsed and issued in the name of the Owner stating that all sealant work of this Section is warranted against leakage, cracking, crumbling, melting, running, deterioration, shrinkage, loss of cohesion, loss of adhesion, staining of adjoining or adjacent work or surfaces, or failure to provide intended seal for a period of five (5) years from the Date of Substantial Performance of the Work, and that any defects will be made good including, related materials and installation at no additional cost to the Owner.

2 Products

2.1 MATERIALS

.1 Joint Cleaner:

.1 Non-corrosive solvents as recommended by sealant manufacturer for applicable substrate material(s).

.2 Primer:

.1 Non-staining type as recommended by sealant manufacturer, for use on substrate conditions outlined, and compatible with specified sealant being applied.

.3 Joint Back-Up – Backer Rod:

.1 Round, closed cell, reticulated foam, 50% compression, compatible with sealant and primer, non-adhering to sealant.

.4 Bond Breaker:

.1 Pressure sensitive plastic tape, not bondable to sealant as recommended by sealant manufacturer.

.5 Sealant Type "A" – Joints around Interior Door Frames, Windows and Under Exterior Thresholds:

.1 One-part, low or medium modulus, neutral curing 100% silicone joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 35.

.1 DC CWS by Dow Corning.

.2 SWS by GE

.3 SikaSil WS-305CN by Sika

.4 Or approved equivalent.

OR

.2 One component, low modulus, moisture curing, polyurethane joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 25.

.1 Dymonic FC by Tremco Ltd., division of RPM Company.

.2 Sikaflex 1A by Sika Canada Inc.

.3 Sonolastic NP1 by BASF.

.4 Pourthane NS by W.R MEADOWS

.5 Or approved equivalent.

.6 Sealant Type "B" – Exterior Wall Joints; Control Joints; Expansion Joints:

.1 One-part, ultra low modulus, non-staining neutral curing 100% silicone joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 50.

.1 DC 790 by Dow Corning.

.2 Spectrem 1 by Tremco

.3 SCS2700 SilPruf LM by GE

.4 SikaSil WS-290 by Sika

.5 Or approved equivalent.

.7 Sealant Type "C" – Floor Control Joints:

.1 Multi-component, chemical curing, self-levelling, polyurethane joint sealant, conforming to ASTM C920-11, Type M, Grade P, Class 25.

.1 THC-900 by Tremco (Canada) Ltd., division of RPM Company.

.2 Sonolastic SL2 by Sonneborn Building Products, division of BASF Building Systems.

.3 Sikaflex 2c SL by Sika Canada Inc.

.4 Or approved equivalent.

.8 Sealant Type "E" – Mould and Mildew Resistant:

.1 Mould and mildew resistant, Shore A Hardness 15-25, conforming to ASTM C920-11, Type S, Grade NS, Class25, use NT, G, and A:

.1 SCS1700 by GE

.2 DC 786 by Dow Corning

.3 Tremsil 200 by Tremco

.4 Omni Plus by Sonneborn

.5 SikaSil –GP by Sika

.6 Or approved equivalent.

.9 Sealant Type "F" – Glazing Joints:

.1 Silicone Sealant: Butt glazing, one part, moisture curing, shore A hardness 15-25, conforming to CAN/CGSB-19.13-M, Classification C-1-40-B-N and C-1-25-B-N and ASTM C920-11, Type S, Grade NS, Class 25, use NT, G, A, O; Colour: clear (translucent):

.1 DC 795 by Dow Corning

.2 SCS2000 by GE.

.3 Multiseal by Chemtron.

.4 Spectrum 2 by Tremco

.5 SikaSil WS-295 by Sika

.6 Or approved equivalent.

.10 Sealant Type "H" – Saw Cut Sealant:

.1 Multi-component, self-levelling, conforming to ASTM D2240-05(2010):

.1 Tremco Control Joint Sealant

.2 BASF Masterfill 300

.3 Sika Loadflex

.4 Rezi-Weld Flex by W.R MEADOWS

.5 Or approved equivalent.

.11 Sealant Type “I” – HVAC Sealant:

.1 One-part, RTV, acetoxy-cure silicone sealant for heating, ventilation, air conditioning and refrigeration applications:

.1 Dow Corning HVAC Silicone Sealant

.2 Or approved equivalent.

.12 Sealant Type “J” – Electrical Sealant:

.1 One-part, white, non-flowing moisture cure adhesive for electrical applications:

.1 Dow Corning 738 Electrical Sealant

.2 Or approved equivalent.

.13 Sealant Type “K” - Interior Acoustical Sealant:

.1 Non-skinning, non-hardening, single component synthetic rubber sealant, conforming to CAN/CGSB-19.21-M:

.1 Tremco Acoustic Sealant

.2 Chemtron Metaseal

.3 Or approved equivalent.

.14 Preformed Compression Seal:

.1 Compartmental open cell neoprene extrusion type conforming to ASTM C509-06(2011), complete with liquid lubricant adhesive recommended by manufacturer.

3 Execution

3.1 INSPECTION

.1 Verify at site that joints and surfaces conditions provided will not adversely affect execution, performance or quality of completed work.

.2 Ensure masonry and concrete have cured 28 days minimum.

.3 Ascertain that sealers and coatings applied to substrates are compatible with sealant used and that full bond of the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and adhesion, if necessary.

.4 Verify that specified recommended environmental conditions are present before commending work.

.5 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.

.6 Do not start work of this Section until conditions are satisfactory.

3.2 PREPARATION

.1 Clean joint surfaces using joint cleaner as necessary, to remove dust, paint, loose mortar, and other foreign matter and dry joint surfaces.

.2 Remove dust, silt, scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease and other coatings from non-ferrous metals with approved cleaning solvent.

.4 Ensure surfaces are free of frost, rust, lacquers, laitance, release agents, moisture or other matter which might adversely affect adhesion of sealant.

.5 Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's written recommendations for specified sealant.

.6 Support joint filler on horizontal traffic surfaces against vertical movement which might result from traffic loads or foot traffic.

.7 Prepare surfaces as recommended by sealant manufacturer.

.8 Fully remove existing sealant scheduled to be removed and replaced with new sealant, in areas indicated on the Drawings.

.1 Follow manufacturers procedures for removal of existing sealant and test areas for adhesion of new sealant. Provide the Consultant with field report identifying results of adhesion testing.

.9 Install joint backing material or apply bond breaker tape to achieve correct joint depth and prevent three-sided adhesion.

.10 To protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or sealing.

.11 Prime sides of joints using two cloth method in accordance with manufacturer's directions immediately prior to sealing.

.12 Before any sealing is commended, a test of the material shall be made for indications of staining, poor adhesion or other undesirable effects.

.13 Seal joints in surfaces to be painted before painting. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure prime paint is compatible with primer and sealant. If incompatible inform Consultant, consult the manufacturer, and change primer and sealant to approved compatible types.

.14 Check form release agent used on concrete for compatibility with primer and sealant. If incompatible inform Consultant and change primer and sealant to approved compatible types or clean concrete to Consultant's approval.

3.3 APPLICATION

.1 Apply sealant in accordance with manufacturer's directions, using a gun with proper nozzle size, ensuring to fill voids and joints completely, to leave a weathertight, airtight installation. Superficial pointing with skin bead is not acceptable.

.2 Neatly tool surface to a slight concave profile. Surface of sealant shall be smooth, free from ridges, wrinkles, sags, air pockets and embedded impurities.

.3 Clean adjacent surfaces immediately and leave Work neat and clean. Remove excess sealant and droppings, using recommended cleaners as Work progresses. Remove masking tape after tooling of joints.

3.4 CLEANING AND PROTECTION

.1 Remove all waste materials from site. Sealant shall be cleaned of all foreign material as recommended by the sealant manufacturer. Leave work in a condition satisfactory to the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 Work Included

As detailed or scheduled in the contract documents, supply only of:

.1 Steel frame products including frames, transom frames (glazed or paneled), sidelight and window assemblies, fire-rated and non-rated.

.2 Steel panels, fixed or removable, flush or rabbetted, similar in construction to steel doors, for use in steel frame product.

.3 Steel doors, swing type, flush, with or without embossed face sheets, with or without glazed or louvered openings, fire-rated, with or without temperature rise ratings, and non-rated.

1.2 References

.1 ANSI/NFPA 80-1999, Standard for Fire Doors and Fire Windows

.2 ASTM A653/A653M-05a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

.3 ASTM C553-02, Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications

.4 ASTM C578-05, Specification for Rigid, Cellular Polystyrene Thermal Insulation

.5 ASTM C591-01, Specification for Un-Faced Pre-formed Rigid Cellular Polyisocyanurate Thermal Insulation

.6 ASTM C592-04, Specification for Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction

.7 ASTM C1289-05a, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

.8 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies

.9 CAN4-S106-M80, Standard Method for Fire Tests of Window and Glass Block Assemblies

.10 CGSB 41-GP-19MA (1984), Rigid Vinyl Extrusions for Windows and Doors

.11 CSA W59-2003, Welded Steel Construction (Metal Arc Welding)

.12 CSDMA, Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000

.13 CSDMA, Selection and Usage Guide for Steel Doors and Frames, 1990

.14 CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products – 08 11 00, 2006

1.3 Submittals

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate each type of door, frame, steel, construction and core.

.3 Indicate material thickness, mortises, reinforcements, anchorages, locations of exposed fasteners, openings (glazed, paneled or louvered) and arrangement of standard hardware.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule of the Architect.

.5 Contractor responsible for coordination and installation of products provided under this Section shall;

.1 Verify and provide to the contractor responsible for the supply of steel door and frame products, actual opening sizes and field conditions by field measurement before fabrication. Submittal drawings shall reflect measurements and conditions provided, and product manufactured accordingly. Coordinate field measurements with fabrication and construction schedules to avoid delays.

.2 Verify that substrate conditions, whether existing or installed under other Sections, are as detailed in the Architect's drawings, and are acceptable for product installation in accordance with the manufacturer's instructions.

.6 Manufacturer shall not proceed with fabrication without receipt of approved submittal drawings and approved hardware schedule.

1.6 Warranty

.1 Materials and workmanship shall be warranted by the manufacturer for a period of one (1) year from date of substantial performance.

PART 2 - PRODUCTS

2.1 Materials

.1 Acceptable Materials: Steel doors and frame product manufactured in accordance with this Specification by CSDMA members, are eligible for use on this project.

.2 Steel: Commercial grade steel to ASTM A653, CS, Type B, Coating Designation ZF75 (A25) minimum. Minimum steel thicknesses shall be in accordance with Appendix 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".

.1 Interior Doors: Face sheets shall be 0.042 in. (1.0 mm) minimum thickness.

.2 Exterior Doors: Face sheets shall be 0.042 in. (1.0 mm) minimum thickness zinc-coated steel conforming to ASTM A 653/A653M CS Type B, Coating Designation A60 (ZF180) or G60 (Z180).

.3 Door Core Materials

.1 Fiberglass: Loose batt type, density 24 kg/m3 (1.5 pcf) minimum, conforming to ASTM C553 or ASTM C592.

.2 Polyisocyanurate. Rigid, modified polyisocyanurate, closed cell board. Density; 32 kg/m3 (2.0 pcf) minimum, thermal values; RSI 1.9 (R 11.0) minimum, in accordance with ASTM C591 (un-faced) or C 1289 (faced).

.4 Primers

.1 Rust inhibitive touch-up only.

.6 Miscellaneous

.1 Door Silencers. Single stud rubber/neoprene type.

.2 Exterior Top Caps. Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.

.3 Frame Thermal Breaks. Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.

2.2 Fire/Impact Safety-Rated Glass

.1 Performance Requirements:

.1 Clear and wireless glass ceramic and tempered or annealed float glass material; listed for use in fire-rated or fire/impact safety-rated insulated glass units in locations with fire rating requirements ranging from 20 to 90 minutes with required hose stream test.

.2 Passes positive pressure test standards UL 10C.

.3 Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.

.4 Fire Rating: Fire rating classified and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2010-01; ULC Standards CAN4 S-104 and CAN4 S-106; NPFA 252 and NFPA 257\; and UL 9 and UL 10B.

.2 Properties:

.1 Thickness: 5/16 inch (8 mm) overall.

.2 Weight: 4 lbs./sq. ft.

.3 Approximate Visible Transmission: 85 percent.

.4 Approximate Visible Reflection: 9 percent.

.5 Fire-rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications (refer to drawings/details/schedules).

.6 Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).

.7 STC Rating: Approximately 38 dB.

.8 Surface Finish: polished.

.9 Positive Pressure Test: UL 10C; passes.

.3 Acceptable products:

.1 FireLite Plus® as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products.

.2 Equivalent products as per Specification 01 25 00.

2.3 Fabrication - Frame Products

.1 Exterior frame product shall be 14 gauge. Exterior frames shall be welded type construction, thermally broken. Exterior transom frames, sidelight and window assemblies shall be welded type construction, thermally broken. Interior frame product shall be 14 gauge. Interior frames and window assemblies shall be welded type construction. Interior transom frames shall be welded type construction. Interior sidelight assemblies shall be welded type construction.

.2 Frame product shall be mortised, blanked, reinforced, drilled and tapped at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.

.3 Mortised cutouts shall be protected with steel guard boxes.

.4 Frame product shall be reinforced only, where required, for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware. Drilling and tapping is by others, on site, at time of installation.

.5 Provide anchorage appropriate to floor, wall and frame construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb. For rebate opening heights up to and including 1520 mm (60") provide two (2) anchors, and an additional anchor for each additional 760 mm (30") of height or fraction thereof, except as indicated below. Frames in previously placed concrete, masonry or structural steel shall be provided with anchors located not more than 150 mm (6") from the top and bottom of each jamb, and intermediate anchors at 660 mm (26") on centre maximum. Fasteners for such anchors shall be provided by others.

.6 Minimum reinforcing, anchor and other component gauges shall be in accordance with Table 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".

.7 Each door opening shall be prepared for single stud rubber door silencers, three (3) for single door openings, two (2) for double door openings, except on gasketed frame product.

.8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.9 Fire-rated frame products shall be provided for those openings requiring fire protection as determined and scheduled by the Architect. Frames, transom and sidelight assemblies shall be listed for conformance with CAN4-S104. Window assemblies shall be listed for conformance with CAN4-S106. All fire-rated frame products shall bear the label of, and be listed by a nationally recognized testing agency having a factory inspection service. Labeling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify the manufacturer. Fire-rated frame products shall be constructed as listed for labeling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers

.10 Provide grout guards fabricated from not less than 0.016 in. (0.4 mm) thick steel at all hardware mortises on frame product to be grouted.

2.4 Welded Type

.1 Frame product shall be accurately mitered or mechanically jointed.

.2 As defined in Appendix 2 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products", frame product perimeter corner joints shall be:

.1 Face welded; continuously welded on the profile faces, with exposed faces filled and ground to a smooth, uniform, seamless surface.

.3 Joints at mullions, sills and center rails shall:

.1 Be coped accurately, butted and tightly fitted.

.2 At intersecting flush profile faces, be securely welded, filled and ground to a smooth, uniform, seamless surface.

.3 At intersecting recessed profile faces, be securely welded to concealed reinforcements, with exposed hairline face seams.

.4 At all other intersecting profile elements, have exposed hairline face seams.

.4 Welding shall conform to CSA W59.

.5 Where frame product is to be installed prior to the adjacent partition, a floor anchor shall be securely attached to the inside of each jamb profile. Each floor anchor shall be provided with two (2) holes for securing to the floor. For conditions that do not permit the use of a floor anchor, an additional wall anchor, located within 150 mm (6") of the base of the jamb, shall be substituted.

.6 Weld in two (2) temporary jamb spreaders per door opening to maintain proper alignment during shipment and handling, which shall not be used for installation.

.7 Glazing stops shall be formed steel channel, minimum 16 mm (0.625") height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.8 When required due to site access, when advised by the contractor responsible for coordination or installation, as specified on the Architect's drawings or due to shipping limitations, frame product for large openings shall be fabricated in sections as designated on the approved submittal drawings, with splice joints for field assembly and welding by others.

.9 Prior to shipment, mark each frame product with an identification number as shown on the approved submittal drawings.

.10 Refer to drawings/details/schedules for frame depth/throat opening sizes

2.3 Fabrication – Doors

.1 General

.1 Exterior doors shall be laminated core construction.

.2 Interior doors shall be welded stiffener construction.

.3 Longitudinal edges shall be continuously welded, filled and sanded with no visible edge seams.

.4 Doors shall be mortised, blanked, reinforced, drilled and tapped at the factory for template hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.

.5 Holes 12.7 mm (0.5") diameter and larger shall be factory prepared, except mounting and through-bolt holes, which are by others, on site, at time of hardware installation. Holes less than 12.7 mm (0.5") diameter shall be factory prepared only when required for the function of the device (for knob, lever, cylinder, thumb or turn pieces) or when these holes over-lap function holes.

.6 Doors shall be reinforced only, where required, for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware. Drilling and tapping is by others, on site, at time of installation.

.7 Top and bottom of doors shall be provided with inverted, recessed, welded steel channels. Exterior doors, and where otherwise scheduled by the Architect, shall be provided with flush steel top caps.

.8 Minimum reinforcing and component gauges shall be in accordance with Table 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".

.9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.10 Fire-rated doors shall be provided for those openings requiring fire protection and temperature rise ratings, as determined and scheduled by the Architect. Such products shall be listed for conformance with CAN4-S104. All fire-rated doors shall bear the label of, and be listed by a nationally recognized testing agency having a factory inspection service. Labeling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify the manufacturer. Fire-rated doors shall be constructed as listed for labeling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.

.11 Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.

.2 Laminated Core Construction

.1 Both face sheets for exterior doors shall be formed from a sheet of 14 gauge steel with polyisocyanurate core, laminated under pressure to face sheets.

.3 Welded Stiffener Construction

.1 Both face sheets for interior doors shall be formed from a sheet of 16 gauge steel.

.3 Doors shall be reinforced with vertical stiffeners, securely welded to each face sheet at 150 mm (6") on center maximum.

.3 Voids between vertical stiffeners shall be filled with fiberglass batt type insulation.

PART 3 - EXECUTION

.1 Site Storage and Protection of Materials

.1 Doors and frame product shall be removed from their wrappings or coverings upon receipt on site, be stored in a vertical position, and be spaced with blocking to permit air circulation between them.

.2 All materials shall be thoroughly inspected upon receipt and all discrepancies, deficiencies and/or damages shall be immediately reported, in writing, to the supplier.

.3 All damages incurred during shipment shall be noted on the carrier's Bill of Lading and immediately reported, in writing, to the supplier.

.4 Any scratches or disfigurement of doors or frame product caused by shipping or handling shall be promptly cleaned and touched-up with a zinc-rich primer.

.5 All materials shall be properly stored on planks or dunnage, out of water and covered to protect from damage from any cause.

.2 Installation

.1 Prior to installation, remove temporary shipping spreaders.

.2 Prior to installation, the area of floor on which the frame is to be installed, and within the path of the door swing, shall be checked and corrected for flatness.

.3 Door and frame product shall be checked for correct size, swing, rating and opening number.

.4 Caulk perimeter of frames between frame and adjacent material.

.5 Set frames plumb, square, level and at correct elevation.

.6 Fire-rated door and frame product shall be installed in accordance with the terms of their listings, NFPA-80, or the local Authority Having Jurisdiction (AHJ).

.7 Secure anchorages and connections to adjacent construction.

.8 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width. Provide vertical support at centre of head for openings exceeding 1200 mm (48") in width.

.9 During the setting of frame product, check and correct as necessary for opening width, opening height, square, alignment, twist and plumb, in accordance with the CSDMA, "Recommended Dimensional Standards for Commercial Steel Doors and Frames".

.10 Grout guards and junction boxes are intended to protect hardware mortises and tapped holes from masonry grout of 4 in. (101 mm) maximum slump consistency that is hand troweled in place.

.11 Frame products are not intended or designed to act as forms for grout or concrete. Grout hollow metal sections in "lifts" or take precautions otherwise to ensure that frames are not deformed or damaged by the hydraulic forces that occur during this process.

.12 Keep hollow metal surfaces free of grout, tar, and/or other bonding materials or sealers. Promptly clean grout, tar, and/or other bonding materials or sealers off of frame product and doors.

.13 Remove wood spreaders after frames have been built-in.

.14 Make allowance for deflection to ensure structural loads are not transmitted to frame product.

.15 Install doors, and hardware in accordance with hardware templates and manufacturer's instructions.

.16 Adjust operable parts for correct clearances and function.

.17 Install louvers, glazing and door silencers.

.18 Finish paint in accordance with Section 09 90 00.

END OF SECTION

1.0 - GENERAL

1.1 References

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.2 ANSI / WDMA I.S.1A - Window and Door Manufacturers Association (WDMA).

.3 CAN / CSA-0132.2.0-90 – General requirements for wood flush doors.

.4 ASTM E 2074-00 - Standard Methods of Fire Tests for Door Assemblies.

.5 UNDERWRITERS' LABORATORIES - UL 10B (Neutral Pressure) and UL 10C (Positive Pressure) - Fire Tests of Door Assemblies, and ULC S-104 Standard Methods of Fire Tests of Door Assemblies.

.6 NFPA 80 - Fire doors and other opening protectives

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Illustrate door opening information, such as: location, size, types, construction, swings, undercuts, special beveling, hardware location and preparation requirement, blocking for hardware in mineral core doors, fire ratings, identify cutouts, factory finish, glass and other pertinent data.

.3 Product Data. Indicate door core materials, thickness, construction, veneer species.

1.3 Samples

.1 Provide samples of door face veneer/finish for Architect’s approval.

1.4 Quality Assurance

.1 Manufacturer: Company specializing in manufacturing products specified in Section with a minimum of five years documented experience. Must be a member in good standing of the Architectural Woodwork Institute (AWI) and Quality Certification Program Certified (QCP). B.

.2 Quality Standard: Meet or exceed WDMA I.S.1-A Premium Grade

.3 Fire Ratings: Fire-rated wood doors to comply with NFPA 80 requirements according to building code standards having local jurisdiction.

.1 Neutral Pressure Testing – CAN/ULC S104; UL10B, NFPA252, and

.2 ASTM E-152. 2) Positive Pressure Testing – UBC 7-2-97 or UL10C.

.4 Label Certification: All doors requiring fire-rating will carry ULC label. Manufacturer's certification labels may be used for door size variations if approved by AHJ (Authority Having Jurisdiction).

1.5 Storage and Protection

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

2.0 – PRODUCTS

2.1 Wood Flush Doors

.1 Solid core, flush interior doors 44mm (1 ¾”) thick, solid core construction, WDMA workmanship for veneer faces, vertical edges, crossbands, horizontal edges and dimensional tolerances. Extra Heavy Duty Performance Level.

2.2 Materials

.1 Door Construction Grade: Except as otherwise shown on the drawings fabricate the work of this section to WDMA “Premium Grade”

.2 Door facing:

.1 Wood veneer: rift cut white oak

.3 Doors to be one piece core construction, no voids. Stiles and rails to be electronically glue bonded to particle core prior to abrasive sanding.

.4 Core material to be structural composite lumber.

.5 Edge: hardwood painted/stained to match door face finish.

.6 Adhesive: Type II (water resistant) for interior doors.

.7 Finish: satin clear coat finish.

2.3 Fabrication

.1 Construction: SCLC 5.

.2 Doors edge construction: Type D

.3 Size of doors; type, size, and location of lights and louvers; astragals, edging, flashing, and specialty hardware; as indicated on Door Schedule/Details.

.4 Fire-rated doors of construction standard of manufacturer and conform to requirements of applicable labeling agencies.

.5 Provide blocking as required for surface mounted hardware to prevent need for through bolting.

.6 Bevel vertical edges of single acting doors [3 mm in 50 mm] on lock side and [1.5 mm in 50 mm] on hinge side.

2.4 Door Construction

.1 No added urea-formaldehyde in wood components and adhesives.

2.5 Interior Glass Glazing and Glazing Surface Films

.1 Refer to Specification 08 81 00.

3.0 - EXECUTION

3.1 Installation

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed instructions [and CAN/CSAO132.2 Series, Appendix A].

.3 Adjust hardware for correct function.

3.2 Adjustment

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Comply with requirements listed in Division 1

.2 Furnish, deliver and install finish hardware.

.3 It is intended that the following list of hardware will cover finish hardware to complete the project. Bring to the Architect's attention any omissions, discrepancies that will affect work in this section during the bidding period.

1.2 QUALITY ASSURANCE

.1 Meet all requirements of the local building code and all other applicable regulations.

.2 Qualified suppliers must have in their employ a Certified A.H.C. (Architectural Hardware Consultant) as licensed by the Door and Hardware Institute. The supplier must have a minimum of two (2) years experience furnishing hardware for similar projects. Only firms that can extend manufacturers warranty to the project are to be considered as suppliers.

.3 Inspection of supplied Finishing Hardware will be done by a Certified A.H.C. A complete Site Inspection Report will be issued to the Architect.

1.3 SUBMITTALS

.1 Upon request, provide mounted samples of hardware items to be supplied.

.2 Prepare and submit two (2) copies of a detailed hardware schedule listing product numbers, size and finishes. Include two (2) sets of catalog cuts.

.3 Furnish other sections with two (2) complete sets of hardware templates for related fabricating and installation.

.4 Submit for owner review and comments two (2) key schedules listing the door number, hardware heading or item, and the key group.

.5 Where electrical hardware is to be supplied, provide wiring diagrams showing all wire termination points. Where electrical hardware is to be supplied and installed provide the contractor with riser diagrams listing the correct wire runs and back box sizes as well as 115 VAC requirements.

.6 Where required in Division 1, provide two (2) operating manuals for the owners use. Include copies of the hardware schedule, templates, installation instructions and all maintenance data.

1.4 PRODUCT DELIVERY, HANDLING, AND STORAGE

.1 Deliver each hardware item in its original package complete with all fasteners, keys, templates, and installation instructions required for installation.

.2 Clearly mark each container with the door opening number and the hardware schedule item or heading number.

.3 The contractor must store hardware delivered in a secure area. The storage area must contain adequate shelf space to hold all the hardware off the floor. Ensure the area is kept dry and clean.

.4 When requested, package items of hardware separately for delivery to other fabricators for their installation.

1.5 WARRANTY

.1 Provide a written warranty for a period of two (2) years for all hardware supplied and a five (5) year warranty for the door closers.

.2 When requested provide extended warranties listed in Division 1.

PART 2 PRODUCTS

2.1 See Hardware Schedule

PART 3 EXECUTION

3.1 INSPECTION

.1 The consultant will inspect all the door openings to ensure the specified products are supplied and installed in accordance with the manufacturers instructions. A written report will be furnished to the Architect detailing openings where products are missing, installed incorrectly or in need of proper adjustment.

3.2 INSTALLATION

.1 The general contractor shall obtain a copy of ANSI/DHI A115.1G-94,"Installation Guide for Doors and Hardware". It is the intent of this document to be used as a reference guide in the proper handling, storage, and installation of finishing hardware, and doors and frames. This document can be obtained through the Door and Hardware Institute.

.2 Other trades installing hardware must follow all manufacturers instructionsincluding door closer adjustment, handing of locksets as required, and degree of door swing. Advise the consultant if door frames are not square and plumb and prevent proper door hardware installation.

.3 Use only the original manufactures fasteners for the installation of all hardware products. Drill and tap doors and frames, where required, to properly install finishing hardware products.

.4 Mount hardware to suit door elevations. Unless otherwise directed by the consultant, install hardware at the following mounting heights:

Locksets	40"	(1015mm)
Exit device	40"	(1015mm)
Push/Pull	42"	(1065mm)
Deadlock	48"	(1200mm)

.5 Manufacturers of specified products are responsible to instruct hardware installers in the proper installation methods of their products.

3.3 FIELD QUALITY CONTROL

.1 Verify each door leaf opens closes and latches. Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements. Test access control system and electrified hardware devices for proper operation, owner to sign off on verification of operation. Verify electric door release hardware operates properly upon activation of the fire alarm system.

.2 Perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.

.3 Before completion of the work but after the hardware has been installed, submit a certificate to the architect stating that final inspection has been made and that hardware has been checked for installation and operation by a technician from the manufacturer and hardware consultant

3.4 ADJUSTING AND CLEANING

.1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.

.2 Adjust doors with self-closing devices or automatic closing devices for operation after the HVAC system is balanced and adjusted. Adjust spring power of non sized door closers to close and latch the door.

.3 Hardware to be left clean and free of disfigurements.

.4 Instruct owner personnel in the proper operation, adjustment and maintenance of hardware.

.5 Check locked doors against approved keying schedule.

3.5 PROTECTION

.1 Protect hardware from damage during construction. Wrap locks, panic hardware, and fire exit hardware, door pull trim with kraft paper or plastic bubble materials to protect finish from damage until date of substantial completion. Remove and reinstall or where necessary, use temporary hardware to maintain finish in new condition and maintain manufacturer's warranty.

3.6 HARDWARE SCHEDULE

.1 See attached Schedule of Finishing Hardware

END OF SECTION

Hardware Group No. 001

For use on Door #(s):
D106
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S SPA OS-OCC	626	SCH
1	EA	KICK PLATE	8400 8" X LDW	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE

Hardware Group No. 002

For use on Door #(s):
D113
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S SPA OS-OCC	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	KICK PLATE	8400 8" X LDW	630	IVE

Hardware Group No. 003

For use on Door #(s):
D116
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ALX80P SPA CMK	626	SCH
1	EA	K/L CYLINDER	BY OWNER	626	UNK
1	EA	KICK PLATE	8400 8" X LDW	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE

Hardware Group No. 004

For use on Door #(s):
D152
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ALX80P SPA CMK	626	SCH
1	EA	K/L CYLINDER	BY OWNER	626	UNK
1	EA	KICK PLATE	8400 8" X LDW	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE

Hardware Group No. 005

For use on Door #(s):
D153
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ALX80P SPA CMK	626	SCH
1	EA	K/L CYLINDER	BY OWNER	626	UNK
1	EA	OH STOP	90S	630	GLY
1	EA	KICK PLATE	8400 8" X LDW	630	IVE

Hardware Group No. 006

For use on Door #(s):
D153B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ALX80P SPA CMK	626	SCH
1	EA	K/L CYLINDER	BY OWNER	626	UNK
1	EA	KICK PLATE	8400 8" X LDW	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE

Hardware Group No. 007

For use on Door #(s):
D154 D155A D155B
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ALX80P SPA CMK	626	SCH
1	EA	K/L CYLINDER	BY OWNER	626	UNK
2	EA	OH STOP	90S	630	GLY
2	EA	KICK PLATE	8400 8" X LDW	630	IVE

Hardware Group No. 008

For use on Door #(s):
ED156
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	702	630	IVE
1	EA	THERMAL BREAK THRESHOLD	8726A X REQ. WIDTH (VERIFY SITE CONDITIONS FOR DEPTH)	A	ZER
1	EA	HARDWARE	BALANCE OF EXISTING HARDWARE TO BE RE-USED		UNK

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Design, labour, products, equipment, tools, and services necessary for glass and glazing work in accordance with the contract documents.

1.2 REFERENCES

.1 ASTM C920, Specification for Elastomeric Joint Sealants.

.2 ASTM D1003, Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.

.3 ASTM D2240, Test Method for Rubber Property - Durometer Hardness.

.4 CAN/CGSB-1.108-M, Bituminous Solvent Type Paint.

.5 CAN/CGSB-12.1-M, Tempered or Laminated Safety Glass.

.6 CAN/CGSB-12.3-M, Flat, Clear Float Glass.

.7 CAN/CGSB-12.8, Insulating Glass Units.

.8 CAN/CGSB-12.9-M, Glass, Spandrel.

.9 CAN/CGSB-12.20-M, Structural Design of Glass for Buildings.

.10 NFPA 80, Standard for Fire Doors and Other Opening Protectives.

1.3 DESIGN REQUIREMENTS

.1 Design glass to CAN/CGSB-12.20-M. Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation, and erection loads.

.2 Limit glass deflection to flexural limit of glass with full recovery of glazing materials.

.3 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.4 Perform a thermal stress analysis on each insulating unit and provide heat strengthening and/or tempered units as necessary to prevent thermal breakage.

1.4 SUBMITTALS

.1 Shop Drawings: Submit shop drawings in accordance with Section 01 33 00 for fabrication and erection of glazing elements indicating materials, thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.2 Samples:

.1 Submit following samples in accordance with Section 01 33 00.

.2 Submit one sample of each type of glass.

.1 300 x 300 mm of each type of insulating glass unit.

.2 Certificates: Submit manufacturer's certification that glass and glazing materials are compatible.

.3 Submit compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer’s interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

.4 Compatibility test report from manufacturer of insulating glass edge sealant, indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, setting blocks, edge blocks and any other material that contacts or can affect the edge seal.

.5 IGMA Compliance Audit: Submit in accordance with Section 01330, a written certification of successful completion of a Compliance Audit within the last six months.

1.5 QUALITY ASSURANCE

.1 Insulating glass unit fabricators shall be a certified member of the Insulating Glass Manufacturer's Alliance (IGMA). IGMA members must participate in the certification program and shall have successfully passed a Compliance Audit within the last six months.

1.6 SITE CONDITIONS

.1 Glaze with compounds, sealants, or tapes only when glazing surfaces are at temperatures over 4°C, and when positive that no moisture is accumulating on them from rain, mist, or condensation.

.2 When temperature of glazing surfaces is below 4°C, obtain from Consultant approval of glazing methods and protective measures which will be used during glazing operations.

1.7 EXTENDED WARRANTY

.1 In accordance with Section 08 90 00.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Glass manufacturers:

.1 Oldcastle Building Envelope.

.2 PPG Industries Ltd.

.3 Pilkington

.4 Prelco Architectural Glass Products

.5 Equivalent products per Specification 01 25 00.

2.2 MATERIALS

.1 General: All materials under work of this Section, including but not limited to, primers, coatings, sealers, sealants, adhesives and cleaners are to have low VOC content limits.

.2 Clear Tempered Glass **(TGL)** for use at interior glazed doors and screens shall conform to ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3. Glass thickness to suit opening size.

.3 Glazing and rebate primers, sealants, sealers, and cleaners: Compatible with each other. Type as recommended by glass manufacturer.

.4 Glazing sealant: Silicone sealant as recommended by glazing manufacturer. Verify compatibility with insulating glass unit secondary sealant.

.5 Heel & toe bead: Silicone sealant as recommended by glazing manufacturer.

.6 Screws, bolts and fasteners: Type 304 stainless steel..

2.3 FABRICATION

.1 Verify glazing dimensions on Site.

.2 Clearly label each glass lite with maker's name and glass type. Do not remove labels until after work is accepted by Consultant.

.3 Fabricate glazing not less than 3 mm smaller than rebate size in either dimension; allow for edge spacers, shims, and setting blocks as necessary.

.4 Work shall have smooth finished surfaces free from distortion and defects detrimental to appearance and performance.

.5 Carefully make and fit details. Take special care with exposed finished work to produce a neat and correct appearance to the Consultant's acceptance.

2.4 GLAZING SURFACE FILM STRIP

.1 Acceptable product: Milky Milky SH2MAMM by 3M Window Film or equivalent per Specification 01 33 00.

.2 Refer to door and screen schedule on drawings for locations.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

.3 Laminated glass edges shall be completely covered by tape to protect against sealants and water if required by Manufacturer.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

.1 Provide glazing in accordance with IGMA recommendations. Provide continuous contact between glazing tapes and gasket to the glazing.

.2 Provide neat, straight sight lines. Trim excess glazing material flush with top of stops and fixed leg of frames.

.3 Remove protective coatings, glazing stops, clean rebate and glass contact surfaces with solvent, wipe dry.

.4 Apply primer/sealer to contact surfaces, prior to glazing.

.5 Apply glazing tape as per manufacturer's instructions including recommended corner sealant.

.6 Use setting blocks at 1/4 points and spacers to centre glass unit in frame.

.7 Install glazing in accordance with reviewed shop drawings and manufacturer's written instructions. Install glazing with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.

.8 Apply a continuous heel bead of sealant around perimeter of inboard lite of the sealed unit and the metal framing.

.9 Re-install glazing stops ensuring continuous contact and rattle-free installation. Do not distort glass. Trim tape protruding more than 2 mm above stop.

.10 Install glazing gasket in accordance with manufacturer's recommendations

.11 Do not cut or abrade tempered, heat treated, or coated glass.

.12 Install glass presence markers in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

.13 Remove, dispose of, and replace broken, cut and abraded glass.

.14 Exterior glass: Glaze units with sealant on exterior side and glazing tape on interior side. Seal gap between glazing and stop with sealant to depth equal to bite of frame. Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

.15 Interior glass: Glaze interior glass using glazing gasket glazing tape.

3.4 CLEANING

.1 Immediately remove sealant and compound droppings from finished surfaces.

.2 Remove labels, protective material, and glass presence markers from prefinished surfaces.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes the following:

.1 Steel stud framing systems for interior partitions.

.2 Steel stud steel framing systems for ULC fire rated shaftwall assemblies.

.3 Suspension systems for interior ceilings and soffits.

.4 Grid suspension systems for gypsum board ceilings.

.5 Systems shall be engineered to resist lateral loading and support adjacent building components where indicated.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA):

.1 CSA S136-07, North American Specification for the Design of Cold-Formed Steel Structural Members.

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-7.1-98, Lightweight Steel Wall Framing Components

.3 American Society for Testing and Materials International (ASTM):

.1 ASTM A641/A641M-09a, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.2 ASTM A653/A653M-11 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.4 ASTM A875/A875M-10, Specification for Steel Sheet, Zinc-5% Aluminum Alloy-coated by the Hot Dip Process.

.5 ASTM A1003/A1003M-12, Specification for Steel Sheet, Carbon, Metallic and Non-Metallic Coated for Cold Formed Framing Members.

.6 ASTM C11-10a, Standard Terminology Relating to Gypsum and Related Building Materials.

.7 ASTM C473-12, Standard Test Methods for Physical Testing of Gypsum Panel Products.

.8 ASTM C645-11a, Standard Specification for Nonstructural Steel Framing Members.

.9 ASTM C665-12, Standard Specification for Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.10 ASTM C754-11, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.11 ASTM C834-10, Standard Specification for Latex Sealants.

.12 ASTM C841-03(2008)e1, Standard Specification for Installation of Interior Lathing and Furring.

.13 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033" to 0.112" in Thickness.

.14 ASTM C955-11c, Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

.15 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.4 Canadian Sheet Steel Building Institute (CSSBI):

.1 CSSBI S6-2011, Guide Specification for Lightweight Steel Framing

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data for each materials specified including recommended application rates and methods of installation.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Product Certificates: For each type of code-compliance certification for studs and tracks.

.2 Shop Drawings: Submit shop drawings showing the design, construction and relevant details of furring, enclosures and partitions which require a fire rating.

.3 Retain a Professional Engineer registered in the province of Ontario to design the Lightweight Steel Framing System where indicated in drawings; to prepare, seal and sign all shop drawings; and to perform field review. Shop drawings shall show both design and installation requirements.

1.4 QUALITY ASSURANCE

.1 Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association (SSMA).

.2 Contractor executing work of this Section shall have a minimum of five (5) years continuous experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

1.5 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, enclosed, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact, in accordance with GA-238 and manufacturer's recommendations.

2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

.2 STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

.1 Framing Members, General: Comply with ASTM C754 for conditions indicated.

.1 Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.

.2 Steel sheet components shall comply with ASTM C645 requirements for metal, unless otherwise indicated.

.3 Steel for non-loadbearing members shall have metallic coats that conform to ASTM A653M or ASTM A792M with minimum metallic coating weighs (mass) of Z120 and AZM150 respectively.

.4 Framing members shall comply with the CAN/CSA S136 - North American Specification for the Design of Cold Formed Steel Structural Members, for conditions indicated.

.5 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use bituminous paint, butyl tape or other approved divorcing material.

.2 Studs and Tracks: ASTM C645.

.1 Steel Studs and Tracks:

.1 Minimum 0.0179" (25 gauge), screwable with crimped web and returned flange. Provide knockout openings in web at 150mm (6") O.C. to accommodate (if required) horizontal mechanical and electrical service lines, and bracing. Widths as indicated on drawings. Provide structural studs where indicated.

.2 Framing behind all fire resistant gypsum board shall be minimum 0.0329" (20 gauge).

.3 Where metal stud framing forms walls are to be thermally insulated as indicated on drawings, provide metal studs with integrated fastening system for glass fibre/mineral fibre insulation.

.4 Provide special shapes indicated on drawings as part of steel stud/drywall assemblies.

.3 Steel Framing for Shaft Wall Assemblies

.1 CT profile stud framing in 2 ½", 4" or 6" depth as scheduled, gauge to suit installation.

.2 J-tabbed track profile for use at floor and ceiling of shaft wall assembly.

.4 Slip-Type Head Joints: Where indicated, provide one of the following:

.1 Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2" (51-mm) minimum vertical movement.

.2 Double-Track System: ASTM C645 top outer tracks, inside track with 2" (51 mm) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.

.3 Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

.5 Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

.1 Minimum Base-Steel Thickness: As indicated on Drawings.

.6 Cold-Rolled Channel Bridging: Steel, 0.0538" (1.367 mm) minimum base-steel thickness, with minimum ½" (13 mm) wide flanges.

.1 Depth: As indicated on Drawings.

.2 Clip Angle: Not less than 1-1/2" x 1-1/2" (38 mm x 38 mm), 0.068" (1.72 mm) thick, galvanized steel.

.7 Hat-Shaped, Rigid Furring Channels: ASTM C645.

.1 Depth: As indicated on Drawings.

.8 Resilient Furring Channels: ½" (13 mm) deep, steel sheet members designed to reduce sound transmission.

.1 Configuration: hat shaped.

.9 Cold-Rolled Furring Channels: 0.053" (1.34 mm) uncoated-steel thickness, with minimum ½" (13 mm) wide flanges.

.1 Depth: As indicated on Drawings

.2 Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329" (0.8 mm).

.3 Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062" (1.59 mm) diameter wire, or double strand of 0.048" (1.21 mm) diameter wire.

.10 Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4" (32 mm), wall attachment flange of 7/8" (22 mm), minimum uncoated-steel thickness of 0.0179" (0.455 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

.1 Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062" (1.59 mm) diameter wire, or double strand of 0.048" (1.21 mm) diameter wire.

.2 Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16" (4.12 mm) in diameter.

.3 Flat Hangers: Steel sheet, in size indicated on Drawings.

.4 Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538" (1.367 mm) and minimum ½" (13 mm) wide flanges.

.1 Depth: As indicated on Drawings.

.5 Furring Channels (Furring Members):

.1 Cold-Rolled Channels: 0.0538" (1.367 mm) uncoated-steel thickness, with minimum ½" (13 mm) wide flanges, ¾" (19 mm) deep.

.2 Steel Studs and Tracks: ASTM C645.

.1 Depth: As indicated on Drawings.

.3 Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22 mm) deep.

.4 Resilient Furring Channels: 1/2"' (13 mm) deep members designed to reduce sound transmission.

.1 Configuration: Hat shaped.

.6 Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

.1 General: Provide auxiliary materials that comply with referenced installation standards.

.1 Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

.2 Isolation Strip at Exterior Walls: Provide one of the following:

.1 Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.

.2 Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8” (3.2 mm) thick, in width to suit steel stud size.

3 Execution

3.1 EXAMINATION

.1 Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

.1 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

.1 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

.2 Coordination with Sprayed Fire-Resistive Materials:

.1 Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24” (610 mm) o.c.

.2 After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

.1 Installation Standard: ASTM C754.

.1 Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.

.2 Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

.2 Install framing and accessories plumb, square, and true to line, with connections securely fastened.

.3 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

.4 Install bracing at terminations in assemblies.

.5 Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

.1 Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

.2 Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

.3 Install studs so flanges within framing system point in same direction.

.4 Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

.1 Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

.2 Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

.1 Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

.3 Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

.4 Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

.5 Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

.6 Curved Partitions:

.1 Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

.2 Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6” (150 mm) o.c.

.5 Direct Furring:

.1 Screw to wood framing.

.2 Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

.6 Z-Shaped Furring Members:

.1 Erect insulation, vertically and hold in place with Z-shaped furring members spaced 24” (610 mm).

.2 Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24” (610 mm) o.c.

.3 At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12” (305 mm) from corner and cut insulation to fit.

.7 Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8” (3 mm) from the plane formed by faces of adjacent framing.

3.6 INSTALLATION - VERTICAL SHAFTWALLS

.1 Layout per construction drawings. Secure J-Tabbed Track as perimeter framing and plumb to ceiling, floor and sides. Attached with suitable fasteners, spaced not more than 24" o.c. Apply a bead of non-hardening, flexible sealant to the perimeter.

.2 Pre-plan the stud layout 24" o.c. and adjust the spacing at either end so the end studs will not fall closer than 12" from the end.

.3 Erect the first 1" Shaftliner panel, cut 3/4"-1" less than the total height of the framed section. Plumb the panel against the web of the J-Tabbed Track and bend out tabs in J-Tabbed Track to secure panels in place.

.4 Insert C-T Stud, cut 3/4" less than overall height, into the top and bottom J-Tabbed Tracks and fit tightly over previously installed 1" panel. Allow equal clearance between top and bottom J-Tabbed Track.

.5 Install the next 1" Shaftliner inside the J-Tabbed Track and within the tabs of the C-T stud.

.6 Progressively install succeeding studs and panels as described above until the wall section is enclosed. The final panel section may be secured with tabs from the J-Tabbed Track at 12" o.c.

.7 Where wall heights exceed the standard or available length of Shaftliner panels, the panels may be cut and stacked with joints occurring within the top or bottom third points of the wall. Joints of adjacent panels should be alternately staggered to prevent a continuous horizontal joint. Gypsum panels must engage a minimum of 2 tabs.

.8 C-T Studs cannot be spliced. They must be installed full height, one piece.

.9 For doors, ducts or other large penetrations or openings, install J-Tabbed Track as perimeter framing. Use 20-gauge track with a 3" back leg for elevator doors and block cavity with 12" wide gypsum filler strips for doors exceeding 7'-0" height.

3.7 INSTALLING CEILING SUSPENSION SYSTEMS

.1 Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

.1 Hangers: 48” (1219 mm).

.2 Carrying Channels (Main Runners): 48” (1219 mm)

.3 Furring Channels (Furring Members): 24” (610 mm), unless otherwise indicated on the Drawings.

.2 Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

.3 Suspend hangers from building structure as follows:

.1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

.1 Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

.2 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

.1 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

.3 Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

.4 Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

.5 Do not attach hangers to steel roof deck.

.6 Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

.7 Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

.8 Do not connect or suspend steel framing from ducts, pipes, or conduit.

.4 Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

.5 Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

.6 Installation Tolerances: Install suspension systems that are level to within 1/8” in 12’ (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C1396 Standard Specification for Gypsum Board

.2 ASTM C 475-94, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C 514-94, Specification for Nails for the Application of Gypsum Board.

.4 ASTM C 557-93a, Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.5 ASTM C 840-95, Specification for Application and Finishing of Gypsum Board.

.6 ASTM C 954-93, Specification for Steel Drill Screws for the Application of Gypsum Board.

.7 ASTM C 1047-94, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C1177-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

.9 ASTM C1178M -08, Standard Specification for Coated Glass Mat Water Resistant Gypsum Backing Panel

.10 ASTM C1658-06, Standard Specification for Glass Mat Gypsum Panels

.11 ASTM C1629M-06, Standard Classification for Abuse Resistant Non Decorated Interior Gypsum Panel Products and Fiber Reinforced Cement Panels

.12 ASTM D3273-00, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-1988, Building Materials and Assemblies, Standard Method of Test for Surface Burning Characteristics of.

1.2 Site Environmental Requirements

.1 Maintain temperature minimum 10C, maximum 21C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

PART 2 - PRODUCTS

2.1 Materials

.1 Standard Gypsum Board: to ASTM C1396, 12.7mm (1/2”) or 15.9mm (5/8” thick), 1200mm (4’-0”) wide x maximum practical length.

.1 Provide 15.9mm (5/8”) thick Type X, Fire Rated panels where scheduled/detailed (Classification as to CAN/ULC-S114 for fire resistance, surface-burning characteristics and non-combustibility).

.2 Tilebacker: Acrylic coated glass mat facers with water resistant gypsum core to ASTM C1178, 12.7mm (1/2") thick, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273, or Cement Board to ASTM C1325. Use at all locations scheduled to receive tile and at ceilings to washroom/shower areas.

.1 Provide 15.9mm (5/8") thick Type X, Fire Rated panels where scheduled/detailed (Classification as to CAN/ULC-S114 for fire resistance, surface-burning characteristics and non-combustibility).

.3 Abuse Resistant Gypsum Board; Heavy duty glass mat facers with dense water resistant treated gypsum core to ASTM C1658 and ASTM C1629, 12.7mm (1/2") thick, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273.

.1 Provide 15.9mm (5/8") thick Type X, Fire Rated panels where scheduled/detailed (Classification as to CAN/ULC-S114 for fire resistance, surface-burning characteristics and non-combustibility).

.4 Shaftliner: Glass Mat faced with water resistant treated gypsum core to ASTM C1658, Type X, 25mm (1') thick, 610mm (2'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273

.4 Steel drill screws: to ASTM C 1002.

.5 Stud adhesive: to CAN/CGSB-71.25 ASTM C 557.

.6 Laminating compound: as recommended by manufacturer, asbestos-free.

.7 Shadow gap: Bailey D300 Metal trim, CGC Dur-a-bead or Nicolson Rollforming No 114, fillable edge trim, 0.55mm (0.022") base thickness commercial grade sheet steel with zinc wiped coating to ASTM A 525-93; perforated flanges; one piece length per location. To be used at the junction of all dissimilar materials and/or as detailed.

.8 Corner bead: Bailey D100-90, 90-degree corner trim fillable edge trim, 0.55mm (0.022") base thickness commercial grade sheet steel with zinc wiped coating to ASTM A 525-93; perforated flanges; one piece length per location.

.9 Control joints: No 093 Zinc Control Joints by CGC Inc or Nicholson Rollforming. To be installed where indicated on drawings.

.10 Sealants: in accordance with Section 07 90 00 - Joint Sealers.

.11 Acoustic sealant: concealed purpose made, non-skinning, non hardening type to CAN/CGSB-19.21-M87, as manufactured by Tremco or Monsey-Bakor, USE Hickson

.12 Sound attenuation insulation (acoustic batt insulation type 'C')

.1 Mineral or fiberglass sound attenuation batt or boards to ULC S702 and as required by fire rated tests.

.2 Thickness: full stud thickness or as otherwise stated on the Drawings and Schedule.

.13 Joint compound: to ASTM C 475, asbestos-free. Latex resin base, possessing good adhesion, mixed with fresh, unadulterated water having no detrimental effects on compounds. Type recommended by manufacturer for application indicated.

.14 Joint reinforcing tape; for gypsum board; 50mm (2") x 0.3mm (0.01")thick perforated paper with chamfered edges. Use fiberglass joint reinforcing tape at all areas where gypsum board may come in contact with moisture.

.15 1 hour rated walls to be filled with absorptive material processed from rock or slag with a mass of at least 2.8 kg/m^2 for 89mm thickness and completely filling the wall cavity.

PART 3 - EXECUTION

3.1 Erection

1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.

.2 Do application of gypsum sheathing in accordance with ASTM C 1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes in accordance with ASTM C 840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated

3.2 Application

.1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.

.2 Apply 12 mm (1/2”) diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts,in partitions where perimeter sealed with acoustic sealant.

3.3 Installation

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150mm oc using contact adhesive for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.

.6 Construct control joints of preformed units two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.7 Provide continuous polyethylene dust barrier behind and across control joints.

.8 Locate control joints where indicated at changes in substrate construction at approximate 10m spacing on long corridor runs at approximate 15m spacing on ceilings.

.9 Install control joints straight and true.

.10 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.11 Install expansion joint straight and true.

.12 Splice corners and intersections together and secure to each member with 3 screws.

.13 Install access doors to electrical and mechanical fixtures specified in respective Sections.

.1 Rigidly secure frames to furring or framing systems.

.14 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.15 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.16 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.18 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.19 Mix joint compound slightly thinner than for joint taping.

.20 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.21 Allow skim coat to dry completely for walls receiving high gloss paint and where indicated.

.22 Remove ridges by light sanding or wiping with damp cloth.

.23 Fasten board to metal support members by metal gypsum board screws at, 9.5mm (0.374”) minimum to , and 12.7mm (1/2”) maximum from, center of joints. Space screw:

.1 At ceilings of fire rated board at 200mm (8”) o.c. at edges and in field unless indicated otherwise.

.2 At walls of fire rated board at 200mm (8”) o.c. at edges and 305mm (12”) o.c. in field Locate screws opposite one another in adjacent panels unless indicated otherwise.

.3 At typical board walls at 400mm (16”) o.c. at edges and field unless noted otherwise.

.4 At typical board ceilings at 305mm (12”) o.c. at edges and field unless noted otherwise.

.24 When installing fiberglass mat faced mould and moisture resistant gypsum board do so as per manufacturers recommendations. Tape joints with self adhesive fiberglass tape and embed the tape in setting type compound. Finish joint with two layers of all purpose joint compound. High build primer should be applied to surface before painting. As with regular paper faced gypsum board, in areas where gloss paint is to be applied or in areas of critical light a skim coat should be applied to the surface before priming and painting.

3.4 Schedules

.1 Construct fire rated assemblies where indicated on drawings

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Labour, Products, equipment and services necessary for tile Work in accordance with the Contract Documents.

1.2 REFERENCES

.1 ANSI A108/A118/A136.1, Installation of Ceramic Tile.

.2 ASTM C144, Specification for Aggregate for Masonry Mortar.

.3 CAN/CSA A3000, Cementitious Materials Compendium.

.4 TTMAC Specification Guide 09 30 00 Tile Installation Manual.

.5 TTMAC, Maintenance Guide.

1.3 SUBMITTALS

.1 Product data:

.1 Submit copies of manufacturer's Product data in accordance with Section 01 33 00 indicating:

.1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations and warranties.

.2 Product transportation, storage, handling and installation requirements.

.2 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 01 33 00 indicating:

.1 Tile layout, patterns, and colour arrangement.

.2 Perimeter conditions, junctions with dissimilar materials.

.3 Setting details.

.3 Samples:

.1 Submit following sample panels in accordance with Section 01 33 00.

.1 Each colour, texture, size, and pattern of tile.

.2 Adhere tile samples to 400 x 400 x 12.5 mm thick cement board complete with selected grout colour in joints.

.4 Certificates: Submit manufacturer's certificates stating that materials supplied are in accordance with this specification.

.5 Closeout submittals: Submit recommended maintenance instructions and listing of recommended maintenance Products for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Perform Work of this Section by a company that is a member in good standing of the Terrazzo Tile and Marble Association of Canada with proven, acceptable experience on installations of similar complexity and scope.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in adequate crates or containers with manufacturer’s name and product description clearly marked.

.2 Handle and store tiles in a manner to avoid chipping, breakage or the instruction of foreign matter. Take precautions to protect the mortar and grout admixtures from freezing or from excessive heat.

1.6 SITE CONDITIONS

.1 Do not install Work of this Section outside of the following environmental ranges without the Consultant's and Product manufacturer's written acceptance:

.1 Ambient air and surface temperature: 15^0C to 45^0C.

.2 Precipitation: None.

.2 Install temporary protection and facilities to maintain the Product manufacturer's, and specified, environmental requirements for 7 Days before, during, and 7 Days after installation.

1.7 MAINTENANCE

.1 Submit extra tile amounting to 3% of gross area covered, allowing proportionately for each pattern and type specified and which are part of the same Production run as installed Products. Store maintenance Products as directed by the Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General: All materials under Work of this Section, including but not limited to, primers, and sealers are to have low VOC content limits.

.2 Ceramic Wall Tile CER

.1 Colour & Dimension Series Wall Tile as distributed by Olympia Tile. Format 4” x 4”, allow for 3 colours to be selected by Consultant.

.2 Equivalents as per 01 25 00.

.3 Porcelain Floor Tile (POR)

.1 La Riveria through full body porcelain tile, manufactured by Centura. Size to be selected by consultant. Colour: to be selected by Consultant from Price Group 2, allow for up to 2 colours.

.2 Keystones series series through full body porcelain tile, manufactured by Daltile. Size 5cm x 5cm. Colour: to be selected by Consultant from Price Group 2, allow for up to 2 colours.

.3 Equivalent product as per Specification 01 25 00.

.4 Wall edge trim: L-shaped profile with 1/8" (3.2) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer. Material: Brushed stainless steel Type 304. Acceptable product: Schluter SCHIENE.

2.2 MOARTAR, ADHESIVE AND GROUT MATERIALS

.1 Cement: CAN/CSA A3000, Type GU.

.2 Hydrated Lime: to ASTM C207, Type S.

.3 Sand: ASTM C144, passing 16 mesh.

.4 Water: Potable and free of minerals and other contaminants which are detrimental to mortar and grout mixes.

.5 Polymer additive: Keralastic by Mapei Inc or approved alternative by Latricrete International or Flextile.

.6 Mortar

.1 Single component polymer modified mortar to ANSI 118.4 and 118.11. Acceptable product: Ker 121 by Mapei, 50 PM Mortar by Flextile or approved equal

.7 Grout:

.1 Floors and bases (below 3 mm joint width): 'Keracolor U' by Mapei Inc. or approved alternative by Latricrete International.

.2 Floors and bases (3 mm to 10 mm joint width): 'Ultra/Color' by Mapei Inc. or approved alternative by Latricrete International.

.3 Walls (1.5 mm to 3 mm joint width): 'Ker 800' by Mapei Inc. or approved alternative by Latricrete International.

.4 Walls (over 3 mm joint width): 'Ultra/Colour' by Mapei Inc. or approved alternative by Latricrete International.

2.3 WATERPROOF MEMBRANE

.1 Membrane: premixed, advanced liquid-rubber, extremely quick-drying waterproofing and crack-isolation membrane for installation under ceramic tile or stone capable of providing a thin, continuous barrier to protect adjacent rooms and floors below from water damage. To be installed to floors and walls of all washrooms and/or as indicated in drawings.

.1 Acceptable product: Mapelastic AquaDefense by Mapei

.2 Equivalent per Specification 01 25 00.

.2 Reinforcing Fabric: strong, absorbent, flexible, alkali-resistant, polyester reinforcing fabric for use at coves, corners, cracks and around drains.

.1 Acceptable product: Reinforcing Fabric by Mapei

.2 Equivalent per Specification 01 25 00.

2.4 SEALER

.1 Provide water based penetrating sealer suitable for sanded and non-sanded cementitious grout joints at all locations.

.1 Acceptable product: Mapei UltraCare Grout Sealer or equivalent per Specification 01 25 00.

2.5 ACCESSORIES

.1 Primer: To meet specified requirements of adhesive manufacturer.

.2 Cleaner: To conform to #1000 Series of Terrazzo, Tile and Marble Association of Canada.

.3 Joint backing: Round, closed cell, foam rod, oversized by 30% to 50%, Shore A hardness of 20, tensile strength 140 to 200 kPa.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

.1 Clean and dry surfaces thoroughly. Remove oil, wax, grease, dust, dirt, paint, tar, primers, form release agents, curing compound, and other foreign material from substrate surfaces which may prevent or reduce adhesion.

.2 Neutralize any trace of strong acids or alkali from the substrate.

.3 Contractor is responsible for shot-blasting/grinding existing concrete slab as required to make it suitable for new tile installation.

.4 Prepare concrete slab for installation of new floor tile in accordance with TTMAC requirements/Detail 311F-2009/2010 for dry areas.

.5 Prepare concrete slab and wall substrates for installation of new floor tile in accordance with TTMAC requirements/Detail 319SR-2009/2010 Detail B for washrooms with roll in showers.

3.2 CONTROL JOINTS

.1 Continue control, construction, and cold joints in the structural substrate up through the tile finish, and align with mortar joints where possible. Review joint locations on Site with the Consultant.

.2 Install joint widths to match grout joint widths, except where a minimum width is indicated.

.3 Install control joints in the following typical locations:

.1 Aligned over changes in type of substrate.

.2 At the restraining perimeters such as walls and columns.

.3 Interior areas (not subject to sunlight): 6 mm minimum width, at 7320 mm o.c. maximum.

.4 Interior areas (subject to sunlight): 6 mm minimum width, at 3660 mm o.c maximum.

.5 As indicated on Drawings.

.4 Seal control joints in accordance with Section 07 90 00.

3.3 LEVELLING BED

.1 Install a levelling bed on uneven substrate surfaces if required, level and plumb substrates in accordance with the following tolerances:

.1 Vertical surfaces: 3 mm in 2.4 m maximum.

.2 Horizontal surfaces: 6 mm in 3 m from finished levels of the surface, or better.

.2 Clean structural substrate control joints and blow-clean with compressed air. Grout fill control joints flush to slab with levelling bed.

3.4 WATERPROOF MEMBRANE INSTALLATION

.1 Prepare floor and wall substrates in accordance with manufacturers written instructions.

.1 All substrates should be structurally sound, stable, dry, clean and free of any substance or condition that may reduce or prevent proper adhesion.

.2 Do not use chemicals (acid etching or stripping) to prepare approved substrates.

.3 Concrete substrates should have a concrete surface profile of #2 per the International Concrete Repair Institute (ICRI). Mechanically clean and profile by diamond-cup grinding or other engineer-approved method when necessary.

.2 Application

.1 Fill all cracks, control joints and gaps in corners and coves that are greater than 1/32" (1 mm) with an appropriate filler material. Force material into crack and finish smooth with trowel. Let dry.

.2 Pre-treat cracks, corners, coves and floor wall intersections with 2 coats of waterproof membrane.

.3 Pre-treat drains by filling space between drain pipe and substrate with appropriate expansion joint materials and apply 2-coards of waterproof membrane

.3 Fabric Reinforcing Application

.1 Lay reinforcing fabric into wet waterproof membrane at all “pre-treat” sections as outlined in application section below (cracks, coves, corners and penetrations). Allow for 50mm fabric on horizontal surface and 100mm fabric on vertical surface. Use brush to press fabric into corners until liquid comes through fabric. Work out any wrinkles or bubbles.

.2 While fabric is wet, apply additional waterproof membrane over fabric until completely covered to create void-free surface. Let dry. Apply a second coat and let dry.

.3 Install reinforcing fabric through main/field areas by placing into wet first coat of waterproof membrane. Using a roller, apply pressure to the fabric, working out wrinkles or bubbles while forcing liquid waterproof membrane to come through the fabric. Overlap seams and ends of the fabric by 2" (50mm). While fabric is still wet, apply additional liquid waterproof membrane over the fabric until completely covered, creating a void-free surface. Let dry completely.

.4 Apply a second coat of liquid waterproof membrane to entire area. Let dry.

.5 Apply a bead of commercial-grade silicone or urethane sealant between the membrane and the drain flange, about 1/2" (12 mm) in from the drain opening.

.6 Bolt the drain collar into place while the sealant is still fresh.

.7 Install tile as per following section below.

3.5 GENERAL INSTALLATION REQUIREMENTS

.1 Install tiles in accordance with manufacturer's instructions and TTMAC Specification Guide 09300 Tile Installation Manual. Manufacturer's installation instructions govern over TTMAC Installation Manual.

.2 Lay out Work to produce a symmetrical pattern with minimum amount of cutting. Ensure cut tile at room perimeter is not less than ½ full size.

.3 Install trim to be placed under tile in locations indicated on Drawings.

.4 Apply exterior grade mortar bed to substrate with flat trowel and press firmly into surface, apply additional mortar using notched trowel.

.5 Set tiles in place and rap or beat with a beating block as necessary to ensure a proper bond and to level surface. Align tile for uniform joints and allow to set until firm. Clean excess mortar from surface of tile with a wet cloth or sponge while mortar is fresh.

.6 Adjust joints between units uniform, plumb, straight, even, and true, with adjacent tile flush. Align grout joints in both directions unless indicated otherwise.

.7 Align floor, base and wall grout joints.

.8 Install tile accessory fittings for a complete and fully coordinated tile assembly.

.9 Install wall tile full height unless indicated otherwise.

.10 Cut and fit tile neatly around piping, fittings, projections and around recesses items e.g. washroom accessories. Where surface mounted equipment and accessories are installed on tile surfaces, extend tile over surfaces. Cut edges smooth, even, and free from chipping; chipped and broken edges are not acceptable.

.11 Do not proceed with grouting until minimum 48 hours after tile has set, to prevent displacement of tiles.

.12 Apply grout in accordance with grout manufacturer's directions to produce watertight, filled joints without voids, cracks and excess grout. Thoroughly compact and tool floor grout. Finish grout flush to edge thickness of tile and remove excess grout with soft burlap or sponge moistened with clean water.

3.6 CLEANING

.1 Clean off excess grout with soft burlap or sponge moistened with clean water.

.2 Polish floor and wall tile after grout has cured in accordance with TTMAC recommendations in the Maintenance Guide; do not use acid for cleaning.

.3 Re-point joints after cleaning as required to eliminate imperfections, then re-clean as necessary. Avoid scratching tile surfaces.

3.7 JOINT BACKING AND TILE SEALANT

.1 Install joint backing under sealant as necessary.

.2 Install tile sealant around piping and fittings extending through tiled surfaces.

.3 Seal tile control joints.

.4 Seal internal tile to tile junctions. Tool to a smooth, flush surface, free from air bubbles and contamination.

3.8 PROTECTION

.1 Prevent traffic over tiled areas, and protect tiled assemblies from weather, freezing, and water immersion, for 72 hours minimum, after final installation.

.2 Prevent direct impact, vibration and heavy hammering on adjacent and opposite walls for 24 hours minimum, after final installation.

.3 Cover Work temporarily with building paper properly lapped and taped at joints until Work has been approved by Consultant.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

.1 Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section

1.2 SUMMARY

.1 Section Includes

.1 Acoustical ceiling panels

.2 Exposed gird suspension system

.3 Wire hangers, fasteners, main runners, cross tees, and wall angle moldings

.4 Perimeter Trim

.2 Equivalent Products

.1 As per Section 01 25 00 – Product Substitution Procedures.

.2 Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

.2 ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

.3 ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

.4 ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

.5 ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

.6 ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

.7 ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

.8 ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

.9 ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material

A. Armstrong Fire Guard Products

.10 ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint

.11 ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems

.12 ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

.13 ASTM E 1264 Classification for Acoustical Ceiling Products

.2 ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

.3 Ontario Electrical Safety Code

.4 ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

1.4 SYSTEM DESCRIPTION

Continuous/Wall-to-Wall

1.5 SUBMITTALS

.1 Product data:

.1 Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

.2 Shop Drawings:

.1 Shop Drawings: Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.

.3 Samples:

.1 Submit following sample panels in accordance with Section 01 33 00.

.1 Minimum 6 inch x 6 inch samples of specified acoustical panel

.2 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees

.4 Certificates: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

.1 If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

.5 Closeout submittals: Submit recommended maintenance instructions and listing of recommended maintenance Products for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.6 QUALITY ASSURANCE

.1 Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

.1 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

.2 Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.

.3 Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

.2 Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer,

NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

.3 Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

.2 Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

.3 Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.8 SITE CONDITIONS

.1 Standard Ceilings: Do not install interior ceilings until space is enclosed and weatherproof; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

.2 HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.

.3 HumiGuard Max Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Ceilings with HumiGuard Max performance can be installed in conditions up to 120°F (49°C) and maximum humidity exposure including outdoor applications, and other standing water applications, so long as they are installed with either SS Prelude Plus, AL Prelude Plus, or Prelude Plus Fire Guard XL suspension systems. Products with Humiguard Max performance can be installed in exterior applications, where standing water is present, or where moisture will come in direct contact with the ceiling. Only Ceramaguard with AL Prelude Plus suspension system can be installed over swimming pools.

1.9 WARRANTY

.1 Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following

.1 Acoustical Panels: Sagging and warping

.2 Grid System: Rusting and manufacturer's defects

.2 Warranty Period

.1 Acoustical panels: Ten (10) years from date of substantial completion

.2 Suspension: Ten (10) years from date of substantial completion

.3 Ceiling System: Thirty (30) years from date of substantial completion

.3 The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.10 MAINTENANCE

.1 Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

.1 Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed, for each ceiling type/pattern.

.2 Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed, for each ceiling type/pattern.

2 PRODUCTS

2.1 MANUFACTURERS

.1 Ceiling Panels: Model numbers for acoustic ceiling tiles and grid as manufactured by Armstrong World Industries, are listed to establish a standard of quality for design, function, materials, performance, workmanship, and appearance. The following manufacturers may be submitted for evaluation by the architect by following the conditions of the Product Substitutions Section 01 25 00. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

.1 Armstrong.

.2 Canadian Gypsum Company (CGC).

2.2. ACOUSTICAL CEILING UNITS (ACT)

.1 Surface Texture: Smooth

.2 Composition: Fiberglass

.3 Color: White

.4 Size: 24in X 24in

.5 Edge Profile: Square

.6 Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton .9

.7 Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton 190

.8 Flame Spread: ASTM E 1264; Class A (UL)

.9 Light Reflectance (LR) White Panel: ASTM E 1477; 0.88

.10 Dimensional Stability: HumiGuard Plus

.11 Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label

.12 Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)

.12 Acceptable Product: LYRA Plant Based (PB), 8360PB No added formaldehyde as manufactured by Armstrong World Industries, or equivalent

2.3 SUSPENSION SYSTEM AT CEILING TILE (ACT)

.1 Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

.1 Structural Classification: ASTM C 635 Intermediate Duty

.2 Color: White Aluminum and match the actual color of the selected ceiling tile, unless noted otherwise.

.3 Acceptable Product: Tectum High NRC as manufactured by Armstrong World Industries, Inc.

.2 Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

.3 Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

.4 Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

.5 Accessories

.1 Shadow molding with ½" (13mm) reveal, exposed flange same width as exposed runners, to be used at interface with walls/bulkheads.

.2 2" Floating Edge Trim Channel to be provided at all locations where ACT ceiling terminates away from walls/bulkheads.

3 EXECUTION

3.1 EXAMINATION

.1 Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

.2 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

.3 Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

.1 Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.2 PREPARATION

.1 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

.2 Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

.1 Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

.1 Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

.2 Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

.3 Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

.4 For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

.5 Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 INTERFACE WITH OTHER WORK

.1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.5 ADJUSTING AND CLEANING

.1 Replace damaged and broken panels.

.2 Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

.1 Ceiling Touch-Up Paint, (Item #5760, 8oz. bottles) (Item #5761, quart size cans), "global white" latex paint should be used to hide minor scratches and nicks in the surface and to cover field tegularized edges that are exposed to view.

.3 Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

1 – GENERAL

1.1 SECTION INCLUDES

.1 Design, labour, Products, tools, equipment and services necessary for resilient flooring installation in accordance with the Contract Documents.

1.2 REFERENCES

.1 ASTM D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.

.2 ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.

.3 ASTM D2240: Standard Test Method for Rubber Property (Durometer Hardness).

.4 ASTM D3389: Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).

.5 ASTM E648: Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

.6 ASTM E662: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.7 ASTM E1643: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

.8 ASTM E1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

.9 ASTM F386: Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.

.10 ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.11 ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring.

.12 ASTM F970: Standard Test Method for Static Load Limit.

.13 ASTM F1344: Standard Specification for Rubber Floor Tile.

.14 ASTM F1514: Standard Test method for Measuring Heat Stability of Resilient Flooring by Color Change.

.15 ASTM F1515: Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.

.16 ASTM F1859: Standard Specification for Rubber Sheet Floor Covering Without Backing.

.17 ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.18 ASTM F2055: Standard Test Method for Size and Squareness of Resilient Floor Tile by Dial Gage Method.

.19 ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

.20 ASTM F2199: Standard Test Method for Determining Dimensional Stability of Resilient Floor Tile after Exposure to Heat.

.21 ASTM G21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.3 GREENGUARD Environmental Institute (GEI)

.1 GREENGUARD Certification. Compliant with stringent emission levels for over 360 VOCs, plus a limit on the total of all chemical emissions combined (TVOC).

.2 GREENGUARD Gold. Compliant with safety factors to account for sensitive individuals (such as children and the elderly) and ensures that a product is acceptable for use in environments such as schools and healthcare facilities.

1.4 SUBMITTALS

.1 Action Submittals to be provided in accordance with Section 01 33 00:

.1 Provide current printed data sheets for all Products Supplied.

.2 Provide samples, 6 inches x 6 inches, for verification of such characteristics as color and surface texture of each specified Manufactured Product.

.3 As necessary, provide shop drawings prepared for project illustrating layouts, details, dimensions and other data.

.2 Provide closeout submittals in accordance with Section 01 78 00.

.3 Extra material: provide extra stock materials from original dye lots, for use in facility operations and maintenance (approximately 2% of the total floor surface for each color, surface texture and format of Manufactured Product).

1.5 QUALITY ASSURANCE

.1 Manufacturer must be certified ISO 9001 and ISO 14001.

.2 Manufacturer must have a minimum of fifteen (15) years of experience in the manufacturing of prefabricated resilient rubber flooring.

.3 Manufactured Product must have undergone a vulcanization process; factory lamination should not be accepted as equivalent.

.4 In accordance with ASTM E648, the Manufactured Product must have a critical radiant flux ≥0.45 W/cm^2 (Class 1).

.5 In accordance with ASTM E662, the Manufactured Product must have an optical density of smoke ≤450.

.6 Surfacing Contractor to be recognized and approved by the Manufacturer.

.7 Installer must be approved by the Surfacing Contractor and must have performed installations of the same scale in the last three (3) years.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Products Supplied must be delivered in Manufacturer's original, unopened and undamaged packaging with identification labels intact.

.2 Products Supplied must be protected from exposure to harmful weather conditions and must be safely stored on a clean, dry, flat surface. Store rolls of resilient flooring upright; store tiles of resilient flooring on a flat surface, carefully protecting corners and edges.

.3 Climate controlled storage is recommended. Storage temperature must not be below 40^oF (4^oC) and must not exceed 100^oF (38^oC). Materials must be delivered to site a minimum of 24 hours before work is scheduled to begin so that they may acclimate.

.4 Avoid storing Manufactured Product for extended periods of time or additional material trimming may be required.

.5 Products Supplied need not suffer damage during delivery, storage and handling (i.e. dents/scratches, excessive compression or warping, chipped edges, etc.).

1.7 SITE CONDITIONS

.1 Concrete slabs, on or below grade, must be installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, as per Manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).

.2 Substrate surface must be free of all contaminants that can inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.

.3 Concrete must have a smooth finish, proper density and be highly compacted with a tolerance of 1/8$_{th}$ of an inch in a 10-foot radius (3.2 mm in 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.

.4 Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride).

.5 Maintain stable room and substrate temperatures prior to moisture testing and flooring installation, during the flooring installation, as well as a minimum of 48 hours after the flooring has been completely installed. Recommended ambient temperature range is between 65^{o}F and 86^{o}F (18^{o}C and 30^{o}C) and recommended ambient humidity range is between 35% and 55%.

.6 Installation of resilient flooring will not commence until the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to maintain a secure and clean working area before, during and after the installation of the resilient flooring.

1.8 WARRANTY

.1 The resilient flooring is warranted to be free from manufacturing defects for a period of two (2) years, beginning from the date of Substantial Performance.

2 – PRODUCTS

2.1 Resilient Flooring RES

.1 Polyolefin based resilient plank flooring, manufactured from a mix of pure thermoplastic polymers and natural minerals, and completely free from PVC and plasticizers.

.2 Technical Properties.

Thickness	EN ISO 24346	2.0 mm
Weight	EN ISO 23997	3400 g/m2
Size		177.8mm x 1219.2mm
Colour		To be selected by consultant from standard colour range.

.3 Performance Properties

Fire Resistance	EN 13501-1	C_{fl}-s1
Residual indentation	EN ISO 24343-1 (2,5 h)	< 0.05 mm

Dimensional stability	EN 434 (50 °C/6 h)	< 0.2 %
Colour fastness	EN ISO 105-B02	≥ 6
Slip resistance	EN 13893 DIN 51130	DS (> 0.3) R9
Flexibility	EN ISO 24344 Method A	40 mm
Electrical propensity	EN 1815	< 2 kV (antistatic)
Wear resistance	EN 660-2 ISO 5470-1	< 2.0 mm3 (Class T) 0.05 g/1000 cycles
Chemical resistance	EN ISO 26987	Excellent

.4 Acceptable product:

.1 Linoleum Floor xf2 as manufactured by Tarkett

.2 Equivalents per 01 25 00.

2.2 Rubber Wall Base:

.1 Rubber thermoplastic wall base to ASTM F1861 consisting of a blend of a thermoplastic and rubber backing covered with a durable colored top layer

.2 Dimensions: 107.95mm high x 9.53mm thick x 2440mm lengths

.3 Surface burning: Class A per ASTM E84/NFPA 253, FSR 50/SDS 175 per CAN/ULC-S102.2

.4 Acceptable product:

.1 Contours Profiled Vertical #65 by Roppe

.2 Equivalent per 01 25 00

.5 Colour: To be selected by Consultant from manufacturer's full colour range; allow for 2 colours.

3 – EXECUTION

3.1 EXAMINATION

.1 Ensure that concrete surface is free of any contaminant that could inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.

.2 Confirm concrete has a smooth finish, proper density and is highly compacted with a tolerance of 1/8$_{th}$ of an inch in a 10-foot radius (3.2 mm in a 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.

.3 Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride).

.4 Ensure room and substrate temperatures are maintained prior to moisture testing and flooring installation, during the flooring installation, as well as a minimum of 48 hours after the flooring has been completely installed. Recommended ambient temperature range is between 65^{o}F and 86^{o}F (18^{o}C and 30^{o}C) and recommended ambient humidity range is between 35% and 55%.

3.2 PREPARATION

.1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.3 Old vinyl flooring to be removed only by trained personnel (may contain asbestos).

.4 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.

.5 Surface Preparation:

.1 General: Prepare floor substrate in accordance with manufacturer's instructions.

.2 Floor Substrate: Floors shall be sound, smooth, flat, permanently dry, clean, and free of all foreign materials including, but not limited to, dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt and old adhesive residue.

.3 Concrete Floor Substrate: Comply with ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

.6 Relative humidity of the concrete floor must not exceed RH 85% (< 2.0% CM). Temperature during installation and that of subfloor and material should be at least +18°C (68°F). Before installing the flooring, it must be ensured that the final levelling compounds have dried sufficiently.

3.3 INSTALLATION – RESILIENT FLOOR

.1 Install resilient floor tiles following manufacturers current printed guidelines.

.2 The flooring should be installed using water based acrylic dispersion adhesives approved by manufacturer:

.1 Mapei Ultrabond Eco V4SP; Mapei VS90 Plus or CascoProff XStrong

.3 Installation is performed according adhesive manufacturer´s instructions using semi-wet gluing method. Allow suitable open time for sufficient initial tack properties for easy and clean installation. Use finger test to check that adhesive will not dry too much. There must be some adhesive transfer to fingers to ensure adhesive will spread enough when laying and rolling.

.4 Floor covering must not be installed on top of existing floor covering. Recommended standard trowel types are TKB A1 and TKB A2. Square tiles have arrow marks on the backside of the product to help controlling of installation direction.

.5 When installing on solid unabsorbing subfloor, the leveling compound layer should be thick enough. The layer must create an even and equally absorbing base for the adhesive. Use minimum layer recommended locally or at least which is needed for good levelling and subfloor quality. Before installation make sure all leveling compound has completely dried.

.6 Accurately scribe the tile around the walls, columns, door frames, floor outlets and any other projections through the floor

Note: Contractor is to pay additional attention to tile at perimeter room/space and/or at component junctions, i.e., door frames etc., to ensure complete and proper rolling. Perimeter tiles exhibiting improper or inadequate adhesion and/or variations in levels between tiles shall be removed and replaced immediately.

.7 Lay tiles with straight joints in one direction, offset in the other. Butt tiles to moderate contact and lay symmetrically with and parallel to the axis of room or corridor. Distribute variations in shade or pattern of production run. Obtain uniform effect. Abrupt variations will not be permitted. Where tiles have a pattern or grain, refer to Consultant before installing tiles.

Note: Contractor to pay particular attention to ‘setting-out’ of the tiles in order to provide perimeter tile of not more than one half (1/2) tile in width and not less than one third (1/3) tile in width.

.8 The floor must be rolled while the adhesive is still fresh. The weight of the roll should be 50-70kg. Rolling prevents the emergence of adhesive trowel marks and indentations on the finished floor surface. Avoid traffic on the floor and do not move furniture until the adhesive is totally dry.

.9 After installation, the floor surface should be carefully protected against construction-period loads and stresses with an appropriate material for the purpose. The protective materials should be taped to each other only – not to the surface of the flooring.

3.4 INSTALLATION: BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

3.5 REPAIR

.1 Refer to section 1.4.3 for extra stock materials. Repair material must come from the same original dye lot as the Manufactured Product initially installed.

.2 Repairs are to be performed by Surfacing Contractor’s qualified installers/technicians only.

3.6 CLEANING

.1 Always wait at least a minimum of 72 hours after the resilient flooring has been completely installed before performing initial maintenance. Perform initial cleaning to remove any factory contamination.

3.7 PROTECTION

.1 As needed, protect resilient flooring with 1/8” Masonite during and after the installation, prior to its acceptance by the Owner.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

.1 This section includes labor, materials and other services necessary to complete vinyl wall coverings.

.2 Conform with requirements of all Sections of Division 1, General Requirements, as it applies to the work of this Section.

1.02 REFERENCES

.1. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

.2 American Society for Testing & Materials (ASTM):

1. AST ASTM E 84-05 Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM D5420 Gardner Impact Exceeds 160 inch pounds

1.03 SYSTEM DESCRIPTION

.1 Performance Requirements: Provide hygienic wall covering which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.04 SUBMITTALS

.1 Product Data: Submit manufacturer's current printed product literature, specifications, installation instructions, and field reports in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings: Submit shop drawings to indicate materials, details, and accessories in accordance with Section 01 33 00 - Submittal Procedures including but limited to the following:

1. Submit a layout diagram indicating the location of each panel and joining method.

.3 Samples: Provide 3no 6"x6" samples of material in each colour/texture..

.4 Quality Assurance Submittals: Submit the following:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Manufacturer's Instructions: Current published manufacturer's installation and maintenance instructions.

.5 Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein

1.05 QUALITY ASSURANCE

.1 Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

.2 Mock-ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.

.1 Mock-Up Size: 4' x 8'

.2 Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

.3 Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.06 DELIVERY, STORAGE & HANDLING

.1 Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

.2 Deliver, store and handle panels in accordance with Section 01610 - Basic Material Requirements.

.3 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.4 Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

.5 Store panels in temperature controlled environments. Leave protective blue film on panel until ready to use.

1.07 WASTE MANAGEMENT AND DISPOSAL

.1 Deposit all packaging materials in appropriate container on site for recycling or reuse.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Keep all discarded packaging away from children.

1.08 PROJECT CONDITIONS

.1 Temperature Requirements: If storage temperature is below 65F (18C), hygienic wall panels must be moved to a warmer place and allowed to reach this temperature before installation. For further information, refer to manufacturers current Installation Guide.

.2 Maintain air temperature and structural base temperature at installation area between 65F (18C) and 80F (26C) for 48 hours before, during and 24 hours after installation.

1.09 WARRANTY

.1 Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

.2 Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

.3. Warranty Period for Hygienic Wall Panels shall be 10 years commencing on Date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Provide extra materials of product and adhesives in accordance with Section 01780 - Closeout

Submittals.

C. Provide 64sqft (6m2) of extra materials in one piece and from same production run as installed materials (for each colour/texture scheduled).

D. Clearly identify each wall panel and each container of adhesive.

E. Deliver to Owner, upon completion of the work of this section and store where directed.

PART 2 PRODUCTS

2.01 MATERIALS

.1 100% pure vinyl, extruded, homogenous, semi-rigid PVCu sheet containing no plasticizers or fillers. Acceptable Manufacturers:

.1 Whiterock as manufactured by Altro

.2 Equivalent products as per Specification 01 25 00

.2 Panels

.1 Thickness: 0.10" (2.5 mm); Panel Width: 4’ (1.22m) Panel Height: Either 8’ or 10’ (2.5m or 3m); Weight 4’x8’ Panel: 24 lbs (10.4 kg) Weight 4’x10’ Panel: 29 lbs (12.7 kg).

.1 Colour: to be selected by Consultant from Standard Colour range. Allow for 4 colours.

2.02 ACCESSORIES

.1 Vinyl welding rod: Acceptable material:

1. Altro weld rod

.2 Joint Strips/Accessories:

1. 1-Part Stainless Steel Joint Strip – A855 Brushed Steel
2. 1-Part Transition Strip –G832
3. 1-Part Start and Edge Trim – G833
4. Stainless Steel Capping – A865 Brushed Steel (to be provided at all top of panel locations terminating below ceiling level)

.3 Recessed Shower Shelf: integrated, factory formed hygienic insert that can be welded directly to panels, offering a water-tight, robust recess for shower toiletries. Provide 1 per shower.

.1 Total Size: 406mm x 406mm

.2 Recessed Size: 254mm x 254mm

.3 Depth: 100mm

.4 Colour: to be selected by Consultant.

.4 Acrylic Adhesive: For dry, climate controlled areas, use AltroFix W49, a one-part, water-based, acrylic adhesive as recommended by manufacturer.

.5 Polyurethane Adhesive: The default adhesive for most installations, suitable for wet area, non-climate controlled areas, and non-absorbent surfaces, use AltroFix W39, a two-part resin-based polyurethane adhesive as recommended by manufacturer. Provide written confirmation adhesive is compatible with liquid applied waterproof membrane as per item 5 below.

.6 Acrylic polymer based, liquid applied elastomeric waterproof membrane (to be applied to tile backer substrate at all locations scheduled to receive hygienic wall panel): Liquid Waterproofing Membrane by USG Durock or equivalent.

.6 Caulking and Sanitary Sealant:

1. Altro Sanitary Sealant Sealant, Colour: clear.

2.03 SOURCE QUALITY

.1 Source Quality: Obtain wall products from a single manufacturer.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog, installation instructions and product label instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.03 SUBSTRATE PREPARATION

.1 Walls should be smooth and level. High points must be removed and low points filled with filler intended for the substrate and environmental conditions.

.2 Wall tiles must be fixed firmly to the wall. As long as the tile edges do not protrude you do not have to skim grout joints.

.3 Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure.

.4 Remove loose paint and conduct an adhesive bond test with paint.

.5 Exterior walls must be adequately damp-proofed and insulated.

.6 Dry wall substrates should be paint ready.

.7 Apply liquid waterproof membrane where scheduled.

3.04 PREPARATION

.1 All surfaces must be free from dust and cleaned prior to installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate which may cause panels to de-bond.

.2 Very absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) must have a proprietary sealer e.g. PVA primer or similar, applied to the surface a minimum of 12 hours prior to the installation.

.3 All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.

.4 All plumbing should have pipe-work removed to a first fix or installation state and "tails" left protruding from the substrate. Panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8" (3mm) oversize to allow for expansion, then sealed with Mastic caulking. Plumbing should always be done by a qualified plumber.

.5 Hot pipes and steam pipes should be insulated and a 1/8" to 1/4" (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with Mastic caulking.

.6 All pipes, fixing bolts, etc. extending through the panels should have a minimum 1/8" (3mm) expansion gap and be sealed using Mastic caulking.

.7 If fitting to door frames, these must be in place prior to installation of panels.

.8 Prior to installation, it is advisable to complete any painting which comes in contact with panels, as sealant used at junctions is non-paintable.

.9 Panels should be stored flat and be pre-conditioned a minimum of 24 hours in ambient temperatures similar to the prevailing operational conditions.

.10 The panels must be stored on a level flat surface off the ground (risk of condensation on the panels if stored on damp surfaces). Storage on uneven surfaces could cause the panels to distort prior to installation.

.11 First, check the room using a 6' (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.05 INSTALLATION

.1 **Heat Weld System installation shall be provided throughout**. Install panels in accordance with the manufacturers current published Installation Guide. All joints should be joined by Heat Weld Application methods as detailed in manufacturers installation guide.

3.06 FIELD QUALITY REQUIREMENTS

.1 Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: 1

3.07 CLEANING

.1 Panels can be cleaned with a diluted soap/detergent solution, such as Altro 44 Cleaner.

.2 When cleaning the panel surface, we recommend the temperature of water does not exceed 140° F (60° C).

.3 Pressure cleaning with hot water may be used with the pressure nozzle a minimum of 2 feet (600mm) away from the surface.

.4 To reduce the buildup of static, cleaning the panels with an anti-static solution is recommended.

.5 Stubborn stains use AltroClean 44 cleaner or equivalent alkaline cleaner.

.1 Remove construction debris from project site and legally dispose of debris.

3.08 PROTECTION

.1 Do not install near open heat sources (ovens, etc). Stainless steel panels should be used in such areas.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 60 00 - Basic Product Requirements.

.3 Section 01 78 00 - Closeout Submittals.

1.2 References

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada.

1.3 Quality Assurance

.1 Contractor shall have past experience in the manufacture or fabrication of the products specified herein and shall have successfully completed projects of similar scope and type.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

.4 Materials primers, paints, fillers, thinners, solvents, etc. shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Consultant.

.7 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: No defects visible from floor at 45degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 Environmental Performance Requirements

.1 Provide paint products meeting MPI "Environmentally Friendly" ratings based on VOC (EPA Method 24) content levels.

1.5 Scheduling of Work

1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.7 Quality Control

.1 When requested by Consultant prepare and paint designated surface, area, room or item in each colour scheme to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 Delivery, Handling and Storage

.1 Deliver, store and handle materials in accordance with Section 01 60 00 - Basic Product Requirements.

.2 Labels shall clearly indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7C to 30C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 Site Requirements

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces

.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Contractor and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 C.

.2 Substrate temperature is over 32 C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is above 85% or when the dew point is less than 3 C variance between the air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected

1.10 Extra Materials

1 Submit maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Submit – (one) four litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Contractor and store where directed.

PART 2 - PRODUCTS

2.1 Materials

.1 Paint and fillers shall be manufacture's premium quality, of type and brand herein specified and listed under "Paint Product Recommendations" premium grade as covered in the association manual, latest edition, for specific uses and only as supplied by **Pratt & Lambert Co., Benjamin Moore & Co., Para Paints Canada Inc., ICI Paints (Canada) Inc, (Glidden), Sherwin Williams Canada Inc., Pittsbugh Paints**. Paint material such as linseed oil, shellac, turpentine and the like, and any of the materials not specifically mentioned herein but required for first class work with finish specified shall be highest quality product of approved manufacturer. Where specific products are indicated in painting schedule, use product manufacturer as specified.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Only qualified products with "Environmentally Friendly" rating are acceptable for use on this project.

.4 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.6 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0 C or greater.

.7 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.8 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" rating.

.9 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.

.10 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 Finishes and Colours

.1 Generally and unless otherwise specified herein or noted on Finish Schedules the quantity of colors and finishes shall be based on the following criteria. Consultant will provide Colour Schedule after Contract award.

.2 Interior Colours will be based upon the selection of three (3) base colours and three (3) accent colours. No more than six colours will be selected for the entire project and no more than three colours will be selected in each area. Include for 25% dark tones.

.3 Exterior colors will be based on two (2) base colors and two (2) accent colors with a maximum of two (2) deep or bright colors. No more than four (4) colors will be selected for the entire project. Note that this does not include pre-finished items by others, e.g. flashings, aluminum or vinyl windows, aluminum doors, etc

.4 Selection of colours will be from manufacturers full range of colours.

.5 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.6 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Mixing and Tinting

1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Consultant's written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 Gloss/Sheen Ratings

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte of Flat finish	0 to 5	10 max
G2	Velvet Finish	0 to10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Satin Finish	20 to 35	35 min

G5	Semi-Gloss Finish	35 to 70
G6	Gloss Finish	70 to 85
G7	High Gloss Finish	➢ 85

.2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on Finish Schedule

2.5 Interior Painting Systems

.1 Plaster and Drywall: Int 9.2A Latex (G3) finish over latex sealer

.2 Plaster and Gypsum Board Ceilings: Int 9.2A Latex (G1) finish over latex sealer

.3 Dressed lumber/Wood trim: Int 6.3T Latex (G5) finish over latex primer.

.4 Spray Textured Ceiling: Int 9.1A Latex, flat finish

.5 Concrete Ceilings: Int 3.1B Latex (G1) finish over textured latex primer.

.6 Structural steel & metal fabrications: Int 5.1R (G5) finish.

.7 Galvanized metal/zinc coated steel: Int 5.3A (G5) finish

.8 Use fire retardant paint on fire rated plywood sheets behind electrical panels.

All Finishing System Codes are from the Ontario Painting Contractors Association.

2.6 Exterior Painting Systems

.1 Traffic markings on Asphalt surfaces: Ext 2.1A.

.2 Galvanized metal: Ext 5.3A Latex (G5) finish.

All Finishing System Codes are from the Ontario Painting Contractors Association.

PART 3 - EXECUTION

3.1 General

.1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 Existing Conditions

1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Consultant. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco, Plaster and Gypsum Board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

3.3 Protection

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants and general public in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.

.6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Consultant

3.4 Cleaning and Preparation

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of

blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or vacuum cleaning.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.7 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.5 Application

1 Method of application to be as approved by Consultant. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.

.4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges and behind wall mounted items.

3.6 Mechanical/Electrical Equipment

.1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red, if required.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.7 Field Quality Control

.1 Advise Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.8 Restoration

.1 Clean and re-install all hardware items removed before undertaking painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Magnetic Whiteboards and Exterior Enclosed Bulletin Boards.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-11.3-[M87], Hardboard.

.2 CGSB 41-GP-30M-[82], Wall coverings, Vinyl-Coated Fabrics.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[M88], Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Submit under provisions of Section 01 33 00 - Submittal Procedures

1.4 REGULATORY REQUIREMENTS

.1 Surface burning characteristics of materials: listed and labeled by an organization accredited by Standards Council of Canada.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Magnetic Whiteboards (WB) to be e3 environmental ceramic steel magnetic porcelain whiteboard writing surface.

.2 Enclosed Exterior Bulletin Boards (BB) to be a homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing. The uni-color extends throughout the thickness of the material. Lockable cabinet designed for outdoor uses.

.3 Accessories

.1 Edge Trim: 300 Series Futura heavy duty aluminum trim

.2 Mounting adhesive: to manufacturer's recommendation.

.4 Approved suppliers:

.1 ASI Visual Display Products

.2 Global School Products

.3 Global Industrial

2.2 FABRICATION

.1 Fabricate magnetic whiteboard and bulletin board panels to sizes indicated on architectural drawings.

.2 Magnetic whiteboards and bulletin boards to be factory laminated to be factory laminated to minimum ¼” thick MDF substrate.

2.3 SCHEDULE

.1 Provide magnetic whiteboards and bulletin boards as indicated in drawings/schedules.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

.1 Install magnetic whiteboards and bulletin boards in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure surface.

3.3 CLEANING

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION

PART 1. GENERAL

1.1 SUMMARY

.1 This section includes toilet and bath accessories in accordance with the Contract Documents. The Work of this Section shall include but not be limited to the following:

1. Surface, partition and recessed mounted toilet and bath accessories indicated on the Drawings and Schedules.

1.2 SUBMITTALS

.1 Comply with requirements of Section regarding submittals.

.2 Provide required number copies of:

.1 Product data sheets.

.2 Installation instructions.

.3 Service and parts manual

1.3 WORK INCLUDED

.1 Toilet Room Accessories

1.4 REFERENCES (INCLUDING BUT NOT LIMITED TO)

.1 Ontario Building Code (latest edition)

1.5 QUALITY ASSURANCE

.1 Model numbers for toilet room accessories manufactured by Bobrick Washroom Equipment Inc, are listed to establish a standard of quality for design, function, materials, workmanship, and appearance. The following manufacturers may be submitted for evaluation by the architect by following the conditions of the Alternatives Section 01 25 00. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

.1 Frost

.2 American Specialties, Inc.

.3 Bradley

.2 Accessories with tumbler locks shall be keyed alike with the exception of coin boxes in vending equipment.

.3 Regulatory Requirements

.1 Operation of accessories shall comply with guidelines set forth by the Ontario Building Code. Documentation and samples to be provided to architect upon request.

.4 Samples

.1 Upon request submit one sample of each item specified. If more than one manufacturer is specified, submit one sample of each item for architect's review.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

.1 Deliver items in manufacturer's original unopened protective packaging.

.2 Store materials in original protective packaging to prevent physical damage or wetting.

.3 Handle so as to prevent damage to accessories.

1.6 WARRANTY

.1 Furnish one year guarantee against defects in material and workmanship on all accessories.

.2 In addition to the above the following shall apply:

.1 Welded stainless steel framed mirrors shall have a fifteen year guarantee against silver spoilage.

PART 2. PRODUCTS

2.1 TOILET ROOM ACCESSORIES SCHEDULE

.1 Provide the following toilet and bath accessories in the locations indicated on the drawings/schedules:

Type	Model/Series	Description
W1	Frost 941TG	18”x30” Mirror, tempered glass, 1 per washroom lavatory and/or as shown on drawings
W2	Frost 714-S	Soap dispenser, 1 per lavatory
W3	Frost 109-50S	Paper Towel Dispenser, 1 per lavatory
W4	Frost 165-R	SS recessed mounted toilet paper holder, provide 1 per toilet

PART 3. EXECUTION

3.1 INSPECTION

.1 Check wall open for dimensions, plumbness of blocking or frames that would affect installation of recessed accessories. For surface mounted accessories check condition of wall and confirm installation of backing within wall.

.2 Verify spacing of plumbing fixtures and toilet compartments that affect installation of toilet room accessories.

3.2 INSTALLATION

.1 Install accessories at locations and heights indicated, straight, plumb and level and in accordance with manufacturer's installation instructions.

.2 Install items with non-corrosive anchoring devices.

.3 Installation methods shall conform to manufacturer's recommendations for backing and proper support.

.4 Conceal evidence of drilling, cutting, and fitting to room finish.

.5 Fit flanges of accessories snugly to wall surfaces.

3.3 ADJUSTMENT AND CLEANING

.1 Upon completion of the work, or when directed, remove all traces of protective coatings or paper.

.2 Adjust accessories for proper operation. Test mechanisms, hinges, locks and latches and where necessary adjust and lubricate.

.3 Clean and polish exposed surfaces prior to final installation.

.4 Deliver accessories schedule, keys, and parts manual as part of project closeout documents. For owner's permanent records, provide two sets of the following items of manufacturer's literature:

.1 Technical data sheets of each item used for the project.

.2 Service and parts manuals.

.3 Name of local representative to be contacted in the event of need of field service or consultation.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Manually operated, roll-up fabric interior window shades including mounting and operating hardware.

1.2 REFERENCES

.1 All window coverings offered must meet the HAZARDOUS PRODUCTS ACT, Regulation SOR/2009-112, Sep 8, 2009 - Corded Window Covering Products Regulations

.2 All window coverings offered must meet the CSA Z600-08 - Safety of Corded Window Covering Products standard including but not limited to meeting the product safety requirements of section 4 and the labeling and information requirements of section 5

1.3 SUBMITTALS

.1 Submit under provisions of Section 01 33 00 - Submittal Procedures:

.2 Product Data: Manufacturer's data sheets on each product specified, including:

.1 Preparation instructions and recommendations.

.2 Installation and maintenance instructions.

.3 Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

.4 Storage and handling requirements and recommendations.

.5 Mounting details and installation methods.

.3 Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

.4 Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.

.5 Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

.6 Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.

.2 Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

.3 Label containers and shades according to Window Shade Schedule.

.4 Store products in manufacturer's unopened packaging until ready for installation.

1.5 SEQUENCING

.1 Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

.2 Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.6 PROJECT CONDITIONS

.1 Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 SOLARFECTIVE/LEGRAND.

.2 HUNTER DOUGLAS CANADA.

.3 Equivalent products as per 01 25 00.

2.2 MANUALLY OPERATED WINDOW SHADES

.1 Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation**.**

.1 Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.

.1 Clutch mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon.

.2 Bead chain loop: Stainless steel bead chain hanging at side of window.

.3 Idler Assembly: Provide roller idler assembly of molded nylon with adjustable length idler pin to facilitate easy installation, and removal of shade for service.

.2 Mounting:

.1 Mounting brackets.

.2 Endcaps and headbox.

.3 Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.

.4 Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.

.1 Endcap covers: To match fascia or headbox color.

.5 Brackets: Plated stamped steel. Provide size compatible with roller size.

.1 Mounted to wall.

.6 Coupling system: Provide system to operate shades from single crank by coupling shade rollers together. System to consist of endcaps, plus couplings to connect rollers.

.1 2 shades operated from single control when indicated on drawings.

.7 Fascia/back fascia: aluminum extrusion to conceal shade roller and hardware from both interior and exterior sides.

.1 Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands.

.2 Finish: Clear anodized.

2.4 FABRIC

.1 Light Filtering Fabrics

.1 Shade cloth shall be woven of .018 opaque, vinyl coated polyester yarn consisting of approximately 79% vinyl and 21% 500 dernier polyester core yarn. The fabric shall be tensioned in the finishing range prior to heat setting to keep the warp ends straight and minimize or eliminate weave distortion to keep the fabric flat. The fabric shall be dimensionally stable. Colour to be as selected from standard range.

.2 Average 3% open.

.2 Performance – As a “shade cloth” the fabric shall hang flat without buckling or distortion. The edge, when trimmed, shall hang straight without raveling. An unguided roller shade Cloth shall roll true and straight, without shifting sideways more than +1/8” in either direction due to warp distortion, or weave design.

.3 Flame Retardance - Fabric shall be certified by an Independent Laboratory to pass the Small Scale Vertical Burn Requirements test CAN and ULC-S109-M87 and NFPA 701.

.4 The fabric supplied shall be GREENGUARD certified or approved equivalent.

2.5 SCHEDULE

.1 Provide rollershades at exterior windows as indicated in drawings/schedules.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

.3 Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.

.1 Fascias.

.2 Closure panels.

.3 Endcaps.

3.4 TESTING AND DEMONSTRATION

.1 Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.

.2 During daylight hours, lower shades and turn off interior lights. Verify that there are no light leaks at perimeter or within shade assembly. Correct deficiencies.

3.5 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

MECHANICAL SPECIFICATIONS

FOR

TSSS Family Residence Renovations
4222 Kingston Road
Toronto, Ontario
M1E 2M6

DeCARIA ENGINEERING
ELECTRICAL AND MECHANICAL ENGINEERS

DeCaria Engineering Limited
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Email: peter@decaria.ca

PROJECT: 4843

END OF TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Project general requirements.

1.2 REFERENCE STANDARDS

.1 Ontario Building Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with general project requirements.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing fixtures and accessories.

.3 Shop Drawings:

.1 Submit shop drawings.

.2 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section on Submittal Procedures, use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with relevant Section.

.2 Operation and Maintenance Data: submit operation and maintenance manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified.

.5 Approvals:

.1 Submit electronic copy of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.

.2 Make changes as required and re-submit as directed by Consultant.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 [Departmental Representative] [DCC Representative] [Consultant] will provide [1] set of reproducible mechanical drawings. Provide sets of [white] prints as required for each phase of work. Mark changes as work progresses and as changes occur. [Include changes to existing mechanical systems, control systems and low voltage control wiring] .

.2 Transfer information [weekly] to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.1 Submit to Consultant for approval and make corrections as directed.

.3 Perform testing, adjusting and balancing for plumbing systems using as-built drawings.

.4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section [01 78 00- Closeout Submittals] .

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for the work.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with general project requirenments.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct tests required by OBC and City inspectors.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports where required.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

.1 General Contractor or Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems: fans.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Consultant will record these demonstrations on video tape for future reference.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Project general requiremnets.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A126-[04(2009)] , Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-[09] , Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.1 ANSI/AWWA C700-[09] , Standard for Cold Water Meters-Displacement Type, Bronze Main Case.

.2 ANSI/AWWA C701-[12] , Standard for Cold Water Meters-Turbine Type for Customer Service.

.3 ANSI/AWWA C702-[10] , Standard for Cold Water Meters-Compound Type.

.3 CSA Group (CSA)

.1 CSA-B64 Series-[11] , Backflow Preventers and Vacuum Breakers.

.2 CSA B79-[08] , Commercial and Residential Drains and Cleanouts.

.3 CAN/CSA-B356-[10] , Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP).

.1 IPMVP [2007] Version.

.5 Plumbing and Drainage Institute (PDI)

.1 PDI-G101-[R2010] , Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.

.2 PDI-WH201-[R2010] , Water Hammer Arresters Standard.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section in accordance with general project requirements to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section on Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit electronic copy of WHMIS MSDS in accordance with Health and Safety Requirements. Indicate VOC's:

.3 Shop Drawings:

.1 Submit shop drawings.

.2 Indicate on drawings method of anchorage, dimensions, materials, accessories, weights.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with project requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor Drains and Trench Drains: to CSA B79.

.2 Type 1: general duty ; cast iron body as indicated, round, or square, adjustable head, sediment basket, nickel bronze strainer, integral seepage pan, and clamping collar.

.3 Type 2: heavy duty ; cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan and clamping collar.

.4 Type 3: combination funnel floor drain; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, round or square polished nickel bronze cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: cast box with anchor lugs, rectangular, cast iron body and frame with adjustable secured nickel bronze top and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: round or square, nickel bronze, gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: polished [nickel bronze] [brass] with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

.1 Stainless steel construction, piston type: to PDI-WH201.

2.4 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialities and accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.3 INSTALLATION

.1 Install in accordance with Ontario Building Code, National Plumbing Code of Canada (NPC), and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.5 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures [where indicated] .

3.6 STRAINERS

.1 Install with sufficient room to remove basket for maintenance.

3.7 START-UP

.1 General:

.1 In accordance with Section [01 91 13- General Commissioning Requirements] : General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

3.8 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section [01 91 13- General Commissioning Requirements] : General Requirements, supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- [70] kPa.

.2 Flow rate at fixtures: +/- 20%.

.4 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.7 Roof drains:

.1 Check location at low points in roof.

.2 Check security, removability of dome.

.3 Adjust weirs to suit actual roof slopes, meet requirements of design.

.4 Clean out sumps.

.5 Verify provisions for movement of roof systems.

.8 Access doors:

.1 Verify size and location relative to items to be accessed.

.9 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.10 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.11 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

3.9 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section on Commissioning Requirements: as applicable.

.2 Training: provide training in accordance with relevant section, supplemented as specified.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with general contractor's requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with relevant section.

3.11 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

PART 1.00 - GENERAL

1.01 SCOPE

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to the following commercial piping systems, in accordance with applicable project specifications and drawings, subject to the terms and conditions of the contract:
   1. Hot Water Heating systems ambient up to 450F (232C)
   2. Domestic and service hot water systems, ambient up to 180F (82C)

1.02 REFERENCES

A. Thermal insulation materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:

   1. American Society for Testing of Materials Specifications:

      a. ASTM C 547, "Standard Specification for Mineral Fiber Pipe Insulation"
      b. ASTM C 585, "Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)"
      c. ASTM C 1136, "Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation"

1.03 DEFINITIONS

A. The term "mineral fiber" as defined by the above specifications includes fibers manufactured of glass, rock, or slag processed from a molten state, with or without binder.

1.04 SYSTEM PERFORMANCE

A. Insulation materials furnished should meet the minimum thickness requirements of National Voluntary Consensus Standard 90.1 (1999), "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.

B. Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of applicable building codes when tested in composite form per one of the following nominally equivalent test methods:
   1. American Society for Testing of Materials — ASTM E 84
   2. Underwriters' Laboratories, Inc. — UL 723, CAN/ULC-S102-M88
   3. National Fire Protection Association — NFPA 255

1.05 QUALITY ASSURANCE

A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications listed in Section 1.02 above.

B. Insulation materials, including all weather and vapor barrier materials, closures, hangers, supports, fitting covers, and other accessories, shall be furnished and installed in strict accordance with project drawings, plans, and specifications.

C. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

1.06 DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.

C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2.00 - PRODUCTS

2.01 PIPE INSULATION

A. Molded pipe insulation shall be manufactured to meet ASTM C 585 for sizes required in the particular system. It shall be of a type suitable for installation on piping systems as defined in section 1.01 SCOPE above.

Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C 547. One of the following types shall be used:

1. For indoor systems operating at temperatures from 0^{O}F (-18 ^{O}C) to +850 ^{O}F (454 ^{O}C):

    a. **Fiberglas® Pipe Insulation**, Owens Corning Fiberglas Pipe Insulation with factory applied all-service jacket (ASJ) and two-component adhesive closure system, rated for a maximum service temperature of 850F (454C). For large pipe sizes where SSL-II is not available, the single adhesive SSL closure may be substituted. Circumferential joints shall be sealed by butt strips having a two-component sealing system. Stapling is not required to complete the

closure. When self sealing lap systems are used, sufficient thickness of insulation shall be used to maintain the outer surface temperature of the operating system below +150F (65C). Manufacturer's data regarding thickness constraints in relation to operating temperature shall be followed.

When multiple layers are required, all inner layer(s)shall be No Wrap.

On cold systems, vapor barrier performance is extremely important. All penetrations of the ASJ and exposed ends of insulation shall be sealed with vapor barrier mastic. If humidities in excess of 90% are expected, the ASJ shall be protected with either a PVC vapor retarding outer jacket. Vapor seals at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion.

2. For systems operating at temperatures to +850F (232C) and always above the ambient temperature:
   a. **No Wrap Pipe Insulation** rated for maximum operating temperature of 850F (454C) may be installed using appropriate banding materials and then covered with either metal or PVC jacketing or otherwise jacketed and/or finished in accordance with details shown.

3. For piping equal to or larger than 10" (250 mm) diameter operating at temperatures up to +650F (343C) and where moderate abuse resistance is required, the following may be installed:
   a. **Owens Corning Pipe and Tank Insulation**, fiber glass insulation, maximum operating temperature of 650F (343C), end-grain factory-adhered to an ASJ all-service jacket. All joints shall be stapled then (1) sealed with mastic or (2) closed with 3" (75 mm) pressure-sensitive tape matching the ASJ jacket.

B. Fittings and valves shall be insulated with pre-formed fiberglass fittings, fabricated sections of Owens Corning Fiberglas Pipe Insulation, Owens Corning Pipe and Tank Insulation, Owens Corning blanket insulation, or insulating cement. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings.

Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with suitable weather or vapor resistant mastic as dictated by the system location and service. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.

On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems shall be sealed with caulking to allow free movement of the stem but provide a seal against moisture incursion.

C. Piping located outdoors and exposed to the weather shall be insulated as indicated above except the thickness shall be determined according to the worst weather extremes expected. The insulation shall then be protected with one of the following weatherproof finishes as indicated on contract drawings:

1. Metal jacketing shall be 0.016" (0.4 mm) minimum aluminum or stainless steel with moisture barrier, secured in accordance with the jacket manufacturer's recommendations. Joints shall be applied so they will shed water and shall be sealed completely.

2. UV resistant PVC jacketing may be applied in lieu of metal jacketing provided jacketing manufacturer's limitations with regard to pipe size, surface temperature, and thermal expansion and contraction are followed.

3. Fittings shall be insulated as prescribed above, jacketed with preformed fitting covers matching outer jacketing used on straight pipe sections, with all joints weather sealed.

4. On outdoor chilled water and refrigerant lines, the insulation system shall be completely vapor sealed before the weather-resistant jacket is applied. The outer jacket shall not compromise the vapor barrier by penetration of fasteners, etc. Vapor stops at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion.

D. All piping shall be supported in such a manner that neither the insulation nor the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing shall be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier shall be continuous, including material covered by the hanger saddle.

1. Piping systems 3" (75 mm) in diameter or less, insulated with Owens Corning insulation, may be supported by placing saddles of the proper length and spacing under the insulation as designated in Owens Corning Pub. 1-IN-14210.

2. For hot or cold piping systems larger than 3" (75 mm) in diameter, operating at temperatures less than +200F (93C) and insulated with fiber glass, high density inserts such as wood or foam with sufficient compressive strength shall be used to support the weight of the piping system. At temperatures exceeding +200F (93C), high temperature pipe insulation shall be used for high density inserts.

3. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.

4. Thermal expansion and contraction of the piping and insulation system can generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of insulation are being used and should be so noted on the contract drawings.

5. On vertical runs, insulation support rings shall be used as indicated on contract drawings.

2.02 ACCESSORY MATERIALS

A. Accessory materials installed as part of insulation work under his section shall include (but not be limited to):
   1. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes
   2. Field-applied jacketing materials - Sheet metal, plastic, canvas, fiber glass cloth, insulating cement, PVC fitting covers
   3. Support Materials - Hanger straps, hanger rods, saddles, support rings

B. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

PART 3.00 - EXECUTION

3.01 SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.02 PREPARATION

A. Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean and dry.

B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

3.03 INSTALLATION

A. General

   1. Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.

   2. Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.

3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.

4. Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tears or other damage. All staples used on cold pipe insulation shall be coated with suitable sealant to maintain vapor barrier integrity.

B. Fittings

1. Cover valves, fittings, and similar items in each piping system using one of the following:

   a. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.
   b. Insulation cement equal in thickness to the adjoining insulation.
   c. Owens Corning PVC Fitting Covers insulated with material equal in thickness and composition to adjoining insulation.

C. Penetrations
1. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise specified.

D. Joints
1. Butt pipe insulation against hanger inserts. For hot pipes, it is recommended all joints be staggered when operating temperature is over 400F (204C) double layer. Seal jacketing according to type being used. For cold piping, seal self-sealing laps by firmly rubbing down surface of tape and flap.

2. All pipe insulation ends shall be tapered and sealed, regardless of service.

E. Jackets
1. Provide PVC all service jackets and identification labels on all piping within boiler room.
2. Provide identification labels on all piping in all areas.

F. Vertical Piping

1. If specified on contract drawings, all insulated, exposed vertical piping within the building and all insulated piping exposed to the outdoors shall be additionally jacketed with 0.016" thick (0.4 mm) (minimum) aluminum. Vertical piping shall be protected to a height of 8'-0" (2.4 m) above the floor.

3.04 FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.05 PROTECTION

A. Replace damaged insulation, which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.06 SAFETY PRECAUTIONS

A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.

B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

APPENDIX

Refer to the publications listed below for product information, including uses, descriptions, physical properties, performance, specification compliance and application recommendations:

DATA SHEETS

Owens Corning Vaporwick™ Pipe Insulation	5-IN-44542
Owens Corning Fiberglas® Pipe Insulation	5-IN-20547
Owens Corning Pipe and Tank Insulation	5-IN-14728

CATALOGS

Catalog, Owens Corning Mechanical Insulation Systems	1-IN-14210

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Ontario Building Code

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

- .1 ANSI/ASME B16.15-13, Cast Cooper Alloy Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18-12 , Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22-13 , Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24-11 , Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .5 ASME B16.26-[13] , Cast Copper Alloy Fittings for Flared Copper Tubes.
- .6 ASME B31.9-[14] , Building Services Piping.
- .7 ASME B36.19M-[04] , Stainless Steel Pipe.

.2 ASTM International (ASTM)

- .1 ASTM A182/A 182M-16 , Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
- .2 ASTM A269-[15a] , Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .3 ASTM A307-[14] , Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .4 ASTM A312/A312M-[16] , Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- .5 ASTM A351/A351M-[16] , Castings, Austenitic, for Pressure Containing Parts.
- .6 ASTM A403/A403M-[16] , Wrought Austenitic Stainless Steel Piping Fittings.
- .7 ASTM A536-[84(2014)] , Standard Specification for Ductile Iron Castings.
- .8 ASTM B32-[08(2014)] , Standard Specification for Solder Metal.
- .9 ASTM B42-[15a] , Seamless Copper Tube, Standard Sizes.
- .10 ASTM B88M-[14] , Standard Specification for Seamless Copper Water Tube (Metric).
- .11 ASTM F876-[15] , Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
- .12 ASTM F877-[11] , Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System.

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI/AWWA C111/A21.11-[12] , Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 ANSI/AWWA C151/A21.51-[09] , Ductile Iron Pipe, Centrifugally Cast, for Water.

.3 AWWA C904-[06] , Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service.

.4 CSA Group (CSA)

.1 CSA B137.5-[13] , Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.2 CSA B242-[05] , Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-[07] , Fire Endurance Tests of Buildings Construction and Materials.

.2 CAN/ULC S102.2-[10] , Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.3 CAN/ULC S115-[11] , Standard Method of Fire Tests of Firestop.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-[02a] , Butterfly Valves.

.2 MSS-SP-70-[06] , Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-[05] , Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80-[03] , Bronze Gate, Globe, Angle and Check Valves.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with relevant section.

.2 Product Data

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in relevant section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with General Contractor’s instructions.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Handle and dispose of hazardous materials in accordance provincial and municipal regulations.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground:

.1 Copper tube, hard drawn, types K, L, M, : to ASTM B88M.

.2 PEX Piping to CSA B137.5.

.2 Buried or embedded:

.1 Copper tube, soft annealed, type L or K : to ASTM B88M, in long lengths and with no buried joints.

.2 PEX Piping to CSA B137.5.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 300: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger:

.1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.

.2 PEX fittings to CSA B137.5 and F1960.

.6 NPS 1 ½ and smaller:

.1 Cast copper to ANSI/ASME B16.18, Wrought copper to ANSI/ASME B16.22 ; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

.2 PEX fittings to CSA B137.5.

2.3 JOINTS

.1 Rubber gaskets, [latex-free] [1.6] mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

.7 NPS 1 ½ and smaller: PEX fittings to CSA B137.5.

.8 NPS 2 and larger: PEX fittings to CSA B137.5 and ASTM F1960. Elbows, adapters, couplings, plugs, tees, multi-port tees and valves.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section [23 05 23.01- Valves - Bronze] .

.2 NPS 2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section [23 05 23.01- Valves - Bronze] .

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01- Valves - Bronze.

.2 Lockshield handles: as indicated .

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01- Valves - Bronze.

.2 Lockshield handles: as indicated.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01- Valves - Bronze.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01- Valves - Bronze.

.3 NPS 2 1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section [23 05 23.02- Valves - Cast Iron: Gate, Globe, Check .

2.7 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Forged Brass or bronze body ball, PTFE adjustable packing, brass gland and Bunan, or PTFE or TFE seat, steel lever handle as specified Section 23 05 23.01- Valves - Bronze.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, [chrome plated brass] [stainless steel] ball, PTFE adjustable packing, brass gland and [PTFE] [Bunan] seat, steel lever handle, with NPT to copper adaptors as specified Section [23 05 23.01- Valves - Bronze] .

.3 NPS 2 and under, mechanical:

.1 To CSA B137.5 and ASTM F1960.

.2 [Lead free brass] body.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with local authority having jurisdiction and Provincial Plumbing Code.

.2 Install pipe work in accordance with Section 23 05 15- Common Installation Requirements for HVAC Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

.7 Valves

.1 Isolate equipment, fixtures and branches with [butterfly] [gate] [ball] valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Conform to general requirements.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw [one] sample off longest run. Submit to testing laboratory to verify that system is clean to Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

3.7 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 TAB HWC in accordance with Section 23 05 93- Testing, Adjusting and Balancing.

.3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.4 Sterilize HWS and HWC systems for Legionella control.

.5 Verify performance of temperature controls.

.6 Verify compliance with safety and health requirements.

.7 Check for proper operation of water hammer arrestors. Run [one] outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 In accordance with Section [01 91 13- General Commissioning (Cx) Requirements] : Reports, using report forms as specified in Section [01 91 13- General Commissioning (Cx) Requirements] : Report Forms and Schematics.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.9 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with [Section 23 05 15- Common Installation Requirements for HVAC Pipework] .

.2 Operational requirements in accordance with Section [01 47 19- Sustainable Requirements: Operation] , include:

.1 Cleaning materials and schedules.

.2 Repair and maintenance materials and instructions.

3.10 CLEANING

.1 Clean in accordance with relevant Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General project requiremnets.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM B32-08 , Standard Specification for Solder Metal.

.2 ASTM B306-02 , Standard Specification for Copper Drainage Tube (DWV).

.3 ASTM C564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 CSA Group (CSA)

.1 CSA B67-[1972(R1996)] , Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CAN/CSA-B70-06 , Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CAN/CSA-B125.3-05, Plumbing Fittings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with relevant Section.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with general contractor’s instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground storm, sanitary and vent Type DWV to: ASTM B306.

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.3.

.2 Wrought copper: to CAN/CSA-B125.3.

.2 Solder: lead free, tin-<empty/>95:5, type TA<empty/>] [tin-lead, 50:50, type 50A] , to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary, storm and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.

.1 Joints:

.1 Mechanical joints:

.1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.ASTM C564 or

.2 Stainless steel clamps.

.2 Hub and spigot:

.1 Caulking lead: to CSA B67.

.2 Cold caulking compounds.

.2 Above ground storm, sanitary and vent : to CAN/CSA-B70.

.1 Joints:

.1 Hub and spigot:

.1 Caulking lead: to CSA B67.

.2 Mechanical joints:

.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 In accordance with code and project reqquirements.

.2 Install in accordance with Ontario Building Code.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General project requirements.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D2235- 04 , Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564- 04e1 , Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 CSA Group (CSA)

.1 CAN/CSA-Series B1800- [06] , Thermoplastic Nonpressure Pipe Compendium - B1800 Series.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with relevant Section.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide electronic copies WHMIS MSDS - Material Safety Data Sheets.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with manufacturer’s recommendations.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 MATERIAL

.1 Adhesives and Sealants:

.1 Maximum VOC limit 250 [70] g/L [GSES GS-36] [to SCAQMD Rule 1168] and in accordance with OBC requirements.

2.2 PIPING AND FITTINGS

.1 For buried or above ground] DWV piping to:

.1 CAN/CSA B1800.

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 In accordance with Section [23 05 15- Common installation requirements for HVAC pipework] .

.2 Install in accordance with Ontario Building Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General requirements

1.2 REFERENCE STANDARDS

.1 Ontario Building Code

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section on Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by contractor.

.2 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section [01 33 00- Submittal Procedures] : use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section on Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance information.

.1 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93-Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Owner’s Representative.

.2 Make changes as required and re-submit as directed by [DCC Representative] [Consultant] [Departmental Representative] .

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 [Consultant] [Departmental Representative] [DCC Representative] will provide [1] set of reproducible mechanical drawings. Provide sets of [white] prints as required for each phase of work. Mark changes as work progresses and as changes occur. [Include changes to existing mechanical systems, control systems and low voltage control wiring] .

.2 Transfer information [weekly] to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Consultant for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section [01 78 00- Closeout Submittals] .

.2 Furnish spare parts as follows:

.1 One set of packing for each pump if pump provided.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with General Contractors instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 HVAC and R Equipment:

.1 Refrigerant:

.1 HCFC based refrigerant.

.2 HFC based refrigerant.

.2 Metering Equipment

.1 As required.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for the work

- .1 Visually inspect substrate in presence of General Contractor.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with relevant Section.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct tests as required.

.2 Manufacturer's Field Services:

- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as required.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

.1 Consultant or General Contractor will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

- .1 To be decided.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 Owner may record these demonstrations on video tape for future reference.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor's instructions.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 of 23 05 00.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B1.20.1-1983(R2006) , Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18-2001 , Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International (ASTM)

.1 ASTM A276-08, Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B505/B505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 050 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets as required.

.3 Shop Drawings:

.1 Submit data for valves specified in this Section.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into maintenance manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:
- .1 Valve seats: one for every 10 valves each size, minimum 1.
- .2 Discs: one for every 10 valves, each size. Minimum 1.
- .3 Stem packing: one for every 10 valves, each size. Minimum 1.
- .4 Valve handles: 2 of each size.
- .5 Gaskets for flanges: one for every 10 flanged joints.

.2 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

.1 Valves:
- .1 Except for specialty valves, to be single manufacturer.
- .2 Products to have CRN registration numbers.

.2 End Connections:

.1 Connection into adjacent piping/tubing:
- .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
- .2 Copper tube systems: grooved or solder ends to ANSI/ASME B16.18.

.3 Lockshield Keys:

.1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:
- .1 Standard specification: MSS SP-80.
- .2 Bonnet: union with hexagonal shoulders.
- .3 Connections: screwed with hexagonal shoulders.
- .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
- .5 Packing: non-asbestos.
- .6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: Handwheel.

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: handwheel.

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.

.3 Operator: handwheel.

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Operator: handwheel .

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, union bonnet.

.2 Operator: handwheel .

.5 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:

.1 Body and bonnet: screwed bonnet.

.2 Disc and seat: renewable rotating [PTFE] disc [composition to suit service conditions] , regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: [handwheel] [lockshield] .

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating [PTFE] disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: handwheel.

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.

.3 Operator: handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.

.3 Operator: lockshield.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc: renewable rotating disc of number [6] composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Silent Check Valves:

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.

.2 Pressure rating: [Class 125] .

.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.

.4 Disc and seat: renewable rotating disc.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

.8 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.
.2 Pressure rating: Class125.
.3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders or solder ends to ANSI.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable hard chrome solid ball and Teflon seats.
.7 Stem seal: TFE with external packing nut.
.8 Operator: removable lever handle.

.9 Butterfly Valves:

.1 NPS 2 1/2 through NPS 6, 2068 kPa with grooved ends.

.1 Body: cast bronze, with copper-tube dimensioned grooved ends.
.2 Disc: elastomer coated ductile iron with integrally cast stem.
.3 Operator: lever.

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.
.2 Remove internal parts before soldering.
.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean as required.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General project requirements.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-07, Power Piping.

.2 ASTM International (ASTM)

.1 ASTM A125-1996(2007) , Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-07b , Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-07a , Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2002 , Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003 , Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section [01 78 00-Closeout Submittals] .

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1 and

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: painted with zinc-rich paint or galvanized after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated or copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut.
.1 Rod: 13 mm FM approved or 9 mm UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye [6] mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate [UL listed] [FM approved] to MSS SP69.

.5 Shop and field-fabricated assemblies:
.1 Trapeze hanger assemblies
.2 Steel brackets
.3 Sway braces for seismic restraint systems

.6 Hanger rods: threaded rod material to MSS SP58:
.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP58:
.1 Attachments for steel piping: carbon steel black or galvanized.
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation shields for hot pipework.
.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69 [UL listed] [FM approved] , clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
.1 Finishes for steel pipework: galvanized or black.
.2 Finishes for copper, glass, brass or aluminum pipework: [black] [epoxy coated] [[galvanized] , with formed portion plastic coated] .

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: [galvanized] [black] carbon steel to MSS SP58, type 42

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^{3}density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: [10] % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section [05 12 23- Structural Steel for Buildings] . Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.10 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section [05 12 23- Structural Steel for Buildings] .

.2 Submit structural calculations with shop drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with [4] minimum concrete inserts, [one] at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to Provincial Code and National Plumbing Code of Canada (NPC) or authority having jurisdiction.

.2 Copper piping: up to NPS 1/2: every 1.5 m.

.3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.4 Within [300] mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as required.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work.

3.8 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for [recycling] [reuse] in accordance with Section [01 74 19- Waste Management and Disposal] [01 35 21- LEED Requirements] .

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to general contractor.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-[1998] .

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002 .

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started and confirm in writing to the Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report with Consultant in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required for verification of TAB reports.

1.9 START OF TAB

.1 Notify Consultant 5 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 5 %, minus 5 %.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus [2] % of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to [Consultant] [Departmental Representative] [DCC Representative] list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant if requested.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of [Departmental Representative] [Consultant] [DCC Representative] , prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.15 TAB REPORT

.1 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.2 Submit electronic copy of TAB Report to Consultant for verification and approval, in English.

1.16 VERIFICATION

.1 Reported results subject to verification by Consultant.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results if requested.

.3 Number and location of verified results as directed by Consultant.

.4 Pay costs to repeat TAB as required to satisfaction of Consultant.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of [Departmental Representative] [Consultant] [DCC Representative] , replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by [DCC Representative] [Departmental Representative] [Consultant] .

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of [this section] [TAB standards of [SMACNA] [AABC] [ASHRAE] [NEBB]] .

.2 Do TAB of [following systems, equipment, components, controls

.3 Qualifications: personnel performing TAB qualified to standards of NEBB, AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified by AABC to standards of NEBB.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

1.21 POST-OCCUPANCY TAB

.1 Measure WBT (or %RH), NC levels, DBT, air flow patterns, in occupied zone of following areas: offices and child care wing.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General Requiremnets

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A480/A480M-[12] , Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-[09b] , Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A653/A653M-[11] , Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 National Fire Protection Association (NFPA)

.1 NFPA 90A-[12] , Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-[12] , Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-[11] , Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, [2005] .

.2 SMACNA HVAC Air Duct Leakage Test Manual, [2012] .

.3 IAQ Guideline for Occupied Buildings Under Construction [2007] .

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [metal ducts] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in electronic format.

.4 Test and Evaluation Reports:

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with tape and sealant.

.3 Class C: transverse joints and connections made air tight with gaskets, tape sealant or combination thereof . Longitudinal seams unsealed.

2.2 SEALANT

.1 Sustainability Characteristics:

.1 Adhesives and sealants: VOC limit [250] [30] [70] g/L maximum to SCAQMD Rule 1168 GS-36.

.2 Sealant: oil resistant, water borne, or polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus [93] degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius.

.2 Round: centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with double thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 As indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with section on fire dampers.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct [but next sheet metal thickness heavier than duct] .

.1 Maximum size duct supported by strap hanger: [500] .

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized or black steel angle with galvanized] steel rods to ASHRAE [following table] [SMACNA] :

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: [steel plate washer] [manufactured joist clamp] .

.3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from.

3.2 GENERAL

.1 Do work in accordance with ASHRAE and SMACNA

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Ensure diffuser is fully seated.

.3 Support risers as indicated.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where indicaterd.

3.3 HANGERS

.1 Strap hangers: install in accordance with [SMACNA] .

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with [as follows:] [SMACNA] [ASHRAE]

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

.1 Apply sealant in accordance with [to manufacturer's recommendations] [SMACNA] .

.2 Bed tape in sealant and recoat with minimum of [1] coat of sealant to manufacturers recommendations.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with relevant Section and general contractor’s instructions.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General project requirements.

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, [2005] .

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [01 61 00- Common Product Requirements] [with manufacturer's written instructions] .

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air duct accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene or foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

.2 301 to 450 mm: four sash locks [complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.5 Hold open devices.

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness without trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of general contractor.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: [100] mm.

.3 Minimum distance between metal parts when system in operation: [75] mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by [DCC Representative] [Departmental Representative] [Consultant] .

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00- Cleaning] .

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General project requiremnets.

1.2 REFERENCE STANDARDS

.1 National Fire Protection Association (NFPA)

.1 NFPA 90A-12, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S112-10 , Standard Test Method of Fire Test of Fire Damper Assemblies.

.2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.

.3 ULC-S505-[1974] , Standard for Fusible Links for Fire Protection Service.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fire and smoke dampers and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate the following:

.1 Fire dampers.
.2 Smoke dampers.
.3 Fire stop flaps.
.4 Operators.
.5 Fusible links.
.6 Design details of break-away joints.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with project requirements.

.2 Operation and Maintenance Data: submit operation and maintenance data for [fire and smoke dampers] for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit maintenance materials in accordance with project requirements.

.2 Provide: 6 fusible links of each type.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [with manufacturer's written instructions] [01 61 00- Common Product Requirements] .

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect fire and smoke dampers from [nicks, scratches, and blemishes]

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type A B or C, listed and bearing ULC label, meet requirements of authorities having jurisdiction and NFPA. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.

.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset [single damper] , round or square; [roll door type;] [multi-blade hinged] [interlocking type;] [guillotine type;] sized to maintain full duct cross section [as indicated] .

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 [40 x 40 x 3] mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 SMOKE DAMPERS

.1 Smoke Dampers: to be ULC or UL listed and labelled.

.2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, [from remote alarm signalling device actuated by an electro thermal link] [as indicated] [and/or] . Two flexible stainless steel blade edge seals to provide required constant sealing pressure.

.3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link [and/or] [from remote alarm signalling device] . Blade edge seals of flexible stainless steel to provide required constant sealing pressure. Provide stainless steel negator springs with locking devices to ensure positive closure for units mounted horizontally in vertical ducts.

.4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.

.5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of [74] degrees C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

.1 Damper: similar to smoke dampers specified above.

.2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

2.4 FIRE STOP FLAPS

.1 Fire smoke flaps: ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.2.

.2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps held open with fusible link conforming to ULC-S505 and close at [74] degrees C [or as indicated] .

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper.

.5 Co-ordinate with installer of fire stopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00- Cleaning] .

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with General Contractor’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General project requirements.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-12 , Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-12 , Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 2005.

.4 Underwriters' Laboratories (UL)

.1 UL 181-2005, Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S110-2007 , Standard Methods of Tests for Air Ducts.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [flexible ducts] and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Thermal properties.
.2 Friction loss.
.3 Acoustical loss.
.4 Leakage.
.5 Fire rating.

.3 Test and Evaluation Reports:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [with manufacturer's written instructions] [01 61 00- Common Product Requirements] .

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials [indoors] [in dry location] [off ground] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect [flexible ducts] from [nicks, scratches, and blemishes] .

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Spiral wound flexible aluminum, as indicated.

.2 Performance:
.1 Factory tested to 2.5 kPa without leakage.
.2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC - INSULATED

.1 [Type 2] : spiral wound flexible aluminum with factory applied, [37] mm thick flexible glass fibre thermal insulation with vapour barrier and [vinyl] [reinforced mylar/neoprene laminate] [aluminum] jacket, as indicated.

.2 Performance:
.1 Factory tested to 2.5 kPa without leakage.
.2 Maximum relative pressure drop coefficient: 3.
.3 Thermal loss/gain:

2.4 NON-METALLIC - UNINSULATED

.1 Non-collapsible, coated mineral base fabric, mechanically bonded to, and helically supported by, external steel wire, as indicated.

.2 Performance:
.1 Factory tested to [2.5] kPa without leakage.
.2 Maximum relative pressure drop coefficient: 3.

2.5 NON-METALLIC - INSULATED

.1 Non-collapsible, coated aluminum foil/mylar mineral base fabric type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible mineral fibre thermal insulation with vapour barrier and [reinforced mylar/neoprene laminate vinyl] jacket, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for flexible ducts installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of general contractor.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 DUCT INSTALLATION

.1 Install in accordance with: SMACNA, NFPA 90B, CAN/ULC-S110.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00- Cleaning] .

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

ELECTRICAL SPECIFICATIONS

TSSS Family Residence Renovations

4222 Kingston Road

Toronto, Ontario

DeCARIA ENGINEERING

DeCaria Engineering Limited
1661 Denison St. Unit D16
Markham, ON L4B 3A9
Tel: (905) 707-9200

ELECTRICAL SPECIFIFCATIONS TABLE OF CONTENTS

Part 1 General

1.1 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 Ontario Electrical Safety Code (28th Edition) - 2021

.2 CSA C22.1:21, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 CSA C235:19, Preferred Voltage Levels for AC Systems, up to 50,000 V.

.4 CAN/CSA-C22.3 No.1:20, Overhead Systems.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for all electrical equipment in PDF format including product characteristics, performance criteria, physical size, finish, limitations, etc.

.3 Submit for review single line electrical diagrams under plexiglass in glazed frames and locate as indicated.

.1 Electrical distribution system in main electrical room.

.2 Electrical power generation and distribution systems in power plant rooms.

.4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames under plexiglass at fire alarm control panel and annunciator.

.5 Shop drawings in PDF format:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit full size drawings and product data to inspection authority having jurisdiction.

.6 If changes are required, notify Consultant of these changes before they are made.

.6 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such material and equipment to inspection authorities having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owners Representative and Consultant.

.7 Manufacturer's Field Reports: submit to Consultant and Representative manufacturer's written report, within 5 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for all electrical equipment installed.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect all equipment and materials.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CSA-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of Owners Representative having jurisdiction.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet melamine , matt white finish with white face and black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and/or label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. "

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	

up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 RECEPTACLE AND COMMUNICATIONS IDENTIFICATION

.1 Identify each receptacle with permanent indelible identifying markings, coloured plastic tapes with panel and circuit number.

.2 Identify each communication outlet with permanent indelible identifying markings, coloured plastic tapes with LAN room and port number.

.3 Maintain phase sequence and colour coding throughout.

.4 Colour coding: to CSA C22.1.

2.10 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment Paint outdoor electrical equipment "equipment green" finish to local utility standard/OESA.

.2 Paint indoor switchgear and distribution enclosures light gray to local utility/OESA standard

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable.

.1 Visually inspect substrate in presence of Owners Representative and/or Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant or Owners Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 100 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: not less than 900 mm and not more than 1200 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: between 900mm and 1200 mm.

.6 Fire alarm stations: not less than 900 mm and not more than 1200mm.

.7 Fire alarm bells: 2100 mm.

.8 Television outlets: 300 mm.

.9 Wall mounted speakers: 2100 mm.

.10 Clocks: 2100 mm.

.11 Door bell pushbuttons: not less than 900mm and not more than 1200 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Owner Representative and /or Consultant.

.4 Provide instruments, meters, equipment and personnel including necessary after-hours labour as required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 SYSTEM STARTUP

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

.1 CSA Group (CSA)

.1 CAN/CSA-C22.2 No.65-R2018, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).

.2 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes. (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).

.3 CSA C22.2 No.18.2-06(R2021), Nonmetallic Outlet Boxes.

.4 CSA C22.2 No.18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-national Standard, with ANCE NMX-J-017 and UL 514B).

.5 CSA C22.2 No.18.4-15(R2019), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National Standard, with UL 2239).

.6 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for conductors copper stranded.
- .2 Clamp for copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable, mineral insulated cable, and flexible conduit as required to: CAN/CSA-C22.2 No.18.3.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Consultant and/or Owners Representative.
- .2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65
- .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00- Submittal Procedures.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of padding, pallets, packaging materials and crates in accordance with Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated on drawings, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketed. Where not indicated on drawings conductors shall be copper.

.3 Copper conductors: size as indicated on drawings, with thermoplastic insulation type T90 Nylon rated at 600 V. Where not indicated on drawings conductors shall be copper.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Conductors:

.1 Grounding conductor: copper as indicated on drawings.

.2 Circuit conductors: copper as indicated on drawings; size as indicated.

.3 Where not indicated on drawings conductors shall be copper.

.3 Insulation:

.1 Cross-linked polyethylene XLPE.

.2 Rating: 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.

.3 Outer covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 degrees C .

.4 Overall jacket: none.

.5 Two hour fire rating.

.6 Connectors: watertight, field installed approved for MI cable.

.7 Termination kits: field installed approved for MI cable

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated on drawings. Where not indicated on drawings conductors shall be copper.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: jacket over armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: ACM alloy or aluminum or copper, size as indicated on drawings. Where not indicated on drawings conductors shall be copper.

.2 Insulation: cross linked polyethylene rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated seamless sheath.

.4 Outer jacket: none.

.5 Fastenings for aluminum sheathed cable:

.1 One hole steel straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

2.6 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT:2 soft annealed copper conductors, sized as indicated:

.1 Insulation: TWH polyethylene.

.2 Shielding: braid over conductors group.

.3 Overall covering: polyethylene jackets.

.3 Type: 600 V conductors, sizes as indicated :annealed copper

.1 Insulation: RW90 cross-linked polyethylene type.

.2 Shielding: conductors.

.3 Overall covering: thermosetting jackets.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform for Consultant and/or Owner Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Lay cable in cable trays in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - (0-1000 V).

.3 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.

.2 In underground ducts in accordance with Section 33 71 73.02

.3 In surface and lighting fixture raceways in accordance with Section 26 05 33

.4 In wireways and auxiliary gutters in accordance with Section 26 05 37

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed where required by Architect , securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable concealed or exposed as required , securely supported by straps or hangers.

.2 Support 2 hour fire rated cables at 1 m intervals.

.3 Make cable terminations by using factory-made kits.

.4 Cable terminations: use thermoplastic sleeving over bare conductors.

.5 Do not splice cables unless indicated.

3.6 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.8 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 latest edition, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-12(R2017), Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-18, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates: obtain inspection certificate of compliance covering high voltage stress from inspection authority and include it with maintenance manuals and as-built drawings.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors and terminations from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper short barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 4-way joint boxes dry location type in accordance with Section 26 05 33- Raceway and Boxes for Electrical Systems.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from General Contractor.

3.2 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2NO.41:22.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and Section 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required.

.2 Rod electrodes: galvanized steel 19mm diameter by minimum 3m long.

.3 Grounding conductors: bare stranded copper soft annealed, size per code.

.4 Insulated grounding conductors: green, copper conductors, size per code.

.5 Ground bus: copper, 6x50mm (1/4"x2") size around perimeter in main electrical room, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.13 Ground secondary service pedestals.

3.3 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water metre shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod electrodes and make grounding connections as indicated or required.

.5 Bond separate, multiple electrodes together.

.6 Use size 2/0 AWG copper conductors for connections to electrodes.

.7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary system.

3.5 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.6 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.

.2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.7 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and/or Owners Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and Section 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 Steel channels, zinc coating, U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Secure equipment to hollow, solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 5-foot intervals.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant and/or Owners Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1:21, Canadian Electrical Code, Part 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in PDF format in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 01 33 00- Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat covers.

2.3 CABINETS

.1 Construction: welded sheet steel hinged door, and catch

.2 Type E Empty: flush overlapping sides mounting as required.

.3 Type T Terminal: flush overlapping sides mounting as required containing.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00- Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating, voltage and phase, system name, fed from.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 Ontario Electrical Safety Code, 28th Edition, 2021.

.2 CSA C22.1:21, Canadian Electrical Code,

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Submit samples for floor box in accordance with Section 01 33 00- Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Singleand multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated.102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster and tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry and multi and single gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece die-cast aluminumwith brushed aluminum housing finish for two duplex receptacles. Bottom plate with two knockouts for centered or offset installation.12 x 102 mm extension piece as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.40-17, Junction and Pull Boxes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for raceway and boxes and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for raceway and boxes for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect raceway and boxes from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SPLICE BOXES

.1 Splice boxes cast iron enclosures 6 mm thick painted with chromate primer and grey enamel to provide mechanical protection and moisture seal for direct buried cable splices rated 5 kV and consisting of:

.1 Two halves, split along cable axis, finely ground matching surfaces, fastened with galvanized steel bolts, top half with large filling holes with gasketted plugs for medium hard asphalt base compound, bottom half with screws on inside for bonding armour, lead sheath , and box end openings sealed by:

.1 Wrapping cables with anhydrous tape and clamping to make snug fit, for 4 way splices.

.2 Fitting boxes with cable entrance fittings suitable for interlocking armour or steel tape armour sheaths, for 4way splices.

.2 Submarine splice boxes to provide mechanical protection and waterproof seal for submarine cables as follows:

.1 Cast iron split boxes with cast iron cones and split armour clamps painted with chromate primer and grey enamel with four bronze rods fastened rigidly to splice box and attached to armour clamps to relieve joint of longitudinal stress, designed to be filled with medium hard asphalt base compound, and rated 5kV.

.2 Galvanized steel pipe with filling holes for medium hard asphalt base compound, gasketed plugs, with ends right hand and left hand threaded, cast steel end caps with wire armour clamps, to relieve conductors and splice from mechanical stresses.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for raceway and boxes installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Install splice boxes at cable joint, on floor of trench. Tighten armour clamps and fill with compound.

.1 Ground splice boxes as required.

.2 Install submarine splice boxes at cable joints, tighten clamps and fill with compound before lowering cable to sea, river, or lake bed.

.3 Install junctions boxes on trench floor around cable splice to CSA C22.2 No.40. Connect cable terminals to box contacts.

.1 Ground junction boxes as required.

.2 Fasten lid securely and check for air leaks before trench is backfilled.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).

.2 CSA C22.2 No.18.2-06(R2021), Non-metallic Outlet Boxes.

.3 CSA C22.2 No.18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-national Standard, with ANCE NMX-J-017 and UL514B).

.4 CSA C22.2 No.18.4-15(R2019), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National Standard, with UL 2239).

.5 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).

.6 CSA C22.2 No. 45.1-07(R2017), Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and MX-J-534-ANCE-2007)

.7 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.8 CSA C22.2 No. 83.1-07(R2017), Electrical Metallic Tubing.

.9 CSA C22.2 No. 211.2-06(R2021), Rigid PVC (Unplasticized) Conduit.

.10 CSA C22.2 No. 227.3:15(R2019), Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada latest edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal .

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

.4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45.1 hot dipped galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45.1, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.1, with couplings.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56 , liquid-tight flexible metal.

.6 Flexible PVC conduit: to CSA-C22.2 No. 227.3 .

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 5 foot intervals.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene .

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.

.3 Surface mount conduits except in finished areas.

.4 Use rigid hot dipped galvanized steel threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.

.6 Use rigid PVC conduit in corrosive areas and underground.

.7 Use flexible metal conduit for recessed lighting fixtures work in movable metal partitions connection to recessed without prewired outlet box, connection to motors and transformers in dry areas.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Use explosion proof flexible connection for connection to explosion proof motors.

.10 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.11 Minimum conduit size for lighting and power circuits: 19 mm.

.12 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.13 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel.

.1 Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.

.14 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.15 Mechanically bend steel conduit over 19 mm diameter.

.16 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.17 Install fish cord in empty conduits.

.18 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.19 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.20 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface or suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

.8 Refer to civil engineers drawings and/or specifications for exact requirements of concrete installation.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA C22.1 No.126.1-17, Metal Cable Tray Systems.

.2 CAN/CSA C22.1 No.126.2-02(R2017), Non Metallic Cable Tray Systems.

.3 Ontario Electrical Safety Code (OESC), 28th Edition, 2021 which contains CSA C22.1:21, Canadian Electrical Code and Ontario amendments to that code.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1-2017, Metal Cable Tray Systems.

.2 NEMA VE 2-2018, Cable Tray Installation Guidelines.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.4 Identify types of cable troughs used.

.5 Show actual cable trough installation details and suspension system.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for [recycling in accordance with Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 CABLETROUGH

.1 Cable troughs and fittings: to CSA C22.1 No. 126.1

.2 Ladder, Ventilated, Non-Ventilated or wire mesh type, to CAN/CSA C22.2 No.126.2 and 126.1.

.3 Trays: sheet aluminum, width as required with depth of 75 mm.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable trough supplied.

.1 Radii on fittings: as required.

.5 Solid covers for complete cable trough system including fittings.

.6 Barriers where different voltage systems are in same cable trough.

.7 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CSA C22.1 and OESC requirements.

.8 Provide fire stop material at firewall penetrations.

2.2 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable trough system in accordance with NEMA VE 2.

.2 Support cable trough on both sides.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Lay cables into cabletrough. Use rollers when necessary to pull cables.

.3 Secure cables in cabletrough at 6m centres, with nylon ties.

.4 Identify cables every 30m with size 2 nameplates

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA-Z809-16, Sustainable Forest Management.

.2 Forest Stewardship Council (FSC)

.1 FSC-STD-CAN-1-2018 EN, FSC National Forest Stewardship Standard of Canada

.3 Insulated Cable Engineers Association, Inc. (ICEA)

.4 Sustainable Forestry Initiative (SFI)

.1 SFI-2022 Forest Management Standard.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect cables from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CABLE PROTECTION

.1 Coloured U-fill,

2.2 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of General Contractor.
- .2 Inform General Contractor of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

.2 After sand bed in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable.

- .1 Do not pull cable into trench.

.3 Include offsets for thermal action and minor earth movements.

- .1 Offset cables 190 mm minimum for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.4 Make termination and splice only as indicated leaving 0.6 m minimum of surplus cable in each direction.

- .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.

.5 Underground cable splices not acceptable.

.6 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.7 Cable separation:

- .1 Maintain 75 mm minimum separation between cables of different circuits.
- .2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.
- .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
- .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
- .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
- .6 Install treated planks on lower cables 0.6m minimum in each direction at crossings.

.8 After sand protective cover specified in Section 31 23 33.01- Excavating, Trenching and Backfilling, is in place, install continuous row of interlocking cable blocks overlapping 38 x 140 mm as indicated to cover length of run.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 As noted on drawings.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform tests using qualified personnel.

.1 Include necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.

.1 Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing as recommended by ICEA or manufacturer's instructions.

.4 Leakage Current Testing:

.1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.

.2 Hold maximum voltage for specified time period by manufacturer.

.3 Record leakage current at each step.

.7 Provide Consultant and/or Owners Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

PART 1 – General

1.1 SCOPE

.1 The electrical contractor shall retain the services of an independent third-party firm, or the equipment manufacturer's technical services group, to perform a short circuit/coordination study and arc flash risk assessment as described herein.

.2 Preliminary studies shall be submitted to the CONSULTANT AND/OR OWNERS REPRESENTATIVE prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture to ensure the characteristics and ratings of the proposed overcurrent devices will be satisfactory. The final submittal shall capture any changes in circuit lengths, wire sizes, additional loads, etc. that may occur during the construction project.

.3 The studies shall include all portions of the electrical distribution system from the normal power source or sources, and emergency/standby sources, down to and including the smallest circuit breaker in the distribution system for short circuit calculations. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.

.4 The firm should be currently involved in medium- and low-voltage power system evaluation. The study shall be performed, stamped and signed by a registered professional engineer in the Province of Ontario. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the CONSULTANT AND/OR OWNERS REPRESENTATIVE for approval prior to start of the work. A minimum of five (5) years' experience in power system analysis is required for the individual in charge of the project.

.5 The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

.6 The study and assessment shall be performed on approved software.

1.2 RELATED WORK

.1 Applicable provisions of Division 1 govern work under this section.
.2 Section262300 - Low Voltage Switchgear
.3 Section 262416– Panelboards
.4 Section 019113 – General Commissioning Requirements.

1.3 REFERENCE STANDARDS

.1 IEEE Buff Book", IEEE STD 242-2001.
.2 CSA C22.1:21, Canadian Electrical Code.
.3 Ontario Electrical Safety Code, 28th Edition, 2021.
.4 IEEE 1584 –2018 Guide for Performing Arc Flash Calculations.
.5 IEEE/ANSI 141-1993(R1999), Practice for Electric Power Distribution for Industrial Plants.
.6 National Fire Protection Association (NFPA) 70E, 2021.

1.4 DATA COLLECTION FOR THE STUDY

.1 The contractor shall provide the required data for preparation of the studies. The engineer performing the system studies shall furnish the contractor with a listing of the required data immediately after award of the contract.

.2 The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.

1.5 SUBMITTALS

.1 THIRD PARTY QUALIFICATIONS
Submit qualifications of individual(s) who will perform the work to the CONSULTANT AND/OR OWNERS REPRESENTATIVE for approval prior to commencement of the studies.

.2 PRELIMINARY REPORT
Submit a draft of the studies to the for review prior to delivery of the final study to the Owner. Make all additions or changes as required by the reviewer.

.3 FINAL STUDY REPORT

.1 Provide studies in conjunction with equipment submittals to verify equipment ratings required.

.2 The results of the power system studies shall be summarized in a final report and provided in the following formats. Provide (2) bound hard copies of the final report. Provide (2) electronic copies (on CD) of the final report and one-line diagrams in PDF format. Provide (2) electronic copies (on CD) of the final report in MS Word format and the one-line diagrams in CAD format.

.3 Also provide (2) electronic copies (on CD) of all files generated by the software for all scenarios evaluated in the studies. The files shall permit the studies to be opened, reviewed or updated by any user of the analysis software used for the studies.

.4 The report shall typically include the following sections:

I. Overview
II. Short Circuit Study
SC-1 Purpose
SC-2 Explanation of Data
SC-3 Assumptions
SC-4 Analysis of Results
SC-5 Recommendations
SC-6 Fault Analysis Input Report from Software Program
SC-7 Fault Contribution Report
III. Protective Device Coordination Study
PDC-1 Purpose
PDC-2 Explanation of Data
PDC-3 Assumptions
PDC-4 Analysis of Results
PDC-5 Recommendations (Including ESA Requirement)

PDC-6 Results from Software Program
PDC-7 Example Drawings
IV. Arc Flash Study
ARC-1 Purpose
ARC-2 Explanation of Data
ARC-3 Assumptions
ARC-4 Analysis of Results
ARC-5 Recommendations
ARC-6 Arc Flash Evaluation Report from Software Program
V. Prioritized Recommendations and Conclusions
VI. Appendices
APP-1 One-line Diagrams from Software Program
APP-2 AutoCAD One-line Diagrams
APP-3 Protective Device Summaries from Software Program
APP-4 Reference Data
APP-5 Sample Work Permit Form
APP-6 Copy of Warning Labels, including study date

.5 The above sections shall include the following items in detail:

i. Obtain available fault current from the local utility company.

ii. Short circuit studies shall evaluate the available fault current at each bus (each change of impedance), including all three-phase motors.

iii. Coordination study recommendations for relay settings, breaker settings, and motor protection settings.

iv. Recommendations for improving the coordination and/or load distribution, as well as ground fault requirements.

v. Worst case Arc Flash values (highest incident energy) for project specific scenarios (low short circuit and high short circuit for each possible power supply source).

vi. Arc flash values for two maintenance cases, which define the arc flash values available at the equipment that would be available if the instantaneous trip of the upstream circuit breaker is set at a minimum value. This is recommended if someone has to work on live equipment.

vii. IEEE standard one-line diagram with equipment evaluation and circuit breaker settings that clearly define the system data and are easy to interpret. The diagrams should include the bus names and references used in the studies.

viii. Recommendations to reduce the arc flash incident energy in all areas that are subject to 8 calories per square centimeter or greater of available incident energy.

ix. Condition of Maintenance information for any existing equipment included in the study.

x. Prioritized report summarizing all recommendations from this study. This shall include observed ESA code violations and their corrective action.

xi. The contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 600x900mm (24" x 36") (minimum) Styrofoam backboard. This one-line diagram shall be mounted in each electrical room.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 SHORT CIRCUIT AND COORDINATION STUDY

.1 The short circuit, coordination, and arc flash hazard studies shall be performed using approved software packages. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.

.2 In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

.3 Include on the curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

.4 Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

.5 Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

.6 Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.

.7 Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

.8 Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective devices not property rated for fault conditions.

.9 Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.

.10 When an emergency generator is provided, include phase and ground coordination of the generator protective devices, to meet ESA requirements. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

.11 Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

.12 For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current to ensure protective devices will not trip major or group operation.

3.2 FIELD SETTINGS

.1 The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device coordination study and arc flash risk assessment.

.2 Necessary field settings and adjustments of devices and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

3.3 ARC FLASH RISK ASSESSMENT

.1 As part of the short circuit and coordination study, arc flash risk assessment shall be included. The study shall include the following:

.1.1 Determine and document all possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.

.1.2 Calculations to conform to National Fire Protection Association (NFPA) 70E recognized means of calculation standards. All incident energy units shall be calculated in calories per square centimeter.

.1.3 Provide recommended boundary zones and personal protective equipment (PPE) based on the calculated incident energy and requirements of NFPA 70E for each piece of electrical gear.

.2 Electrical Contractor shall provide warning labels as required by OSHA based upon the results of the arc flash risk assessment. At a minimum, the labeling shall contain the following information: nominal system voltage, arc flash boundary, limited approach boundary, restricted approach boundary, available incident energy and the corresponding working distance or the arc flash PPE category, minimum arc rating of clothing, and study date. Label shall also include the name or logo and the phone number of the company performing the study.

.3 Arc flash warning labels shall be affixed to all electrical equipment that is likely to require examination, adjustment, servicing or maintenance while energized. This includes, but is not limited to, medium-voltage switchgear, transformers, switchboards, panel boards, three-phase disconnect switches, transfer switches, motor control centers, motor controllers, and three-phase motor disconnect switches.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA-C22.2 No.47-13(R2018), Air-Cooled Transformers (Dry Type).

.2 CSA C9-17(R2022), Dry-Type Transformers.

.3 CAN/CSA-C802.2-18, Minimum Efficiency Values for Dry Type Transformers.

.2 National Electrical Manufacturers Association (NEMA).

.3 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC GL1-3-1988, Transformer and Reactor Bushing

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, in dry location, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dry type transformers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN DESCRIPTION

.1 Design.

.1 Type: ANN .

.2 3 phase,

.3 Voltage taps:2 2 1/2% FCBN & FCAN

.4 Insulation: Class H

.5 Basic Impulse Level (BIL): 10KV.

.6 Hipot: standard.

.7 Average sound level: C-9

.8 Impedance at 17 degrees C: standard

.9 Enclosure: CSA, removable metal front panel, sprinkler proof.

.10 Mounting: wall, floor or hung as noted on drawings.

.11 Finish: in accordance with Section 26 05 00- Common Work Results for Electrical.

.12 Aluminum windings.

.13 Winding configuration to be as noted on drawings.

.14 Harmonic Mitigating Phase Shifting transformers as indicated on drawings.

.15 KL-Rated Transformers as indicated on drawings.

.16 Voltage Regulation to be 4% or better.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Label size: 7.

.3 Nameplate wording: TX-floor-#, fed from source, panel feed

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for dry type transformers installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on floor or as indicated on drawings.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

.9 Make conduit entry into bottom 1/3 of transformer enclosure.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by dry type transformers installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.31-18, Switchgear Assemblies.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 IEEE C37.20.3-2013, Metal Enclosed Interrupter Switchgear Assemblies

.2 ANSI C37.57-2003 (R2020), Metal Enclosed Interrupter Switchgear Assemblies – Conforming Testing.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for low voltage switchgear and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Indicate on drawings:

.1 Floor anchoring method and foundation template.

.2 Dimensioned cable entry and exit locations.

.3 Dimensioned position and size of bus.

.4 Overall length, height and depth of complete switchgear.

.5 Dimensioned layout of internal and front panel mounted components.

.4 Certificates:

.1 Submit certified factory test results.

.5 Sustainable Design Submittals:

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data forlow voltage switchgear and components for incorporation into manual.

1.4 EXTRA STOCK MATERIALS

.1 Supply maintenance materials in accordance with Section 01 78 00- Closeout Submittals.

.2 Include:

.1 3 fuses for each type above 600 A.

.2 6 fuses for each type up to and including 600 A.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect low voltage switchgear from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Switchgear assembly: to CSA C22.2 No.31.

2.2 RATING

.1 Secondary switchgear: indoor

2.3 ENCLOSURE

.1 Main incoming section to contain:

.1 Insulated case power circuit breaker sized as indicated on drawings.

.2 Digital metering system to Section 26 09 23.01- Metering and Switchboard Instruments.

.3 Provision for electrical power supply authority metering.

.2 Distribution sections to contain:

.1 Moulded case circuit breaker sized as indicated on drawings.

.2 Aluminum bus, from main section to distribution sections [including vertical bussing.

.3 Blanked off spaces with bus stabs and hardware for mounting future units.

.4 Metal enclosed, free standing, floor mounted, dead front, indoor, CSA Enclosure 3 cubicle unit.

.5 Ventilating louvres: vermin, insect sprinkler proof.

.6 Access from front.

.7 Steel channel sills for base mounting in single length common to multi-cubicle switchboard.

.8 Provision for future extension as noted on drawings.

2.4 BUSBARS

.1 Three phase and 100% rated bare busbars, continuous current rating 1,000A , suitably supported on insulators multi-cubicle switch board.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: 99.30% minimum conductivity aluminum.

.4 Allow for extension of bus on both sides of unit without need for further drilling or preparation in field.

.5 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one section.

2.5 GROUNDING

.1 Copper ground bus not smaller than 50 mm x 6 mm extending full width of multi-cubicle switchboard and situated at bottom.

.2 Lugs at each end for size as required.

2.6 GROUND FAULT UNIT

.1 Shall be part of main breaker.

2.7 MOULDED CASE CIRCUIT BREAKERS

.1 25,000AIC

2.8 INSTRUMENTS

.1 Provide Digital showing, Voltage, Amperage, KW, KVA and KWH. Reading shall be phase to phase and phase to neutral.

2.9 INSTRUMENT TRANSFORMERS

.1 As required for digital metering

2.10 POWER SUPPLY AUTHORITY METERING

.1 Separate compartment and metal raceway for exclusive use of power supply authority metering.

.2 Arrange with authority having jurisdiction for supply of mounting accessories and wiring for metering as follows:

.1 Watthour meter.

.2 Demand metre with kWh register.

.3 Ammeter.

.4 Voltmeter.

.5 Ammeter phase selector switch.

.6 Voltmeter phase selector switch.

2.11 FINISHES

.1 Apply finishes in accordance with Section 26 05 00- Common Work Results for Electrical.

.1 Cubicle exteriors gray.

.2 Cubicle interiors white.

2.12 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Nameplates:

.1 White plate, black letters, size 7.

.2 Complete switchgear labelled: voltage, system configuration and main bus ampacity.

.3 Main cubicle labelled: "Main Breaker".

.4 Distribution units labelled: "Feeder No.1", "Feeder No.2" etc. as per single line diagram.

2.13 SOURCE QUALITY CONTROL

.1 Consultant and/or Owner Representative may witness final factory tests.

.2 Notify Consultant and/or Owners Representative in writing 5 days minimum in advance that switchgear assembly is ready for testing.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for low voltage switchgear installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Locate switchgear assembly as indicated and bolt to housekeeping pad.

.2 Connect main secondary power supply to main breaker.

.3 Connect load side of breakers in distribution cubicles to distribution feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run one grounding conductor 4/0 AWG bare copper in 25 mm conduit from ground bus to ground.

.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by low voltage switchgear installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.29-15(R2019), Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 600V and 250V panelboards: bus and breakers rated as shown on drawings

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Aluminum bus with neutral of same ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel as per colour schedule.

.11 Isolated ground bus.

.12 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02- Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owners Representative.

.5 Lock-on devices for receptacles, fire alarm, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00- Rough Carpentry. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00- Common Work Results for Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Where panels of different systems (i.e. Standard and Vital Power) supply a common patient care area, ground busses in panels to be interconnect with a minimum #6 AWG ground conductor.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 94.1:15(R2020), Enclosures for Electrical Equipment, Non-Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2020, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsell System of Colour Notation

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7mm thick minimum steel, with weather and corrosion resistant finish to CSA C22.2 No. 94.1 and NEMA 250 latest edition, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m^2area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails 1m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

- .1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
- .2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3-point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

.8 Door interlocks:

.9 Enclosure construction such as to allow configuration of single or ganged enclosures.

.10 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Consultant and/or Owners Representative.
- .2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.42:10(R2020), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-13(R2022), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55:15(R2020), Special Use Switches.

.4 CAN/CSA-C22.2 No.111-18, General-Use Snap Switches (Tri-national standard, with UL 20 and NMX-J-005-ANCE)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario of Canada

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and Section 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SWITCHES

.1 20A, 120 V and 347 V, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111-18.

.2 Manually-operated general purpose AC switches with following features:

- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle.

.3 Toggle operated locking fully rated for tungsten filament LED and fluorescent lamps, and up to 80% of rated capacity of motor loads heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42.1 with following features:

- .1 White urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

- .1 White urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

- .1 Clock hanger outlets, 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in flush outlet box.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Plastic white cover plates, thickness 2.5 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.5 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owner Representative.

.2 Inform Consultant and/or Owner Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owner Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height as indicated in accordance with Section 26 05 00 Common Work Results for Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height as indicated in accordance with Section 26 05 00-Common Work Results for Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 5-16(R2021), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with ampacity of 100A and over with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit in PDF format copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Consultant and/or Owners Representative for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant and/or Owners Representative. Unless complying with this requirement, Consultant and/or Owners Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title: [_____]

.2 End user's reference number: [_____]

.3 List of circuit breakers: [_____]

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and Section 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store circuit breakers in dry location off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Circuit breakers, accessory high-fault protectors Moulded-case circuit breakers, ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum interrupting capacity as noted on the drawings.

2.2 THERMAL MAGNETIC BREAKERSDESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS DESIGN B

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS DESIGN C

.1 Thermal magnetic breakers with current limiters.

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

.1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE TRIP BREAKERS DESIGN D

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, long time, instantaneous, short time tripping and for groundphase fault short circuit protection.

2.6 OPTIONAL FEATURES

.1 Include: as noted on the drawings

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism c/w time delay unit.

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CAN/CSA-C22.2 No.4:16(R2020), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).

.2 CSA C22.2 No.39-13(R2022), Fuseholder Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, Horsepower rated and Non-fusible, disconnect switch in CSA enclosure size.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 13.01- Fuses - Low Voltage.

.5 Fuseholders: relocatable and to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning .

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast In Place Concrete for Sidewalks and Curbs

.2 Section 33 41 16 - Subdrainage Piping

1.2 MEASUREMENT FOR PAYMENT

.1 Aggregate materials will be paid as part of the applicable surfacing, including but not limited to drainage, rock work, granular bases and subbases, and site services. Refer to applicable specification sections for inclusion of this item into the measurement for payment.

1.3 REFERENCE

.1 Society for Testing and Materials (ASTM)

.1 American Current ASTMC117, Test Method for Material Finer Than 0.075mm Sieve in Mineral Aggregates by Washing.

.2 Current ASTMC127, Test Method for Specific Gravity and Absorption of Coarse Aggregate.

.3 Current ASTM C 136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 Current ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft3) (600kN-m/m3).

.5 Current ASTM D698, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49-kg) Rammer and 12-in (304.8-mm) Drop

.6 Current ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/m3).

.7 Current ASTM D4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.8 Current ASTM D4791- [99], Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.9 ASTM E11, Specification for Wire - Cloth Sieves for Testing Purposes.

.10 Current ASTM F355-95, ASTM F1292-99 (Playground Sand)

.2 Canadian General Standards Board (CGSB)

.1 Current CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.

.2 Current CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA)

.1 Current CAN/CSA-A5, Portland Cement.

.2 Current CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.3 Current CSA A82.56, Aggregate for Masonry Mortar.

.4 Current CAN/CSA Z614-14 (Playground Sand).

.4 Ontario Provincial Standard Specifications (OPSS)

.1 Current OPSS 1010 – Aggregates for Granular O, A, B, M and Select Subgrade Materials.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to the Consultant, samples of material for sieve analysis at least three (3) weeks before commencing asphalt and concrete work.

1.5 TESTING

.1 Compaction and materials tests to be completed as per Section 01 45 00 – Quality Control.

.2 Testing to be conducted for this section of work is as follows:

.1 Sieve designation of specified aggregate.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose in accordance with Section 01 35 50 – Waste Management and Disposal

Part 2 Products

1.7 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.3 Aggregate materials to satisfy the following requirements:

.1 Bedding and Surrounding Material - Catch Basins and Manholes.

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to current ASTM C136 and ASTM C117. Sieve sizes to current CAN/CGSB-8.1.

.3 Table:

Sieve Designation (mm)	% Passing Stone/Gravel	% Passing Gravel/Sand
25	100	-
12.5	65-90	100
4.75	35-55	50-100
2.00	-	30-90
0.425	10-25	10-50
0.075	0-8	0-10

.2 Bedding and Surrounding Material – Storm Sewer Pipe

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to current ASTM C136 and ASTM C117. Sieve sizes to current CAN/CGSB-8.1.

.3 Table:

Sieve Designation (mm)	% Passing Stone/Gravel	% Passing Gravel/Sand
25	100	-
12.5	65-90	100
4.75	35-55	50-100
2.00	-	30-90
0.425	10-25	10-50

0.075	0-8	0-10

.3 Bedding – Sub-Drain Pipe

.1 Open graded, hard, durable particles, 19mm diameter clear stone.

.4 Type 1 and Type 2 Fill.

.1 Type 1 and Type 2 Fill properties to be as per the following requirements:

.1 Type 1: crusher run material.
.2 Type 2: pit sourced gravel and sand.
.3 Gradations to be within limits specified when tested to current ASTM C 136 and ASTM C 117. Sieve sizes to current CAN/CGSB-8.1.

.5 Type 3 Fill.

.1 In accordance with Section 02315 – Excavating, Trenching and Backfilling.

.6 Granular Base.

.1 Granular A.

.1 As described in current OPSS 1010 – Aggregates for Granular O, A, B, M and Select Subgrade Materials.
.2 Consisting of hard, durable, angular particles; free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
.3 Gradations: within limits specified when tested to current ASTM C 136 and ASTM C 117. Sieve sizes to current CAN/CGSB-8.1 rather than ASTM E 11.
.4 Liquid Limit current ASTM D 4318 Maximum 25.
.5 Plasticity Index current ASTM D 4318 Maximum 6.
.6 Table:

Sieve Designation (mm)	% Passing
19	100
12.5	70-100
4.75	40-70
2	23-50
0.425	7-25
0.075	3-8

.2 19mm crusher run limestone.

.7 Granular Sub-Base.

.1 Granular B.

.1 As described in current OPSS 1010 – Aggregates for Granular O, A, B, M and Select Subgrade Materials.
.2 Crushed pit run, screened stone, gravel or sand.
.3 Hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
.4 Gradations: within limits specified when tested to current ASTM C 136 and ASTM C 117. Sieve sizes to current CAN/CGSB-8.1 rather than ASTM E 11.
.5 Table:

Sieve Designation (mm)	% Passing
75	100
4.75	25-85
0.425	5-30
0.075	0-10

1.8 SOURCE QUALITY CONTROL

.1 Inform Consultant of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.

.2 If, in opinion of the Consultant, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.3 Advise Consultant 4 weeks in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 2 Execution

2.1 PREPARATION

.1 Processing

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified.

.3 Wash aggregates, if required to meet specifications.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

.2 Handling

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.3 Stockpiling

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by the Consultant. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedule.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.5 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Consultant within 48h of rejection.

.6 Stockpile materials in uniform layers of thickness as follows:

.1 Max 1.5m for coarse aggregate and base course materials.

.2 Max 1.5m for fine aggregate and sub-base materials.

.3 Max 1.5m for other materials.

.7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.8 Do not cone piles or spill material over edges of piles.

.9 Do not use conveying stackers.

.10 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

2.2 CLEANING

.1 Restore stockpile areas to pre-construction condition or as otherwise specified.

.2 Dispose of any unused aggregates.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Clearing site of incidental paving, curbs, walls, debris, grass topsoil, subsoil, aggregate materials, play equipment, fencing, rubber surfacing,

1.2 RELATED SECTIONS

.1 Section 31 23 33 - Excavation, Trenching and Backfilling.

1.3 MEASUREMENT FOR PAYMENT

.1 Clearing and grubbing will be measured as specified in the Form of Tender and shall include the disposal of any waste materials from the site.

1.4 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetation close to ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-Cut Clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at existing grade and disposing of fallen timber and surface debris.

.3 Isolated Trees Clearing consists of cutting off designated trees flush to ground, and disposing of felled trees and debris.

.4 Underbrush Clearing consists of removal of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter from treed areas, and disposing of all fallen timber and surface debris.

.5 Grinding consists of removal and disposal of wood below grade while leaving tree stumps in place.

.6 Grubbing consists of excavation and disposal of stumps and roots, boulders and rocks below existing ground surface.

1.5 PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees which are to remain.

.1 Repair any damaged items to approval of the Owner.

.2 Replace any trees designated to remain, if damaged, to the satisfaction of the Consultant.

.3 Protect benchmarks, property corners, and survey monuments from damage or displacement. If marker needs to be removed, reference and replace it by licensed land surveyor.

.4 Temporarily cover catch basins and maintenance holes to prevent entry of earth or debris. Ensure adequate surface drainage in affected area is maintained.

Part 2 Products – Not Applicable

Part 3 Execution

3.1 PREPARATION

.1 Inspect site and verify with the Contract Administrator and Owner, items designated to remain, or be relocated on site.

.2 Notify utility authorities before commencing any work.

.3 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.

3.2 CLEARING

.1 Clear as indicated on drawings, by cutting at a height of not more than 300mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000mm above ground surface.

.2 Cut off branches and cut down trees overhanging area cleared as indicated on drawings.

.3 Cut off unsound branches on trees designated to remain as directed by the Consultant.

3.3 CLOSE CUT CLEARING

.1 Close cut clearing to ground level to within 100mm of ground surface.

.2 Cut off branches / cut down trees overhanging area cleared as directed by the Consultant.

.3 Cut off unsound branches on trees designated to remain as directed by the Consultant.

3.4 ISOLATED TREES CLEARING

.1 Cut off isolated trees as indicated on drawings at height of not more than 300mm above ground surface.

.2 Grub out isolated tree stumps.

3.5 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level to within 100mm of ground surface.

3.6 GRUBBING

.1 Grub out stumps and roots to not less than 300mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300mm in greatest dimension, but less than 0.25m3.

3.7 ROOT SENSITIVE EXCAVATION

.1 Perform root sensitive excavation where indicated on Tree Preservation Drawings, per Tree Preservation Details.

3.8 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site.

3.9 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations.

END OF SECTION

General

1.1 RELATED SECTIONS

.1 Section 01 45 00 – Quality Control.

.2 Section 31 23 33- Excavation, Trenching and Backfilling.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D698-[91(1998)], Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

1.3 EXISTING CONDITIONS

.1 Examine any available Geotechnical Investigation reports which may form part of this work.

.2 Known underground and surface utility lines and buried objects are as indicated on drawings. Refer to dewatering in Section 31 23 33- Excavating Trenching and Backfilling.

1.4 PROTECTION

.1 Protect and/or transplant existing silt fencing, trees, shrubs, bench marks, buildings, pavement, surface or underground utility lines which are to remain as outlined on drawings. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

Part 1 Products

1.1 MATERIALS

.1 Fill material: Granular B in accordance with of Section 31 23 33- Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Owners Representative.

Part 2 Execution

2.1 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Contract Administrator.

.2 Strip topsoil to depths as indicated. Rototill weeds and grasses and retain as topsoil on site. Avoid mixing topsoil with subsoil.

.3 Stockpile in locations as directed by the Contract Administrator. Stockpile height not to exceed 2 m.

.4 Dispose of unused topsoil off site in accordance with Ontario Regulation 406/19: on-site and excess soil management.

2.2 PROOF ROLLING

.1 Following the removal of topsoil and organic layers, proof roll the exposed subgrade surfaces with a heavy roller.

.2 Notify Contract Administrator once proof rolling is complete for review prior to installation of fill and base courses.

.3 Any soft or loose areas of the fill and/or native soils that are detected during the proof rolling process shall be sub-excavated and replaced with approved material.

2.3 ROUGH GRADING

.1 Verify rough grades and notify the Contract Administrator of discrepancies prior to performing work

.2 Modify rough grading methods where root sensitive excavation is indicated on Tree Preservation Plan.

.3 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.4 Rough grade to following depths below finish grades:

.1 As indicated on drawings for permeable precast concrete unit pavers.

.2 As indicated on drawings for concrete surfaces and curbs.

.3 As indicated on drawings for rubber surface paving.

.5 Slope rough grade as indicated.

.6 Grade swales to depth as indicated.

.7 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.8 Place fill in maximum 300mm lifts.

.9 Compact filled and disturbed areas to Standard Proctor Maximum Dry Density (SPMDD) to ASTM D698, as follows:

.1 As indicated in geotechnical report and contract drawings for unit paver, concrete, and rubber surfaces.

.10 Perform root sensitive excavation within branch spread of trees or shrubs to remain as indicated in the Tree Preservation Plan.

2.4 VERIFICATION OF CONSTRUCTED ROUGH GRADE

.1 Provide the Consultant with “as recorded” shots in in accordance with grade verification plan to verify that constructed rough grades are in accordance with drawings. Correct discrepancies to the approval of the Consultant.

.2 Obtain approval from Contract Administrator of rough grades before commencing finish grading.

2.5 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory as outlined in Section 01 45 00 - Quality Control.

2.6 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site in accordance with Ontario Regulation 406/19.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

.1 Section 31 05 16 – Aggregate Base Materials
.2 Section 31 32 19.01 - Geotextiles.
.3 Section 31 22 13 - Rough Grading
.4 Section 33 41 16 - Subdrainage Piping

1.2 References

.1 Canadian General Standards Board (CGSB)
  .1 Current CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  .2 Current CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.2 Canadian Standards Association (CSA)
  .1 Current CAN/CSA-A23. 1, Concrete Materials and Methods of Concrete Construction.

.3 Ontario Provincial Standard Details:
  .1 OPSD 509.010
  .2 OPSD 600.110
  .3 OPSD 310.010.

1.3 Measurement for Payment

.1 Measurement for excavation, trenching and backfill will be included with the specific item of installed work or furnishing as noted in the contract price schedule.

1.4 Definitions

.1 Excavation classes: two classes of excavation will be recognized; common excavation, and rock excavation.
  .1 Rock: any solid material in excess of 0.25 m3 and which cannot be removed by means of mechanical excavating equipment having a 0.95 to 1.15 m 3 bucket. Frozen material not classified as rock .
  .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation .

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

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.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Unsuitable materials:
- .1 Weak and compressible materials under excavated areas.
- .2 Frost susceptible materials under excavated areas: coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

.7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 Protection of Existing Features

.1 Existing buried utilities and structures:
- .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

- .2 Prior to commencing excavation work, notify applicable owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.

- .3 Confirm locations of buried utilities by obtaining a certified utility Stakeout.

- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

- .5 Where utility lines or structures exist in area of excavation, obtain direction of the Contract Administrator before removing or re-routing.

- .6 Record location of maintained, re-routed and abandoned underground lines.

- .7 Protect surface features from damage while work is in progress. In event of damage, immediately make repair to approval of the Contract Administrator.

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.8 Where required for excavation, cut roots or branches in accordance with tree preservation plan

1.6 Shoring, Bracing and Underpinning

.1 Protect existing features in accordance with applicable local regulations and as specified by a qualified professional engineer.

PART2 PRODUCTS

2.1 Materials

.1 Type 1 and Type 2 fill: properties to the following requirements:
- .1 Crushed, pit run or screened stone, gravel or sand.
- .2 Gradations to be within limits specified when tested to current ASTM C 136 and ASTM C 117. Sieve sizes to current CAN/CGSB-8.1.

.2 Type 3 fill: selected material from excavation or other sources, approved by the Contract Administrator for use intended, unfrozen and free from rocks larger than 75
mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 19mm diameter clear stone

.4 Clean sand

.5 Unshrinkable fill: proportioned and mixed to provide:
- .1 Maximum compressive strength of 0.4 MPa at 28 days .
- .2 Maximum Portland cement content of 25 kg/m 3
- .3 Minimum strength of 0.07 MPa at 24 h .
- .4 Concrete aggregates: to CAN/CSA-A23.1 .
- .5 Portland cement: Type 10 .
- .6 Slump: 200 mm.

PART3 EXECUTION

3.1 Site Preparation

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

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3.2 Stockpiling

.1 Stockpile fill materials in designated areas. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.3 Excavation

.1 Excavate to lines, grades, elevations and dimensions as indicated.

.2 Remove asphalt, concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation.

.3 Excavation must not interfere with normal 45E splay of bearing from bottom of any footing.

.4 Do not disturb soil within dripline of trees or shrubs that are to remain. If excavating through roots, cut in accordance with Tree Preservation Plan.

.5 For trench excavation, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 5 m at end of day's operation.

.6 Dispose of surplus and unsuitable excavated material off site.

.7 Do not obstruct flow of surface drainage or natural watercourses.

.8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.9 Notify Contract Administrator when bottom of excavation is reached.

.10 Remove unsuitable material from trench bottom to extent and depth as Indicated in the drawings.

.11 Obtain Contract Administrator review of completed excavation prior to backfill.

.12 Correct unauthorized over-excavation with no additional cost to the Owner as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings.

.2 Fill under other areas with Type 2 fill compacted to not less than 98% of corrected maximum dry density.

.13 Hand trim, make firm and remove loose material and debris from

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excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of the Contract Administrator.

3.4 Fill Types and Compaction

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from corrected maximum dry density.

.1 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.

3.5 Backfilling

.1 Use suitable vibratory compaction equipment.

.2 Do not proceed with backfilling operations until the Contract Administrator has reviewed installations.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.6 Backfill around installations.

.7 Place unshrinkable fill in areas as indicated. Consolidate and level unshrinkable fill with internal vibrators.

.1 Place bedding and surround material per specific details.

.2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed work to equalize loading.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 28 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from the Contract Administrator; or

.2 if approved by The Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is

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approved the Contract Administrator.

.8 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

3.6 Restoration

.1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as indicated.

.2 Replace topsoil as indicated.

.3 Clean and reinstate areas affected by work to condition existing before excavation.

.4 Reinstate prescribed surface materials to elevation existing before excavation.

.5 Reinstate road pavement, sidewalks, lawns and plantings to condition existing before excavation.

.6 Comply with Detail OPSD 509.010 and the Contract Administrator's structural requirements for minor collector roads to reinstate road pavement.

.7 Comply with Detail OPSD 600.110 to reinstate concrete curbs.

.8 Comply with Detail OPSD 310.010 to reinstate concrete sidewalks.

.9 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 Aggregate Base Courses

.2 Section 31 23 33 Excavation Trenching and Backfill

.3 Section 32 14 13.19 Permeable Precast Concrete Unit Paving

.4 Section 32 14 29 Rubber Surface Paving

.5 Section 32 16 13 Cast-In-Place Concrete for Sidewalks and Curbs

.6 Section 33 41 16 Subdrainage Piping

1.2 MEASUREMENT AND PAYMENT

.1 Geotextile will be paid as part of the applicable surfacing, including but not limited to drainage, unit pacing, rubber pavement surfacing aggregate bases. Refer to applicable specification sections for inclusion of this item into measurement for payment. No allowance will be made for seams and overlaps.

1.3 REFERENCE STANDARDS

.1 ASTM International

- .1 ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- .3 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- .4 ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
- .5 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-4.2 No. 11.2, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
- .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
  - .1 No.2, Methods of Testing Geosynthetics - Mass per Unit Area.
  - .2 No.3, Methods of Testing Geosynthetics - Thickness of Geotextiles.
  - .3 No.6.1, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
  - .4 No.7.3, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.5 No. 10, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 CSA Group

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 1860, Material Specification for Geotextiles.

1.4 SUBMITTALS

.1 Provide in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Provide following samples 3 weeks prior to beginning Work.

.1 Minimum length of 2 m of roll width of geotextile.

.2 Methods of joining.

.4 Test and Evaluation Reports:

.1 Submit copies of mill test data and certificate at least 3 weeks prior to start of Work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect geotextiles from direct sunlight and UV rays.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIAL

.1 Geotextile: Terrafix 270R non-woven or approved equal.

.2 Securing pins and washers: to CAN/ CSA-G4O.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600g/m2 to CAN/CSA G164.Execution

.3 Factory seams: sewn in accordance with manufacturer's recommendations.

.4 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for geotextile material installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

.1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.3 Overlap each successive strip of geotextile 450 mm over previously laid strip.

.4 Join successive strips of geotextile by pinning.

.5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.6 Replace damaged or deteriorated geotextile

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

.1 Section 31 05 16 – Aggregate Based Materials
.2 Section 31 32 19.01 - Geotextiles
.3 Section 32 16 13 - Cast-in-Place Concrete
.4 Section 32 33 00.01 – Play Equipment

1.2 Measurement for Payment

.1 Payment will be made as noted in the Contract Unit Price Schedule, including all labour, materials, and equipment and all incidentals required to complete the installation as shown on the drawings and specified herein.

1.3 References

.1 ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
.2 ASTM D624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
.3 ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
.4 ASTM D2859 Standard Test Method for Flammability of Finished Textile Floor Covering Materials.
.5 ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
.6 ASTM F1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
.7 ASTM F1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment
.8 CSA Z614:20 (or most current at time of construction) Standards for Children's Play Spaces and Equipment

1.4 Shop Drawings/Submittals

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate dimensions, sizes, colour, assembly, anchorage and installation details for each product specified.

.3 Issue to Contract Administrator 300mm x 300mm x __mm (to confirm depth after final play equipment selection/height) rubber sample, in accordance with Section 01 33 00 – Submittal Procedures, demonstrating the full rubber profile and colour selection.

1.5 Delivery and Storage of Materials

.1 Materials and equipment shall be delivered and stored in accordance with the manufacturer's recommendations in a manner so as to prevent damage and degradation due to weather, environmental conditions, contamination by foreign matter, etc.

.2 Deliver materials in manufacturers clearly labelled unopened containers.

1.6 Quality Assurance

.1 The rubber system must be a type which has been installed and by an installer in exterior environments in Ontario during the last ten (10) years, minimum.

.2 All materials and products shall be new and of optimum quality.

.3 The rubber installation shall be protected by the Contractor until it has fully cured. It is expected that the Contractor, at their own expense, will provide appropriate security during the curing period. Damage to the rubber installation due to failure to provide such security may result in rejections of the entire rubber system.

1.7 Inspection and Testing

.1 The rubber system must be tested by an independent testing agency, hired and paid for by the Contractor, to assure compliance with the following standards:

.1 CAN/CSA Z614 Standards for Children's Play Spaces and Equipment, most current revision at time of installation.

.2 ASTM F1292 Impact Attenuation of Surface Systems Under and Around Playground Equipment. The Gmax shall be less than 150 and the HIC shall be less than 800. (These values are more stringent than CSA Z614 requirements) The drop height shall be measured from the tops of barriers and guards in compliance with testing requirements.

.2 Test reports shall be submitted by the Contractor to the Owner and Contract Administrator upon receipt.

.3 Certificate of compliance with the above noted tests must be provided to the Owner and Contract Administrator from the appointed agency prior to acceptance of rubber installation.

.4 If the rubber installation does no comply with the tests, it is the Contractor's responsibly to remedy the work and pay for all subsequent testing necessary to achieve compliance.

1.8 Closeout Submittals

.1 Provide maintenance data for care and cleaning of all products for incorporation into the maintenance manual specified in Section 01 78 00 - Closeout Submittals.

.2 Third Party CSA Inspection: All playground installations and safety surface will be third party inspected by a Certified Playground Inspector for CSA compliance within 5 (five) working days of the Contractor declaring that the installation of the play equipment and safety surfacing is complete. Third party CSA inspection shall be arranged by the Contractor and paid for by the Contractor as part of base bid Contractor shall be responsible to notify the Owner of the scheduled inspection date and time

.3 Contractor shall supply warrantee certificate(s) for all components, stating the warrantee start date which shall be the Owner's date of play space acceptance.

1.9 Warranty

.1 The Contractor shall provide minimum warranty coverage of all components of the rubber surface paving system for a period of five (5) years from the date of substantial performance as published (which may be after the completion of the rubber installation date). This warranty shall cover all of the rubber surface components.

.2 The rubber surface paving system shall maintain performance as tested by ASTM F1292 Impact Attenuation of Surface Systems Under and Around Playground Equipment for the entire warranty period. The Gmax shall be less than 150 and the HIC shall be less than 800. (These values are more stringent than minimum CSA Z614 requirements)

.3 The Contractor must repair all defects which occur during the five (5) year warranty period at no additional cost to the Owner and within five (5) working days of receiving notification from the Owner about the defects. Weather permitting and for defective workmanship (vandalism has material compensation for manufacturer).

PART 2 PRODUCTS

2.1 Materials

.1 Granules
- .1 Pure vulcanized EPDM rubber particles
- .2 EPDM content to range from 20% minimum to 26% maximum
- .3 Particle size to range from 1mm minimum to 4mm maximum
- .4 Granules to be Ultra-Violet stable in exterior environments

.2 Matrix
- .1 Resin: Aliphatic isocyanate
- .2 Binder: Aliphatic isocyanate polyurethane resin or approved equivalent.

.3 Granular base materials as indicated on drawings and as per Section 31 05 16 – Aggregate Base Materials

.4 Granular sub-base materials as indicated on drawings and as per Section 31 05 16 – Aggregate Base Materials

.5 Geotextile as per Section 31 32 19.01 - Geotextiles

PART 3 EXECUTION

3.1 Subgrade and Granular Sub-Base

.1 Set out work to lines and levels shown on Drawings. Contract Administrator to review the lines and levels prior to sub-base installation. Maintain lines and levels for duration of work.

.2 Excavate and prepare all subgrade as shown on Drawings. Remove and dispose of existing unsuitable and excess subsoil off site.

.3 Verify grades of subgrade for conformity with elevations and sections before placing base material.

.4 Disturbed subgrade or fill shall be compacted to 98% SPMDD.

.5 Place sub-base material in 75mm lists and compact each lift to 98% SPMDD.

.6 Contract Administrator to review subgrade and sub-base prior to placing base material.

3.2 Subdrainage

.1 Install subdrainage to lines and levels shown on drawings.

3.3 Granular Base

.2 Exercise caution at all times to prevent base material from becoming contaminated by soils or other deleterious materials

.3 Place base material to compacted thickness as indicated on drawings.

.4 Place in layers not exceeding 150mm compacted thickness. Compact to density not less than 98% SPMDD.

.5 Granular base surface shall be rolled continuously, compacted and bladed as necessary.

.6 The granular base surface shall be within 10mm of specified grade, but not uniformly high or low.

.7 Contract Administrator to review the installed granular base. Installation of rubber can only commence after granular base test results confirm that the specific compaction has been achieved.

.8

.7 Excavate and prepare all subgrade as shown on Drawings. Remove and dispose of existing unsuitable and excess subsoil off site.

.8 Verify grades of subgrade for conformity with elevations and sections before placing base material.

.9 Disturbed subgrade or fill shall be compacted to 98% SPMDD.

.10 Place sub-base material in 75mm lists and compact each lift to 98% SPMDD.

.11 Contract Administrator to review subgrade and sub-base prior to placing base material.

3.4 EPDM Rubber

.1 Air Temperature: Ensure air temperature is a minimum of 41 degrees F (5 degrees C) before and during installation. Temperature is to remain above minimum 41 degrees F (5 degrees C) for 48 hours after installation.

.2 Place geotextile to Section 31 32 19.01 Geotextiles over the prepared granular base.

.3 Install rubber profile to required thicknesses in compliance with CSA Z614 and ASTM F1292 standards, tested to article 1.7 – Inspection and Testing of this section. Minimum thickness of EPDM layer course to be 13-20mm. Minimum thickness of SBR cushion base layer to be 50mm for structural stability over stone and shock absorption.

.4 Install rubber in weather conditions recommended by the manufacturer.

.5 EPDM Laying Course(s):

.1 EPDM laying course mixture to be comprised of EPSM granules and resin in a non-porous container, mixed thoroughly to ensure complete coverage of resin to granules.

.2 Place surface in multiple layers at required depths to ensure appropriate absorption of impact forces and trowel uniformly over geotextile. Minimum thicknesses to be 50mm. Maximum thickness to be dictated by the thickness required to be the performance criteria of the latest CSA Z614 and ASTM F1292.

.6 EPDM Topcoat:

.1 Topcoat shall be bonded to base mat and installed as per manufacturer’s requirements.

.2 Topcoat should be less than 10mm and should NOT form part of the 50mm minimum thicknesses required for the EPDM laying course

.3 Joints:

.1 Rubber surfacing of the same colour shall have zero (0) joint/seams. Rubber surfacing of the same colour shall be installed in on continuous pour on the same day

.2 Rubber coat shall be installed with a minimum number of joints. Review number of joints with Contract Administrator prior to proceeding. Where seams are necessary, a step configuration shall be constructed to maintain wear surface integrity.

.4 Joints:

.1 Rubber surfacing of the same colour shall have zero (0) joint/seams. Rubber surfacing of the same colour shall be installed in on continuous pour on the same day.

.2 Rubber coat shall be installed with a minimum number of joints. Review number of joints with Contract Administrator prior to proceeding. Where seams are necessary, a step configuration shall be constructed to maintain wear surface integrity.

.5 Perimeter:

.1 Appropriate adhesive must be applied along the entire perimeter, in location shown on detail, so that the rubber does not separate from the concrete.

.2 Refer to detail drawings, Contractor to ensure 0.5” (13mm) ledger (notch) in place prior to placing material.

.3 Rubber surface cushioning layer shall not extend to the curb. The base layer just below the topcoat shall be trenched in an addition 80mm below the bottom of the 50mm notch on the face of the concrete curb.

.4 Rubber coat shall be installed with a minimum number of joints. Review number of joints with Contract Administrator prior to proceeding. Where seams are necessary, a step configuration shall be constructed to maintain wear surface integrity.

.6 Finish Surface:

.1 The surface shall be slip resistant to the touch when wet or dry.

.2 The surface shall be smooth with no visible irregularities such as divots or bumps.

3.5 Defective Work

.1 Correct irregularities and defects which develop before rubber surfacing is completed. If irregularities or defects remain after completion, the entire installation my be rejected. The

Contractor shall borne the entire cost to removed and replace the surface in it's entirety to an acceptable standard.

3.5 Warranty

.1 Correct irregularities and defects which develop before rubber surfacing is completed. If irregularities or defects remain after completion, the entire installation my be rejected. The Contractor shall borne the entire cost to removed and replace the surface in it's entirety to an acceptable standard.

.2 Install rubber profile to required thicknesses in compliance with CSA Z614 and ASTM F1292 standards, tested to article 1.7 – Inspection and Testing of this section. Minimum thickness of EPDM layer course to be 13-20mm. Minimum thickness of SBR cushion base layer to be 50mm for structural stability over stone and shock absorption.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 Section 31 05 16 - Aggregate Materials
.2 Section 33 40 00 – Surface Drainage Systems
.3 This specification only applies to poured in place concrete sidewalks and curbs. Refer to specifications prepared by others for footings, piers, foundations, and interior work.

1.2 MEASUREMENT FOR PAYMENT

.1 Measurement of payment to be as specified in the Form of Tender including construction of compacted base, steel reinforcement and all incidental items as shown on the details and drawings.

1.3 REFERENCES

.1 Concrete materials and methods of construction: to current CAN/CSA-A23.1 standards.

.2 Construct work in accordance with applicable current ASTM and ASTI standards.

1.4 INSPECTION AND TESTING

.1 Current ASTMD698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft3) (600kN-m/m3).

.2 Concrete testing: to current CAN/CSA-A23.2 by a third-party testing agency retained and paid for by the Contractor. Accelerated test methods will apply.

.3 Give the testing agency minimum 24h notice before each concrete pour.

.4 Comply with the requirements of Section 01 45 00 - Quality Control and Testing.

.5 Conform to current CSA Standard CAN3-A23.2-M90.

.6 Concrete testing by a third party retained by the Contractor will include:

.1 A standard strength test for concrete placed but not less that one test for concrete placed each day. Each strength test sample will consist of three cylinders with proper identification and field data. One specimen will be tested at 7 days and 28 days. Cylinders will be field cured prior to shipping to the test laboratory.
.2 One standard air entrainment test for each standard strength test.
.3 One or more standard slump test with each standard strength test. The Owner may require additional testing for each truck load placed, as deemed necessary.

.7 Concrete may be rejected prior to placement if:

.1 Concrete fails to conform with the specified mix design.
.2 The concrete placement does not begin within 2 hours from plant batch time.
.3 The concrete is older than 2 hours from plant batch time.
.4 The concrete has undergone less than 70 or more than 100 revolutions at the mixing speed.

.8 Concrete test compressive strength: Concrete will be considered under strength if:

.1 The average of any day's tests of each class of concrete is below specified strength.
.2 Any single test falls below 80 percent of the specified strength. In case of dispute, the Contractor may have two 100mm DIA cores from the concrete drilled and tested at his own expense, in accordance with the current CSA Standard CAN3-A23.2-M90. The results shall be applied in the manner outlined above.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.

.3 Detail reinforcing steel in accordance with Manual of Standard Practice of Reinforcing Steel Institute of Ontario (RSIO).

.4 Each drawing submitted showing formwork design shall be in accordance with the current CAN/CSA-A23.1, and bearing stamp and signature of professional engineer registered or licensed in province Ontario, Canada.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Concrete work materials and measurements to conform to applicable details.

.2 Granular base and subbase as indicated on drawings and as per Section 32 11 23 – Aggregate Base Courses

.3 Portland cement: to current CAN/CSA-A5, Type 10.

.4 Shrinkage compensating grout: pre-mixed, non-metallic aggregate, 50 MPa at 28 days.

.5 Reinforcing bars: to current CSA-G30.18, Grade 400

.6 Welded steel wire fabric: to current CSA-G30.5, 150x150, #10 gauge, flat not rolled.

.7 Premoulded joint filler: bituminous impregnated fibreboard to current ASTM D 1751.

.8 Sealer: proprietary poly-siloxane resin blend.

.9 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel, insulation filled.

.10 Non-shrink grout: premixed compound consisting of metallic aggregate, cement, water, reducing and plasticizing agents, of pouring consistency, capable of developing compressive strength of 45 Mpa at 28 days.

.11 Dry pack: premixed of non premixed composition of non metallic aggregate, cement and sufficient water for the mixture to retain its shape when made into a ball of hand and capable of developing compression strength of 32 Mpa at 28 days.

.12 All other concrete materials: to current CAN/CSA-A23.1.

2.2 CONCRETE MIXES

.1 The proportions and qualities of cement, water and aggregate shall conform to the CSA Specifications A23.1-M, latest revision, for “READY MIX CONCRETE”.

.2 Concrete shall be supplied from a Ready Mixed Concrete Supplier certified by the “Ready Mixed Concrete Association of Ontario” to the following minimum requirements:

.1 Compressive Strength: 32 Mpa in 28 days.
.2 Cement Content: 335 kg/m³.
.3 Exposure: Class C2.
.4 Water/Cement Ratio: 0.45.
.5 Maximum size of aggregates: 20mm.
.6 Maximum slump: 80 mm +/-10 mm
.7 Air Entrainment: 5% to 8%.

.3 The Owner reserves the right to take whatever corrective action is needed if the concrete fails to meet the requirements of this specification or shows defects after placing. The Contractor shall facilitate any needed investigation or inspection of the work.

2.3 MIX PROPORTIONS

.1 Method: Alternative 1 of current CAN/CSA-A23.1.

.2 Cement type: as specified under 2.1.

.3 Minimum 28 day compressive strengths and exposure classifications:
.1 Pavements, walks, curbs and exposed site concrete: 32 MPa; C-2.
.2 All other concrete in accordance with applicable details.

.4 Nominal size of coarse aggregate: Clause14 of current CAN/CSA-A23.1.

.5 Slump: to Table 6 of current CAN/CSA-A23.1.

.6 Air content: all concrete to contain purposely entrained air in accordance with Table10 of current CAN/CSA-A23.1.

.7 Admixtures: to Clause 6 of current CAN/CSA-A23.1.

PART 3 EXECUTION

3.1 WORKMANSHIP

.1 Obtain Contract Administrator approval before placing concrete.

.2 Place concrete in accordance with current CAN3-A23.1-M90.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Obtain Contract Administrator approval of proposed method for protection of concrete during placing and curing in adverse weather, prior to placing of concrete. No costs for winter concrete or blankets will be paid for by the Owner unless approved in writing prior.

.5 Maintain accurate records of cast-in-place concrete items to indicate date, location of pour, air temperature and test samples taken.

3.2 SUBGRADE AND GRANULAR SUB-BASE

.1 Set out work to lines and levels shown on drawings. Gain approval from the Consultant of lines and levels prior to sub-base installation. Maintain such lines and levels for duration of work.

.2 Excavate and prepare all subgrade as noted on details. Remove and dispose of existing unsuitable subgrade materials off site.

.3 Verify grades of subgrade for conformity with elevations and sections before placing base material.

.4 Disturbed subgrade or clean fill shall be compacted to 98% of Standard Proctor Density in accordance with ASTM D698-70.

.5 Place sub-base material in 150 mm lifts and compact each lift to 98% Standard Proctor Density.

.6 Obtain subgrade and sub-base approval from the Consultant prior to placing base material.

3.3 GRANULAR BASE

.1 Exercise caution at all times to prevent base material from becoming contaminated by clay or other deleterious materials.

.2 Place base material to compacted thickness as indicated on drawings.

.3 Place in layers not exceeding 150mm compacted thickness. Compact to density not less than 98% of Standard Proctor Density in accordance with ASTM D698-70.

.4 The granular base surface shall be rolled continuously, compacted and bladed as necessary.

.5 The granular base surface shall be within 10 mm of specified grade, but not uniformly high or low.

.6 Gain approval from the Consultant of the installed granular base. Installation of concrete can only commence after granular base test results confirm that the specified compaction has been achieved.

3.4 CONCRETE INSTALLATION

.1 Backfilling: Backfill the underside of the curbs, sidewalks. with 19mm crushed run limestone, compacted to 98% Standard Proctor Maximum Dry Density, as detailed.

.2 Placing Formwork: design, fabrication, erection and use of concrete formwork shall conform to the current requirements of CSA Standard S269.3.

.3 Forms shall be constructed with temporary ports or openings at the bottom of all deep units such as columns and walls to facilitate cleaning and inspection.

.4 For treated formwork surfaces the materials used as a parting agent shall be non-staining. The amount of material used shall be kept to a minimum and any that adheres to

reinforcing steel shall be removed. When the concrete surfaces are to receive a permanent finish coating, the parting agent shall be compatible with the coating.

.5 Prior to placing concrete, a suitable means for checking the alignment and elevations of forms during placing shall be provided. These checks shall be made frequently during the placing of the concrete, and adjustments to the formwork and falsework made as required until all concrete is in place.

.6 Forms where used shall remain in place at least 8 hours after the concrete has been placed against them. Where the air temperature drops below 10ºC at any time during the 8 hour period the forms shall be left in place for such additional time as is necessary to prevent damage to the edges. Curing of the exposed concrete shall begin immediately upon removal of the forms.

.7 Placing Joints: Crack-control joints shall be cut within 24 hours using power-driven abrasive or diamond blades. Cutting of joints shall begin as soon as the cut is made and before shrinkage cracks form in the concrete.

.1 The depth of the control joints shall be between a quarter and a third of the thickness of the slab or wall.
.2 Control of construction joints to the surface plane, as shown on drawings.
.3 Maximum interval not to exceed 2 metres or as shown on drawings.
.4 Placing Expansion Joint: material should be placed to full depth to isolate any rigid structure encountered in the line of the work, and place expansion joints to the full depth of the concrete curb at a maximum of 6 metres spacing.

.8 Placing Concrete: All concrete shall be placed under the following conditions:

.1 Each load shall have correct air content.
.2 Slump tests shall be taken on the first load of concrete arriving on the job site, and thereafter at the discretion of the Consultant
.3 In dry forms accepted by the Testing Agency.
.4 As near as possible to its final position.
.5 Maximum vertical drop from chutes shall be 1.5m.
.6 Evenly on both sides of the expansion joints so as to retain their vertical position.
.7 Forms shall be filled with an excess of concrete thoroughly spaded, compacted and struck off to its required level in such a manner as to force the coarse aggregate below the surface of the mortar.
.8 Air temperature shall be 5ºC and rising, and all necessary precautions shall be taken during cold weather.
.9 No concrete shall be placed on frozen ground.
.10 Concrete shall have a temperature of no less than 10ºC and no more than 38ºC at the time of the placing, and means acceptable to the Testing Agency shall be provided to maintain these limits for 72 hours after placing.

.9 Concrete Finishing and Form Stripping: The formwork may be stripped after initial set of the concrete has been achieved.

.10 On exposed formed surfaces, neatly chip off fins, unsightly ridges or other imperfections; fill small surface voids with grout and rub flush with the general surfaces.

.11 All exposed surfaces to have broom finish.

.12 Rub exposed sharp edges of concrete with Carborundum to produce 3mm radiused edges unless otherwise detailed.

.13 Slope surfaces as indicated on plan.

.14 Tolerances: Finished surfaces to within 3 millimeters in 3 meters as measured with a 3 meter straightest placed on surface.

3.5 INSERTS

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100mm x 100mm not indicated, must be approved by the Consultant.

3.7 CURING

.1 Concrete surfaces shall be cured for 3 days at a minimum temperature of 10ºC or for the time necessary to attain 35% of the specified 28-day compressive strength of the concrete.

.2 Cure and protect concrete in accordance with current CAN/CSA-A23.1, except that curing compounds shall not be used where bond is required by subsequent topping or coating.

.3 Where concrete is cured by applying curing compound, apply evenly to form continuous film in accordance with manufacturer's requirements.

.4 Where concrete is cured by installation of a curing compound of polyethylene vapour barrier ensure complete coverage of the concrete.

3.8 COLD WEATHER WORK

.1 Take cold weather precautions whenever the ambient temperature is, or is expected to be, at or below 5 ºC.

.2 Have protective measures in place, or adjacent to the work before any concrete is mixed or ordered.

.3 Maintain concrete temperature between 10ºC and 20ºC for a minimum of 3 days for unloaded areas, and 6 days for areas receiving partial load. These durations may be reduced by 33% with the use of high early strength cement.

.4 In methods employed to maintain the concrete temperature, provide suitable access for inspection.

3.9 FINISHES

.1 Formed surfaces exposed to view: sack rubbed finish in accordance with current CAN/CSA-A23.1.

.2 Equipment pads: smooth trowelled surface; finishing tolerance classification: Very Flat.

.3 Pavements, walks, curbs and exposed site concrete: screed to plane surfaces and float using aluminum, magnesium, or wood floats. Round edges using standard tools. Trowel smooth followed by lightly brushed non-slip finish.

3.10 CONTROL JOINTS

.1 Saw cut control joints in slabs on grade at locations indicated, in accordance with current CAN/CSA-A23.1.

3.11 EXPANSION AND ISOLATION JOINTS

.1 Install pre-moulded joint filler in expansion and isolation joints full depth of slab flush or no greater than 3mm below finished surface.

.2 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or other permanent structures.

3.12 GROUT

.1 Grout voids under baseplates.

.2 Grout into place, bolts and other items of concrete hardware, that are not placed prior to pouring concrete.

.3 Mix and place grout.

3.13 SEALING

.1 Following curing, apply poly-siloxane resin blend sealer treatment to exposed surfaces.

.2 Apply poly-siloxane resin blend sealer at 4 m^2/L.

END OF SECTION

1.1 PART I - GENERAL

1.2 SCOPE OF WORK

Work described in this section includes materials, equipment, labor costs, including shipping of laser cut fence panels, posts, gates, and accessories.

.1 RELATED WORK

.1 Section 03 30 00 Cast in Place Concrete for Sidewalks and Curbs

1.3 REFERENCES

.1 ASTM STANDARDS: American Society for Testing and Materials

.1 A121 - 19 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire

.2 A123 / A123M - 17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products A153 / A153M - 16a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.3 A500 / A500M - 18 Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Round

.4 Shapes.

.5 A505 - 16 Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements A513/A513M - 19 Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing A641/A641M - 09a (2014) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.6 A653/A653M - 19 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.7 A659/A659M - 18 Standard Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled

.8 A787/A787M - 15a Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing A853 - 24 (2017) Standard Specification for Steel Wire, Carbon, for General Use

.9 A1008 / A1008M - 18 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High- Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

.10 A1064 / A1064M - 18a Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

.11 B6 - 18 Standard Specification for Zinc

.12 B22 - 14 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes. B209 – 14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.13 B210 / B210M – 19a Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

.14 B221 – 20 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes. D2247 - 15 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

.15 D2794 - 93 (2014) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact). D3359 - 17 Standard Test Methods for Measuring Adhesion by Tape.

.16 F626 - 14 (2019) Standard Specification for Fence Fittings

.17 F900 - 11 (2017) Standard Specification for Industrial and Commercial Swing Gates.

.18 F934 - 96 (2017) Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials. F1043 - 18 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence

.19 Framework.

.20 F1184 - 16 Standard Specification for Industrial and Commercial Horizontal Slide Gates.

.21 F2919 / F2919M - 12 (2018) Standard Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated) with Variable Mesh Patterns or Meshes Greater than 6 in^2 [3871 mm^2] in Panels

.22 F2957 - 13(2019)e1 Standard Specification for Ornamental Aluminum Fence Systems

.2 CSA STANDARDS: Canadian Standards Association

.1 A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete

.2 G164-18 Hot Galvanization of Irregularly Shaped Articles.

.3 CGSB STANDARDS: Canadian General Standards Board

.1 CAN/CGSB-138.1-2019 Fabric for Chain Link Fence CAN/CGSB-138.2-2019 Steel Framework for Chain Link Fence CAN/CGSB-138.3-2019 Installation of Chain Link Fence CAN/CGSB-138.4-2019 Gates for Chain Link Fence

1.4 SUBMITTALS

.1 Product Data: Material descriptions, dimension of individual components and profiles, and finishes for the following:

.1 Fence, gate posts, brackets, rails and fittings.

.2 Shop Drawings: In accordance to Section 01 33 00 with digital PDF copies:

.1 Show locations of fence, posts, rails, and other operation, hardware, and accessories.

.2 Indicate materials, dimensions, sizes, weights, and finishes of components.

.3 Include plans, elevations, sections, and other required installation and operational clearances, and details of post anchorage, attachment and bracing.

.4 Installation recommendations and instructions by manufacturer describing all details for a typical fence.

.5 Where fence is operating as a guard as defined by the Ontario Building Code (OBC), provide shop drawings that are stamped by a licensed, practicing structural engineer that certifies the fence design is in compliance with guard requirements within the OBC.

.3 Installation recommendations and instructions by manufacturer describing all details for a typical fence and gates.

.4 Verification Samples: For each finish product specified, two (2) samples, minimum size 6 in (150 mm) long, representing actual standard/optional color or color chips for custom color.

.5 Qualification Data: For firms and persons specified in “Quality Assurance” article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

.6 Maintenance Data: Material Safety Data Sheet available upon request.

1.5 SUBSTITUTION OF PRODUCTS

To enable all tenders to be judged equitably, they shall be based on the specified products in this document and shown on the drawings:

The proposal for any substitute products must be attached to their tender separately, identifying the substitution product by its trade name along with any savings it may represent.

.1 Following the opening of the tender, only the substitutions proposed by the lowest bidder of the specified products will be considered.

.2 All substitutions approval requests shall be accompanied by manufacturing drawings and specifications, and they meet all specifications for design, size gauge of metal parts and fabrication.

.3 Each substitution sample must be presented to the owner/consultant within seven days following the opening of tenders. After this time, the bidder will be required to supply the original specified product.

.4 The owner/consultant reserves the right to grant or deny approval for proposed substitutions without prejudice to this right and the decision shall be final.

.5 Fencing products must be entirely interchangeable, if applicable, with already installed material.

.6 The above conditions apply to this section independently of any other clauses on the subject found in this document.

1.6 QUALITY ASSURANCE

.1 Installer Qualifications: An experienced installer who has completed installations of fences and gates similar in material, design, and extent to those indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

.2 Source Limitations for Fences and Gates: Obtain each color, grade, finish, type, and variety of components for fences and gates from one source with resources to provide fences and gates of consistent quality in appearance and physical properties.

1.7 PROJECT CONDITIONS

.1 Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

.1 Notify local utility making services before beginning work.

.2 Unless otherwise indicated in the general provisions of the contract, notify the Architect no less than two (2) days in advance of proposed utility interruptions.

.3 Do not proceed with utility interruptions without Architect's written permission.

.2 Field Measurements: Verify layout information for fences and gates shown on drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

Part 2 PRODUCT

2.1 MANUFACTURER

.1 OMEGA II FENCE SYSTEMS ™

A division of Metaltech - Omega Inc. 1735, St-Elzéar west
Laval (Quebec), Canada H7L 3N6
Tel: 800-836-6342 / 450-686-9600
Fax: 450-681-5318
Email: customerservice@omegatwo.com Web site: www.omegafence.com

.2 Acceptable Substitutions:

.1 WireWorks Plus by Ameristar.

.2 All substitution approval requests shall be accompanied by manufacturing drawings and specifications, and they shall meet all specifications for design, size, gauge of metal parts, and fabrication.

2.01 COATINGS

.3 Polyester Coating:

.1 Polyester coating to be minimum 4 mils applied by an electrostatic process. Coating shall cover all surfaces of the wire and post sections. Coating shall be capable of withstanding the following tests:

.1 Mechanical adhesion test as per ASTM D3359 - Method B.

.2 Shock resistance tests as per ASTM D2794.

.3 Salt spray testing with a minimum of 1 000 hours without red rust appearance, as per ASTM B117.

.4 Humidity resistance in a weather meter chamber as per ASTM D2247.

.5 Exposure to ultraviolet light with exposure of 1 000 hours using apparatus Type E and 63°C as per ASTM D1499.

.4 Polyester Surface Coating Colors:

.1 Metallic Silver.

2.2 MATERIALS

MODEL “ELITE” FENCE AND ACCESSORIES

.1 Panel Height:

.1 4-foot-high nominal panels: 48-7/16 in (1 230 mm).

.2 Steel Mesh Fence Panels:

.1 98-5/8 in (2505 mm) wide, welded by one vertical wire of 6 gauge (0.192 in or 4.9 mm) placed between two horizontal wires of 4 gauge (0.225 in or 5.72 mm) to form rectangles 1-15/16 x 7-7/8 in (50.0 x 200.0 mm).

.2 Cold rolled annealed wire made of AISI Grade 1018 steel with tensile strength of at least 75 000 psi (515 Mpa) in accordance with ASTM A853.

.3 All ends of the vertical wires of the panel shall be cut flush prior to powder coat.

.4 Panel camber may not exceed 0.094 in (2.5 mm).

.3 Square Posts:

.1 Posts are made of cold-formed AISI 1008 steel to meet ASTM A500 and ASTM A787 and the following maximum horizontal loads, length as required for installation type:

.2 Installation

.1 Surface mounted, flanged.

.3 Post Size:

.1 2 in x 2 in (50.8 mm x 50.8 mm) 11 gauge (3.0 mm)

.4 Post Brackets:

.1 Universal Collar Bracket Kit: Universal bracket for standard use on line and end posts. Includes the following: 14 gauge (1.9 mm) steel collar and wire retaining plate 1/4 in x 1 in (6.4 mm x 25.4 mm), nut, washer and carriage bolt 5/16 in x 1-1/4 in (7.9 mm x 31.8 mm), all galvanized steel.

.1 For 90º turn, use the same bracket

.2 For different angles, used the “Universal collar angle brackets”.

.3 For 4-foot-high nominal panels: Provide 6 brackets per panel.

.5 Post caps:

.1 Aluminum alloy: For dimension post 2 in x 2 in (50.8 mm x 50.8 mm).

.6 Polyester powder coating: (See article 2.01).

Part 3 EXECUTION

3.1 EXAMINATION

.1 Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

.2 Do not begin installation before final grading is completed, unless otherwise permitted by Contract Administrator.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 ft (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 SURFACE MOUNT INSTALLATION

.1 Flange Post Installation: Bolt mounting plates attached to each post to slab or structure as indicated, using expansion bolts. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations.

.1 Dimensions and Profile: As indicated on drawings.

.2 Space line posts uniformly at center to center.

.3 Posts affixed to concrete slab.

3.4 FENCE INSTALLATION – Model “ELITE”

.1 Install the fence along the specified layout according to the drawings. The fence panel shall be installed to maintain a clear distance of 2 in (50.8 mm) from the ground surface.

.2 Posts shall be adequately supported within the concrete slab to maintain the required positioning and prescribed level. All necessary anchors, base plates, brackets, and posts shall be as indicated in drawings.

.1 Post Size 3 in x 3 in (76.2 mm x 76.2 mm)

.2 Post Spacing Center to Center 104 5/8 in (2 657 mm)

.3 Post Installation: Once the posts are fastened to the concrete slab, the panels are fastened to the posts. For fences with non-standard panel width, refer to custom approved shop drawings by the manufacturer.

.4 Upon cutting or trimming a post, apply a zinc rich primer to the exposed ends and finish with the matching touch-up paint supplied by the manufacturer.

3.5 GROUT AND ANCHORING CEMENT

.1 Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

.2 Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or

waterproof coating and that is recommended in writing by manufacturer for exterior applications.

3.10 SITE CLEANING

.1 Clean and adjust soil disturbed during work. Dispose of unused topsoil off site in accordance with Ontario Regulation 406/19: on-site and excess soil management.

3.11 MAINTENANCE

1. Inspection
    1. A thorough visual inspection shall be done annually.
    2. This inspection must include overall verification of physical condition.

2. Moveable parts shall be adjusted, if needed, every five (5) years, unless project requires additional inspections.

3. In areas of extreme winter conditions, entire installation must be free of excessive ice and snow accumulation.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

.1 All Division 1 Specifications.
.2 Section 03 30 00 - Cast-in-Place Concrete
.3 Section 32 14 29 – Rubber Surface Paving

1.2 Measurement for Payment

.1 Site furnishings shall be counted per item as listed in the Form of Tender including the construction of all foundations and miscellaneous work incidental to their complete installation.

.2 Play equipment shall be as noted in the Form of Tender, including all labour, materials, equipment and all incidentals required to complete the installation as shown on drawings.

1.3 Product Data

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate dimensions, sizes, colour, assembly, anchorage and installation details for each product specified. For play equipment, identify footing shape, size, reinforcement, concrete type/strength, anchor rods, post embedment or connections, steel channel, welding.

1.5 Closeout Submittals

.1 Play Equipment
  .1 Provide maintenance data for care and cleaning of all products for incorporation into the maintenance manual specified in Section 01 78 00 - Closeout Submittals.
  .2 Third Party CSA Inspection: All playground installations will be third party inspected by a Certified Playground Inspector for CSA compliance within 5 (five) working days of the Contractor declaring that the installation of the play equipment and safety surfacing is complete. Third party CSA inspection shall be arranged by the Contractor and paid for by the Contractor as part of base bid Contractor shall be responsible to notify the Owner of the scheduled inspection date and time

  .3 Provide maintenance data for care and cleaning of all products for incorporation into the maintenance manual specified in Section 01 78 00 – Closeout Submittals. Contractor shall supply a maintenance kit consisting of: a maintenance manual customized to the equipment provided; touch up paint; extra speciality fasteners and any tools for tamper proof fasteners for each playground structure. Provide a

list of any speciality parts available only from the equipment manufacturer. Provide valid SDS sheets for all paint products.

.4 Contractor shall submit as-built drawing showing all equipment, surfacing and concrete curbing to scale in final dimensions locations. The as-built drawing shall be provided in AutoCAD version 2023 and PDF format.

.5 Contractor shall supply warrantee certificate(s) for all components, stating park name and the warrantee start date which shall be the Owner's date of play space acceptance.

PART 2 PRODUCTS

2.1 Materials

.1 Play Equipment (no alternatives will be accepted):

Manufacturer:	Natures Instruments • Creative Panels Post Mounted Product NI-PG-30X-01 • Hanging Amadina Frame Post Mounted Product NI-PG-403-0301
Local Sales:	Carla Walker
Phone:	1-800-306-3319 ext. 516
Email:	carla.walker@bienenstockplaygrounds.com

Manufacturer:	PlayPower LT Canada Inc. • Little Tikes Commercial CAN240TBD - E0016241196 • Miracle Recreation CAN240TBD - E0016240055
Quote:	E0016241196-240055 dated July 25, 2024
Local Sales:	Jake Hoogstraten
Phone:	519-761-7752
Email:	jake.hoogstraten@playpower.com

PART 3 EXECUTION

3.1 Installation

.1 Verify that play structure's fall zones and non-encroachment zones do not conflict surrounding paving and site furnishings. Should such conflicts occur, the contractor to notify the Consultant immediately.

.2 Install concrete footings to a minimum depth of 1200 millimeters below finish grade and must meet the requirements of the site-specific geotechnical reports and shop drawings, which may be a greater depth than the manufacturer's minimum recommendations.

.3 Assemble all products in accordance with manufacturer's instructions.

.4 Assemble play structures in accordance with manufacturer’s specifications and in compliance with CSA standards.

.5 Install all products true, plumb, and firmly anchored.

.6 Damaged products will be rejected.

3.2 Final Acceptance and Payment

.1 Playground areas will be accepted by the Owner provided that the following items are completed and approved by the Owner:

.1 A third-party CSA inspection report completed by a Canadian Certified Playground Inspector (CCPI) prior to use inspection report is received and indicates that the play equipment and safety surface meets and/or exceeds the requirements in CSA Z614:20 (or most current version at time of construction),

.2 All deficiencies, if any, have been corrected;

.3 The as-built drawing(s) have been received

.4 Warranty information has been received;

.5 Maintenance kit has been received.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section provides materials and installation of manufactured items such as benches, tables and bike racks.

1.2 MEASUREMENT PROCEDURES

.1 Payment for site furniture will be made as per plan quantities Components included in bid price include:

.1 All labour, materials, equipment and incidental services necessary (including shipping, storage, delivering material to roof terraces to supply and install site furnishings

1.3 QUALITY CONTROL

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.3 Indicate dimensions, sizes, colour, assembly, anchorage and installation details for each product specified.

.4 Contractor to inspect all exterior site furnishings after delivery for signs of damage during transit

.5 Contractor to protect all parts of exterior site furnishings from damage during storage and installation.

.6 Consultant to confirm location and orientation of site furnishings prior to anchoring by contractor

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate facilities.

Part 2 Products

2.1 Bench

.1 Erlau Stella Style, Surface Mount Bench, with Backrest

.1 Part No: 5412833

.2 Material: Wire Mesh

.3 Colour/Finish: RAL 7016 Anthracite Grey

.4 Size: 1800mm length

.2 Supplier: Landmark by Crozier Enterprises Ltd.

2.2 Picnic Tables

.1 Erlau Parador Style, Surface Mount Picnic Table, without Backrest

.1 Part No: 5493733
.2 Material: Wire Mesh
.3 Colour/Finish: RAL 7016 Anthracite Grey
.4 Size: 1800mm long table; 1800mm long bench (two (2) benches per table)

.2 Erlau Parador Harmony, Barrier-Free, Surface Mount Picnic Table

.1 Part No: -----33
.2 Material: Wire Mesh
.3 Colour/Finish: RAL 7016 Anthracite Grey
.4 Size: 1800mm long table; 1200mm long bench (two (2) benches per table; one (1) bench with backrest and one (1) bench without backrest)

.3 Supplier: Landmark by Crozier Enterprises Ltd.

.4 Contractor to provide shop drawing of anchor/fastener assembly for review by Consultant.

.5 Contractor to supply approved anchor/fastener assembly. Refer to drawings for requirements.

.6 Contractor to provide standard range of color samples for approval by Consultant and Owner prior to ordering site furniture. Provide additional colour samples as required until product colour is selected.

2.3 Bike Rack

.1 Maglin 500, Surface Mount Bike Rack

.1 Part No: MBR-0500-00003
.2 Steel Colour/Finish: Gunmetal Finetex Powder Coat

.2 Supplier: Maglin Site Furniture

.2 Contractor to provide shop drawing of anchor/fastener assembly for review by Consultant.

.3 Contractor to supply approved anchor/fastener assembly. Refer to drawings for requirements.

.4 Contractor to provide standard range of color samples for approval by Consultant and Owner prior to ordering site furniture. Provide additional colour samples as required until product colour is selected.

Part 3 Execution

3.1 INSTALLATION

.1 Examine areas to receive furniture.

.2 Notify Consultant of conditions that would adversely affect installation or subsequent use.

.3 Do not begin installation until unacceptable conditions are corrected.

.4 Assemble and install furnishings in accordance with manufacturer's instructions.

.5 Install benches, tables and storage sheds level. Slope on all other site furniture shall not exceed 2%.

.6 Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by Consultant.

.7 Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

.8 Clean furniture promptly after installation in accordance with manufacturer’s instructions.

.9 Do not use harsh cleaning materials or methods that could damage finish.

.10 Protect installed furniture for the duration of construction to ensure that, except for normal weathering, furniture will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.1 Related Work

.1 Section 31 05 16 – Aggregate Based Materials

.2 Section 32 16 13 - Cast-in-Place Concrete

1.2 Measurement for Payment

.1 Payment will be made as noted in the Contract Price Schedule, including all labour, materials, and equipment and all incidentals required to complete the installation as shown on the drawings and specified herein.

1.3 References

.1 ASTM International (ASTM): ASTM A240/A240M – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM International (ASTM): ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 European Standard (EN): EN1433 – Drainage channels for vehicular and pedestrian areas; Classification, design and testing requirements, marking and evaluation of conformity.

1.4 System Description

.1 System Type:

.1 Trench drain systems shall employ an angled grade on both sides of a linear trench to move runoff into a point along the channel. Liquids shall be discharged by gravity flow at the end of the drain into an underground pipe system or culvert.

.2 System Design:

.1 Modular trench drains shall be factory manufactured and engineered with compatible grates and accessory components in sizes and capacities to provide a complete functioning trench drain system.

.2 Modular channels are aligned onsite via male/female interconnecting ends to form a continuous sloped run. Systems shall provide a continuously sloped trench up to 130 feet (40 m) long. Neutral channels with no slope that can be inserted along runs shall be provided as required to extend length.

.3 System Requirements:

.1 Loading:

.2 Durability:

.1 Liquid Type:
.2 Grade Surface Adjacent To Trench Grate:
.3 Grate and trench materials shall resist Liquid Type attack and corrosion of trench drain components and grate.

.3 User Requirements:

.1 Grate Finish:
.2 Grate Safety Requirements:

.1 Grates shall comply with requirements of the Americans with Disabilities Act (ADA).
.2 Grates shall include a ‘heelsafe’ pattern in compliance with American Society of Mechanical Engineers (ASME) A112.6.3, Floor and Trench Drains. Section 7.12, “Heel Resistant Strainers and Grates,
.3 Grates shall prevent small stiletto-style heels from getting stuck, causing injury or falls.
.4 Grates shall be bicycle-safe grates to avoid slot openings that trap modern bicycle wheels.

.4 Hydraulic Performance:

.1 Trench drain system shall provide drain performance without grate bypass occurring and without uncontrolled ponding during maximum design flow rate and duration.

1.5 Submittals

.1 System Type:

.1 Submit under provisions of Section 01 33 00.
.2 Product Data: Submit product data and installation instructions including manufacturer’s product sheet, for specified products.
.3 Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.
.4 Engineering Calculations: Manufacturer shall provide Trench Hydraulic Service by modeling lateral intake into the trench design based on Project environmental locale and drainage surfaces.

.1 Calculations shall include Grate Hydraulic Service comparing the specified grate catchment efficiency with the hydraulic modeling to determine the Bypass amount.
.2 Calculations shall include a ponding analysis of area indicated on drawings acceptable for ponding of discharge during storm events that exceed trench drain capacity.

.5 Quality Assurance Submittals: Submit the following:

.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

.7 Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.6 Quality Assurance

.1 Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

.2 Installer Qualifications: Installer experienced in performing Work of this section who has specialized in installation of work similar to that required for this project.

1.7 Pre-Installation Meetings

.1 Convene minimum two weeks prior to starting work of this section.

1.8 Delivery, Storage, and Handling

.1 General: Comply with Division 01 Product Requirements Sections.

.2 Ordering: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.
.3 Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

.4 Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.9 Project Conditions

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 Sequencing

.1 Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

.2 Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.11 Warranty

.1 Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

.2 Manufacturer’s Warranty:

.1 Warranty Period: 24 months commencing on Date of Substantial Performance

PART 2 PRODUCTS

2.1 Manufacturers

.1 Acceptable Manufacturer:

.1 ACO, Inc.; 9470 Pinecone Dr., Mentor, OH 44060. ASD. Toll Free Tel: (800) 543-4764. Tel: (440) 285-7000. Fax: (440) 285-7005. Email: info@acousa.com. Web: http://www.acousa.com.

.2 Substitutions: not permitted

2.2 System Design

.1 Load Class: Provide trench drain system designed, engineered and installed to support the minimum loads as defined by EN1433. Load Class shall be: B.

.2 Grate Design: Safety.

.1 Grates that comply with requirements of the Americans with Disabilities Act (ADA) of 1990 are available.

.2 Other safety-focused grates include a ‘heelsafe’ pattern in compliance with American Society of Mechanical Engineers (ASME) A112.6.3, Floor and Trench Drains. Section 7.12, “Heel Resistant Strainers and Grates”

.3 Grates are designed to prevent small stiletto-style heels from getting stuck, causing injury or falls. In addition, bicycle-safe grates avoid slot openings that can trap modern bicycle wheels.

2.3 KlassikDrain – General purpose trench drains system

.1 Product: KlassikDrain Trench System as manufactured by ACO, Inc.

.1 Units: Polymer concrete with steel edge protection rail, grate lugs and locks to prevent dislodgement.

.1 One meter (39.4 inches) long units shall provide 130 feet (40m) continuous slope (0.5%, 1/17 inch fall per linear foot). Five neutral slope channels extend run lengths. Four half-meter neutral slope channels and accessories for a complete system.

.2 Stainless Steel Edged, Single Lock, Modular Trench System. Grade 304 stainless steel.

.1 4 inch nominal (100 mm) Trench System: KS100 Trench System.

.2 Product: KlassikDrain Grates as manufactured by ACO, Inc.

.1 K/KS100 Grates (4 inch nominal)

.1 Type 467D 1.0m Grate: Stainless Intercept, EN1433 load class B

2.4 Materials

.1 Polymer Concrete: Durable material which is resistant to road salts and common chemicals, made from polyester resin reinforced with mineral aggregates and fillers.

.2 Stainless Steel: Type 304, ASTM A240/A240M

PART 3 EXECUTION

3.1 Examination

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 Preparation

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 Installation

.1 Install in accordance with manufacturer's instructions and approved submittals. Install in proper relationship with adjacent construction.

3.4 Protection

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 3 23 33 – Excavating Trenching and Backfilling.

1.2 MEASUREMENT FOR PAYMENT

.1 Supply and installation of sub-drainage will be measured per plan quantity with trenching, bedding, backfill, granular filler material, and other incidental items required to complete the installation as per the details and drawings.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 Current ASTM C 136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 Current ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.2 Canadian General Standards Board (CGSB)

.1 Current CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.

.2 Current CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA)

.1 Current CAN/CSA-8182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

1.4 1.4 SAMPLES

.1 Submit samples in advance of installation.

1.5 1.5 MATERIAL CERTIFICATION

.1 Certification to be marked on pipe.

1.6 1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 MATERIALS

.1 Fully perforated plastic pipe and fittings: to CAN/CSA-B 182.1. Nominal pipe sizes as detailed and fully filter wrapped.

.2 Aggregate for French drain: open graded, hard, durable particles 19mm diameter clear stone as detailed.

.3 Geotextile filter: to Section 31 32 19.16- Geotextiles for Soil Stabilization as detailed.

Part 3 Execution

3.1 TRENCHING

.1 Excavate, trench and backfill.

.2 Place filter material after approval of trench by the Consultant and Municipality.

3.2 BEDDING

.1 Place layer of aggregate material as detailed.

3.3 INSTALLATION OF PIPE SUB-DRAINS

.1 Lay pipe drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with bed throughout full length.

.2 Commence laying at outlet and proceed in upstream direction.

.3 Lay bell and spigot pipe with bell ends facing upstream. Do not mortar joints.

.4 Make joints tight in accordance with manufacturer's instructions.

.5 Make watertight connections to existing drains, new or existing manholes and catch basins where indicated or as directed by the Municipality.

.6 Plug open upstream ends of pipes with pre-manufactured plastic caps.

.7 Surround and cover drain with filter material in uniform layers as detailed.

.8 Backfill remainder of trench as detailed.

.9 Do not place bedding surround and backfill materials in frozen condition.

.10 Protect sub-drains against flotation during installation.

.11 Install "wye" connections to surface as indicated.

END OF SECTION