

PROJECT MANUAL VOL. 1

Issued for Tender

Architectural, Structural, Civil, Landscape

Vaughan Fire Station 7-12

T24-253

9511 Weston Road, Vaughan, ON

1.1 DOCUMENT RESPONSIBILITY

- .1 Refer to *Project* Manual, Section 00 01 10 - Table of Contents, for indication of document responsibility (DR). Abbreviations for entity responsible for document preparation are as follows:
 - .1 A - Denotes documents prepared by Architect.
 - .2 C - Denotes documents prepared by Civil *Professional Engineer* (Site Servicing).
 - .3 E - Denotes documents prepared by Electrical *Professional Engineer*.
 - .4 L - Denotes documents prepared by Landscape Architect.
 - .5 M - Denotes documents prepared by Mechanical *Professional Engineer*.
 - .6 S - Denotes documents prepared by Structural *Professional Engineer*.
- .2 Professional seals if applied next to company names in the *Project* directory (below) govern only those *Specification* Sections and schedules identified by the corresponding document responsibility (DR) abbreviation in Section 00 01 10 – Table of Contents.
 - .1 With regard to Section 00 30 00: The architect's seal governs only Section 00 30 00 proper, and not the documents listed therein.

1.2 PROJECT DIRECTORY

- .1 Architect (the *Consultant*) (A):

Thomas Brown Architects Inc.
197 Spadina Avenue, Suite 500
Toronto, Ontario M5T 2C8
Tel: 416 364 5710
- .2 Structural *Professional Engineer* (S):

Salas O'Brien
2235 Sheppard Avenue, E Suite 1100
Toronto, Ontario M2J 5B5
Tel: 416 635 9970
- .3 Mechanical *Professional Engineer* (M):

Jain Consultants Inc.
7405 East Danbro Crescent
Mississauga, ON L5N 6P8
Tel: 905 285 9900
- .4 Electrical *Professional Engineer* (E):

Jain Consultants Inc.
7405 East Danbro Crescent
Mississauga, ON L5N 6P8
Tel: 905 285 9900

.5 Landscape Architect (L):

Strybos Barron King Ltd.
5770 Hurontario Street,
Mississauga, ON, L5R 3G5

.6 Civil *Professional Engineer* (C):

MGM Consulting Inc.
400 Bronte Street South
Milton, Ontario L9T 0H7
Tel: 905-875-1228

END OF SECTION

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

Document Identification

DR

VOLUME 1 SPECIFICATIONS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 01	Project Manual Title Page	A
00 01 05	Document Responsibility and Project Directory	A
00 01 10	Table of Contents	A
00 30 00	Information Available for Review	A

DIVISION 02 – GENERAL REQUIREMENTS

01 10 00	General Instructions	A
01 10 00.1	CAD Data Disclaimer	A
01 21 00	Cash Allowances	A
01 25 00	Product Substitution Procedures	A
01 25 01	Substitution Request Form	A
01 26 00	Contract Modification and Requests for Interpretation	A
01 29 73	Schedule of Values	A
01 31 13	Coordination	A
01 31 19	Project Meetings	A
01 31 46	Field Engineering	A
01 32 00	Construction Progress Documentation - Schedule	A
01 33 00	Submittal Procedures	A
01 35 18	General Requirements for Energy Efficiency	P
01 35 20	General LEED Requirements	A
01 35 29	Health, Safety, and Emergency Response	A
01 35 50	LEED Waste Management & Disposal	A
01 35 50.1	Waste Management Disposal Schedules	A
01 35 90	Indoor Air Quality Management	M
01 35 90.1	Indoor Air Quality Management Schedules	M
01 41 00	Regulatory Requirements	A
01 42 13	Abbreviations and Acronyms	A
01 45 00	Quality Control	A
01 50 00	Temporary Facilities and Controls	A
01 56 39	Temporary Tree, Plant Protection and Trimming	A
01 57 13	Erosion and Sedimentation Control	A
01 57 13.1	Erosion and Sedimentation Control Schedules	A
01 57 20	Temporary Indoor Air Quality Control	M
01 60 00	Products and Workmanship	A
01 61 10	LEED Product Requirements	A
01 61 10.1	LEED Product Requirements Schedules	A
01 73 29	Cutting and Patching	A
01 74 13	Progressive Cleaning	A
01 74 19	Waste Management and Disposal	A
01 76 00	Protecting Installed Construction	A
01 77 00	Contract Closeout Procedures and Submittals	A

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

<u>Document Identification</u>	<u>DR</u>
01 78 23 Operation and Maintenance Manuals	A
01 78 36 Warranties	A
01 78 39 As-Built Documents	A
01 91 00 Commissioning Requirements	P
01 91 19 Building Envelope Commissioning	P
DIVISION 02 - EXISTING CONDITIONS	
02 27 00 Erosion and Sediment Control	C
02 52 30 Concrete Curb and Toe Walls	C
02 83 20 Retaining Walls	A
DIVISION 03 – CONCRETE	
03 30 53 Cast-In-Place Concrete	S
DIVISION 04 – MASONRY	
04 05 00 Masonry Procedures	A
04 05 13 Mortar and Grout for Masonry	A
04 05 19 Masonry Reinforcement and Connectors	A
04 05 23 Masonry Accessories	A
04 21 00 Brick Masonry Units	A
DIVISION 05 – METALS	
05 12 23 Structural Steel Framing	S
05 31 23 Steel Roof Decking	S
05 50 00 Metal Fabrications	A
05 50 01 Post Guard Bollard Covers	A
DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES	
06 10 53 Rough Carpentry	A
06 17 00 Shop-Fabricated Structural Wood	S
06 17 19 Cross-Laminated Timber	S
06 18 00 Glue-Laminated Structural Units	S
06 40 00 Architectural Woodwork	A
DIVISION 07 - THERMAL AND MOISTURE PROTECTION	
07 13 26 Sheet Waterproofing	A
07 21 00 Thermal Insulation	A
07 26 13 Above Grade Vapour Barrier	A
07 26 16 Below Grade Vapour Barrier	A
07 27 00 Air Barrier Systems	A
07 46 16 Aluminum Panel Cladding System	A
07 52 16 Styrene Butadiene Styrene (SBS) Modified Bituminous Membrane Roofing	A
07 61 00 Sheet Metal Roofing	A
07 62 00 Metal Flashing	A

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

<u>Document Identification</u>	<u>DR</u>
07 81 00 Sprayed Fire Resistive Materials (SFRM)	A
07 84 00 Firestopping and Smoke Seals	A
07 92 00 Joint Sealants	A
DIVISION 08 – OPENINGS	
08 11 13 Steel Doors and Frames	A
08 31 00 Access Panels	A
08 35 13 Four-Fold Metal Doors	A
08 36 13 Sectional Overhead Metal Doors	A
08 41 00 Aluminum Framed Glazing Systems	A
08 42 43 Sliding Doors	A
08 71 00 Door Hardware	A
08 71 00.1 Hardware Schedule	A
08 71 13 Automatic Door Operators	A
08 80 00 Glass and Glazing	A
08 91 19 Louvres	A
DIVISION 09 – FINISHES	
09 22 00 Metal Supports for Gypsum and Cement Board	A
09 29 00 Gypsum and Cement Board	A
09 31 00 Tiling	A
09 51 23 Acoustical Tile Ceiling Systems	A
09 65 20 Rubber Tile Flooring	A
09 67 23 Epoxy Flooring	A
09 91 00 Painting	A
DIVISION 10 – SPECIALTIES	
10 11 00 Visual Display Surfaces	A
10 14 53 Traffic Signage	A
10 26 13 Corner Guards	A
10 28 00 Washroom Accessories and Janitor Accessories	A
10 50 30 Turnout Gear Locker – Wall Mounted and Tubular Frame	A
10 51 13 Prefinished Metal Lockers	A
10 75 16 Flagpoles	A
DIVISION 12 – FURNISHINGS	
12 24 13 Roller Window Shades	A
12 36 61 Solid Surfacing Countertops	A
12 48 16 Entrance Floor Grilles	A
DIVISION 31 – EARTHWORK	
31 05 17 Aggregates	
31 11 00 Clearing and Grubbing	
31 23 10 Excavating, Trenching, Backfilling	
31 23 13 Site Grading	
31 25 00 Erosion and Sedimentation Control	

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

<u>Document Identification</u>	<u>DR</u>
31 32 19 Geotextiles	A
DIVISION 32 - EXTERIOR IMPROVEMENTS	
32 01 90 Temporary Tree and Plant Protection and Trimming	A
32 11 19 Granular Sub-base	
32 11 23 Granular Base	
32 12 16 Asphalt Paving	
32 13 13 Concrete Sitework	
32 13 15 Concrete Curbs	
32 13 16 Concrete Sidewalks	
32 14 13 Permeable Paving	
32 17 23 Traffic Markings	A
32 17 26 Tactile Warning Surfacing	A
32 31 13 Chain Link Fences	A
32 31 25 Wood Composite Fences and Gates	A
32 33 00 Site Furnishings	
32 91 19 Topsoil placement and grading	
32 92 23 Sod	
32 93 00 Trees - Shrubs - Covers	
DIVISION 33 – UTILITIES	
33 05 14 Manholes and Catch Basin	
33 11 17 Water Systems	
33 31 13 Sanitary Sewers	
33 44 00 Storm Sewers	
33 44 01 Subdrains	
33 44 16 Precast Trench Drain Systems	A

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

Document Identification

DR

VOLUME 2 SPECIFICATIONS

MECHANICAL SPECIFICATION

21 05 01	Mechanical General Requirements	M
21 07 00	Insulation	M
21 13 00	Fire Protection	M
22 05 00	Plumbing & Drainage	M
23 05 93	Testing, Adjusting, Balancing	M
23 21 00	Liquid Heat Transfer	M
23 31 00	Air Distribution	M
25 90 00	Building Automation System	M

ELECTRICAL SPECIFICATION

260100	Electrical General Requirements	E
260500	Electrical Basic Materials & Methods	E
260526	Grounding	E
260535	Telecommunication Raceway System	E
260800	Electrical System Commissioning	E
260923	Digital Metering	E
262401	Service	E
262416	Panelboards	E
262726	Wiring Devices	E
262823	Disconnect Switches	E
263300	Power Generator – Natural Gas	E
263623	Low Voltage Bypass/Isolation Automatic Transfer Switches	E
265000	Lighting Equipment	E
265200	Emergency Lighting System	E
283100	Fire Alarm System	E

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

1.2 INFORMATION AVAILABLE FOR REVIEW

- .1 Be advised the neither the *Owner* nor the *Consultant* guarantees the accuracy or completeness of any data contained therein. Bidders must satisfy themselves with regard to all matters relating to conditions that may affect either the methods of construction or the cost of the *Work* before submitting bids or commencing the *Work*.
- .2 The Architect's seal, if applied to the *Project Manual*, governs only Section 00 30 00 proper, and not the documents listed herein.
- .3 The following documents have been made available by the *Owner* for review:
 - .1 Arborist Report:
 - .1 "Arborist Report - Vaughan Fire Station 7-12, 9541 Weston Road, dated March 2022, prepared by LGL Limited.
 - .2 Butternut Tree report:
 - .1 "Butternut Health Assessment: September 2, 2022 dated September 6, 2022, prepared by LGL Limited.
 - .3 Geotechnical report:
 - .1 "Vaughan Fire Station 7-12, 9541 Weston Road, Woodbridge, Ontario, City of Vaughan, Final Geotechnical report", dated June 8, 2022, prepared by Englobe Corp.
 - .4 Soil Characterization report:
 - .1 "Soil Characterization, 9541 Weston Road, Vaughan, Ontario, City of Vaughan, Final Report," dated June 22, 2022, prepared by Englobe Corp.
 - .5 Environmental Impact Study:
 - .1 "Environmental Impact Study - Vaughan Fire Station 7-12, City of Vaughan, dated April 2022, prepared by LGL Limited.
 - .6 Hydrogeological Assessment reports:
 - .1 "Hydrogeological Assessment, 9541 Weston Road (Fire Station Number 7-12), City of Vaughan, Ontario", dated October 14, 2022, prepared by Terraprobe Inc.
 - .7 Environmental Site Assessment reports:
 - .1 "Phase One Environmental Site Assessment, 9541 Weston Road, Vaughan, Ontario, City of Vaughan, Final Report," dated June 22, 2022, prepared by Englobe Corp.
 - .2 "Phase Two Environmental Site Assessment, 9541 Weston Road, Vaughan, Ontario, City of Vaughan, Final Report," dated June 22, 2022, prepared by Englobe Corp.
 - .8 Assessment of Past Uses:
 - .1 "Assessment of Past Uses, 9541 Weston Road, Vaughan, Ontario, City of Vaughan, Final Report," dated June 22, 2022, prepared by Englobe Corp.

- .9 Archaeological Assessment reports:
 - .1 “Stage 1 and 2 Archaeological Assessment Part of Vellore Hall Park, 9541 Weston Road, Part of Lot 17, Concession 5, Geographic Township of Vaughan, County of York, Now in the City of Vaughan, Regional Municipality of York ”, dated February 22, 2023, prepared by ASI.
- .10 Functional Servicing and Stormwater Management Report
 - .1 “Functional Servicing and Stormwater Management Report, Proposed Emergency Services Development, Vaughan Fire Station 7-12, 9541 Weston Road, Woodbridge, ON M6M 4P8” dated June 12, 2023, prepared by MGM Consulting Inc.
- .4 These documents are included in this Project Manual as a separate volume. The documents are combined in the order that they appear above.
- .5 *Contractor* must confirm receipt of these documents prior to commencement of construction.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Language of the *Contract*
- .4 1.4 The *Contract Documents*
- .5 1.5 Laws, Notices, References, Standards and Regulations
- .6 1.6 Permits, Deposits and Responsibilities
- .7 1.7 *Project* Coordination and Responsibility
- .8 1.8 Examination of the *Place of the Work*, Documents, Surfaces and Conditions
- .9 1.9 Quantity of Items
- .10 1.10 Standards and Codes
- .11 1.11 Schedule of Values
- .12 1.12 Discrepancies and Clarifications
- .13 1.13 Setting out the *Work* and Field Engineering
- .14 1.14 Protection and Damages of Property and *Work*
- .15 1.15 Fires and Smoking
- .16 1.16 Documents at the *Place of the Work*
- .17 1.17 Concealed Services
- .18 1.18 Trademark and Labels
- .19 1.19 Waste Audits/Plans for Waste Reduction
- .20 1.20 Interferences
- .21 1.21 Not In *Contract* Items and Items Supplied by *Owner*
- .22 1.22 Seismic Design and Requirements
- .23 1.23 Electronic Files

1.3 LANGUAGE OF THE CONTRACT

- .1 The use of the words "include" or "including", or variations thereof, within the *Contract Documents* is not limiting.

1.4 THE CONTRACT DOCUMENTS

- .1 The *Contract Documents* have been arranged into various divisions, sections, Drawings, and schedules for the purpose of presenting the *Work* in a logical and organized form and to enable ease of reference and interpretation, and are not intended to be an arrangement of precise and independent *Subcontractors*, or jurisdiction of responsibility for the various parts of the *Work*. The *Contractor* shall be solely responsible for coordinating the execution of the *Work* of this *Contract* in accordance with the requirements of the *Contract Documents*.

- .2 As a result, the *Consultant* shall not be required to decide on questions arising with regard to agreements or contracts between the *Contractor* and *Subcontractors* or *Suppliers*, nor to the extent of the parts of the *Work* assigned thereto.
- .3 Further, no extra will be allowed as a result of the failure to coordinate and allocate the *Work* such that the *Work* is Provided in accordance with the *Contract Documents*.
- .4 The *Contract Documents* may specify, indicate, or schedule requirements that exceed the requirements of the Ontario Building Code, other applicable codes, requirements of the *Authorities Having Jurisdiction*, and standards cited in the *Contract Documents*. In such cases, the requirements specified, indicated, or scheduled in the *Contract Documents* shall govern.
- .5 This Section coordinates, relates, and governs the *Work* of other Sections of the Specifications.

1.5 LAWS, NOTICES, REFERENCES, STANDARDS AND REGULATIONS

- .1 The Ontario Building Code - Ontario Regulation 332/12, including amendments, shall govern the *Work*.
- .2 Comply with codes, by-laws, and regulations of the *Authorities Having Jurisdiction* over the *Place of the Work*. Codes and regulations form an integral part of the *Contract Documents*.
- .3 It shall be the responsibility of the *Contractor* to give the required notices and comply with the laws, bylaws, ordinances, rules, regulations, codes, and orders of all *Authorities Having Jurisdiction*, which are or become in force during the performance of the *Work*, and which relate to:
 - .1 The *Work*.
 - .2 The preservation of the public health;
 - .3 Environmental protection; and/or,
 - .4 Construction safety.
- .4 *Contractor* shall arrange for inspection, testing and acceptance of the *Work* required by the *Authorities Having Jurisdiction* and be responsible for necessary preparations, provisions and pay costs.
- .5 It is the responsibility of the *Contractor* to schedule notifications and inspections required by the *Authorities Having Jurisdiction* such that notifications can be properly received and that inspections can be properly undertaken without causing a delay in the *Work*. The *Contractor*, at no additional cost to the *Owner*, shall be solely responsible for any delay in the *Work* caused by failure to properly schedule required notifications and inspections.
- .6 The *Contractor* shall *Provide* to the chief building official or the registered code agency, where a registered code agency is appointed under the Ontario Building Code Act in respect of the construction to which the notice relates, the required notices set out in Division C - Part 1 Sentence 1.3.5.1(2) and Sentence 1.3.5.2 of the Ontario Building Code, O. Reg. 332/12 as amended. The *Contractor* shall be present at each site inspection by an inspector or registered code agency as applicable under Division C - Part 1 Sentence 1.3.5.2 of the Ontario Building Code.
 - .1 It is the responsibility of the *Contractor* to schedule notifications to the chief building official or the registered code agency such that the inspection pertaining to the notifications can be made within the time frame as required under Division C – Part 1 Sentence 1.3.5.3 of the

Ontario Building Code, O. Reg. 332/12 as amended, without causing a delay in the *Work*.
The *Contractor*, at no additional cost to the *Owner*, shall be solely responsible for any delay in the *Work* caused by failure to properly schedule required notifications and inspections.

- .7 Without limiting the foregoing, wherever bylaws, codes, or standards are quoted in the *Contract Documents*, they shall be taken to mean the latest edition, including all revisions, amendments, or supplements, which are or become in force during the performance of the *Work*, unless an earlier edition is specifically quoted. If more than one bylaw, code, or standard is quoted for a given *Product*, material or method, the latest edition of the most stringent shall govern.
- .8 Wherever reference is made to “manufacturer’s instructions” or “manufacturer’s recommendations”, it shall mean printed instructions or recommendations, received directly from the referenced manufacturer. It shall also be taken to mean the latest edition of such instructions or recommendations.
- .9 The *Contractor* shall be responsible for any delay in the progress of the *Work* due to a violation of any legislated requirements, and shall take the necessary steps to avoid delay in the final completion of the work, and such steps will not be considered or approved as changes in the *Work*.

1.6 PERMITS, DEPOSITS AND RESPONSIBILITIES

- .1 The *Owner* will apply and pay for the Building Permit.
- .2 All permits, licenses, certificates, and the like, other than the Building Permit, where required for the *Work*, shall be applied for, paid for, and obtained by the *Contractor*.
- .3 The *Contractor* shall obtain all permits required to execute *Work* on municipal rights of way. Obtain damage deposits for sidewalks, roads and services.
- .4 The *Contractor* shall pay for any deposit for clean-up of mud-tracking onto roadways, and for the repair of any damage to roadways adjacent to the *Place of the Work* as may be required by the *Authorities Having Jurisdiction*.

1.7 PROJECT COORDINATION AND RESPONSIBILITY

- .1 The *Contractor* shall coordinate the progress of the *Work*, mobilization areas of the *Place of the Work*, progress schedules, submittals, access to and use of the *Place of the Work* and facilities subject to any restrictions and conditions in accordance with the *Contract Documents*, reports and records, and any other processes, events, work, approvals, inspections and testing as may be required for the complete, proper and seamless execution of the *Work*.
- .2 The *Contractor* shall be solely responsible for ensuring that the complete *Contract Documents* are distributed to, or otherwise made available for review by, all *Subcontractors* and suppliers as required for the complete and proper and informed coordination and execution of the *Work*. Failure in this regard will be the sole responsibility of the *Contractor* and will not be accepted as a justification for a change in the *Work* and no change in the *Work* will be approved therefore.
- .3 The *Contractor* is required to employ a competent supervisor and necessary assistants who shall be in attendance at the *Place of the Work* at all times throughout the progress of the *Work* when work is being performed. The *Contractor*, through the supervisor, shall maintain good order and discipline among the *Contractor's* employees engaged on the *Work*, and among any *Subcontractors* engaged on the *Work*.

- .4 The responsibility as to which *Subcontractor* provides the required materials or articles, and/or builds-in articles, rests solely with the *Contractor* unless otherwise explicitly stated in the *Contract Documents* or directed by the *Consultant*.
- .5 The *Contractor* shall ensure that *Subcontractors* shall give the *Contractor*, in writing, instructions and information regarding their requirements as related to other parts of the *Work*.
- .6 There shall be cooperation at all times between *Subcontractors* as required for the proper execution of the *Work*. The *Contractor* shall ensure that *Subcontractors* supply others with the necessary accessories for building-in where required.
- .7 There shall be cooperation at all times with any representatives of any Inspection and Testing Companies (as may be retained by the *Owner*) during the performance of their duties.
- .8 The *Contractor* shall ensure that each *Subcontractor* shall report to the *Consultant* and the *Contractor*, in writing, any defects of surface or work, prepared by other *Subcontractors*, that adversely affects the work of their trade. Commencement of work shall imply acceptance of the prepared work otherwise.
- .9 The *Contractor* shall ensure that each *Subcontractor*, upon completion of their work, removes any equipment, surplus materials, and debris resulting from their work. The *Contractor* shall also ensure that each *Subcontractor* shall, and at its own expense, make good any damage to the work of another *Subcontractor* as a result of its own work. The definition of what constitutes "damage" shall be at the sole discretion of the *Consultant*.

1.8 EXAMINATION OF THE *PLACE OF THE WORK*, DOCUMENTS, SURFACES AND CONDITIONS

- .1 Examine the *Place of the Work* and investigate matters relating to the nature of the *Work*, means of access and egress, obstacles, rights and interests of other parties which may be interfered with during the execution of the *Work*, conditions and limitations including obstructions, existing structures or facilities, local conditions, actual levels, character and nature of the *Work*, documents related to existing building or buildings, as applicable and when available, and other consideration which may affect performance of the *Work*.
- .2 Examine the extent of the *Work* to be performed and matters which are referred to in the *Contract Documents* prior to start of the *Work*.
- .3 Examine the *Work* to which the *Work* is to be applied, anchored or connected, and relevant as-built conditions.
- .4 Each work operation following on a previous work operation of a differing *Subcontractor*, as in the case of finishing and surfacing work, shall include a thorough examination of the condition of the previous work. Conditions found unacceptable, either for the commencement of the new work or its satisfactory completion, shall be reported in writing to the *Consultant*.
- .5 Do not commence the *Work* until unsatisfactory conditions are corrected. Commencement of the *Work* implies acceptance of surfaces, tolerances, and conditions and existing conditions will not be accepted as a contributing factor to subsequent failure or acceptability of the *Work*.

1.9 QUANTITY OF ITEMS

- .1 Where a component, device, item or part of materials or equipment is referred to in the singular number, such reference shall require the provision of as many components, devices, items or parts of material or equipment necessary to complete the *Work*.

1.10 STANDARDS AND CODES

- .1 *Contract* forms, codes, specifications, standards, manuals and installation, application and maintenance instructions referred to in these Specifications, unless otherwise specified in the Contract Documents, amended or date suffixed, shall be latest published editions at which are or become in force during the performance of the Work.

1.11 SCHEDULE OF VALUES

- .1 The schedule of values shall include line items identifying full costs for the following:
 - .1 Preparation and submission of closeout submittals in accordance with the requirements of Section 01 77 00.

1.12 DISCREPANCIES AND CLARIFICATIONS

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

1.13 SETTING OUT THE WORK AND FIELD ENGINEERING

- .1 The *Contractor* shall assume full responsibility for and execute complete layout of the *Work* to required locations, lines and elevations.
- .2 Verify all grades, lines, levels, and dimensions as indicated or otherwise provided, and report errors or inconsistencies to the *Consultant* before commencing work, or as soon as discovered.
- .3 Upon completion of foundation work, *Provide* an accurate survey showing the location of the foundations on the *Site*, the foundation wall dimensions, and the gross floor area of the Foundation Plan. The survey shall be prepared by a surveyor who is a Registered Ontario Land Surveyor acceptable to the *Owner* and the *Consultant*. The cost of the survey shall be included in the *Contract Price*.
- .4 Surveys and Survey Requirements:
 - .1 Surveyor shall be a land surveyor qualified to practice in the Province of Ontario, acceptable to the *Owner* and the *Consultant*.
 - .2 Locate, confirm, and protect control points prior to starting the *Work*. Preserve permanent reference points throughout the *Work*.
 - .3 Establish two permanent benchmarks on *Site*, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in the *Project Record Documents* described under Section 01 77 00 *Project Closeout*.

- .4 Establish lines and levels, locate and lay out by instrumentation.
- .5 The *Contractor* shall *Provide* all *Subcontractors* with, and be responsible for, all levels and dimensions they require. The *Contractor* shall notify all *Subcontractors* that such levels and dimensions must be obtained from the *Contractor* only.
- .6 The *Contractor* shall maintain a complete and accurate log of control and survey work as it progresses.
- .7 Upon completion of foundations and major *Site* improvements, have prepared a certified survey showing dimensions, locations, angles, and elevations of the work completed.
- .8 As the work progresses, the *Contractor* shall be responsible for laying-out the exact locations of walls as a guide to the *Subcontractors*.
- .9 The *Contractor* to ensure that all pipes, service lines and ducts are concealed. Any exceptions to this should be noted on the As- Built Drawings. Advise the *Consultant* in advance of the installation or fabrication of items where conditions are such that the installation or fabrication will be exposed.

1.14 PROTECTION AND DAMAGES OF PROPERTY AND WORK

- .1 The *Contractor* shall ensure provision of adequate protection of materials, property, and work from damage and staining and to ensure protection of adjacent materials and work of *Subcontractors* to prevent damage. The *Contractor* shall ensure that any party responsible for damage to the work of another, shall make good such damage to the satisfaction of the *Consultant* at no additional cost to the *Owner*. The cost for such making good will not be considered or approved as a change in the *Work*.
- .2 Maintain access and surrounding areas to the *Place of the Work* free from soiling and debris resulting from the *Work*. Make good any soiling and remove any and all debris caused as a result of the *Work* to the satisfaction of the *Owner* and the *Consultant*.
- .3 All damage to existing sidewalks, fences, structures, curbs, services, roadways, parking and asphalt areas, grounds, sodding, trees, or other items on, or adjacent to, the *Place of the Work*, including mud tracks, deemed by the *Consultant* as being damaged due to the performance of the *Work*, shall be made good by the *Contractor* to the satisfaction of the *Consultant* at no additional cost to the *Owner*. The cost for such making good will not be considered or approved as a change in the *Work*.
- .4 Abide by the requirements of the Authorities Having Jurisdiction for maintaining sidewalks and roads in proper condition throughout the course of the *Work*. *Provide* a flag-person as required for the safe ingress and egress of vehicles to and from the *Place of the Work*.
- .5 Floors and roofs shall not be over-loaded by accumulated materials. Place proper supports and braces as required to safely disseminate any temporary loading.

1.15 FIRES AND SMOKING

- .1 Fires are not permitted at the *Place of the Work*.
- .2 Explosives shall not be used in the execution of the *Work* and are not permitted at the *Place of the Work*.
- .3 Smoking shall be prohibited at the interior of the building at all times. Smoking shall also be prohibited in areas where volatile fumes or liquids are being used. Post "No Smoking" signs accordingly.

- .4 Precautions shall be taken to avoid fire by spontaneous combustion. Remove combustible and non-combustible waste at regular intervals and/or when directed by the *Consultant* or the *Owner*.

1.16 DOCUMENTS AT THE *PLACE OF THE WORK*

- .1 Maintain at the *Place of the Work*, one copy of each of following:
 - .1 *The Contract Documents* including *Drawings*, *Specifications*, *Addenda*, and other modifications to the *Contract*.
 - .1 The Issued for Construction (IFC) version of the *Contract Documents* shall be the version retained at the *Place of the Work*. The IFC version shall be prepared by the *Consultant* and provided to the *Contractor*.
 - .2 *Drawings* and *Specifications* "Issued for Construction" are complementary to the *Contract Documents*. To the best of the *Consultant's* knowledge they are an accurate representation of documented revisions. In the case of any discrepancy, omission or conflict between the "Issued for Construction" documents and the *Contract Documents*, the *Contractor* is to promptly bring it to the attention of the *Consultant*."
 - .3 In cases of dispute, the original signed version, of the *Contract Documents*, including addenda issued, shall govern over the IFC version.
 - .2 'Reviewed' or 'Reviewed as Modified' shop drawings.
 - .3 Construction and submittal schedules.
 - .4 *Supplemental Instructions*, *Notices of Change*, *Change Orders*, and *Change Directives*.
 - .5 Inspection and Testing Reports.
 - .6 *The Consultant's* field review reports and deficiency reports.
 - .7 Reports by the *Authorities Having Jurisdiction*.
 - .8 Building and other applicable permits, and related permit documents.
 - .9 Substantial Performance Procedure issued by the *Consultant to the Contractor*
 - .10 Daily log including:
 - .1 Number of the *Contractor's* and *Subcontractors'* workers actively working at the *Place of the Work* by each subcontract.
 - .2 *Subcontractors* working at the *Place of the Work*.
 - .3 Parts of the *Work* being worked on.
 - .4 Working hours worked at the *Place of the Work*.
 - .5 Activities with intermittent progress.
 - .6 Time lost and explanation for such time lost.
 - .7 Difficulties (*Work* scheduled to start but did not with the reason why, delays, labour inefficiencies, labour shortage).
 - .8 Products and materials delivered.

- .9 Equipment mobilized and/or demobilized.
- .10 Demolition conditions.
- .11 Start and finish date of each part of the *Work*.
- .12 *Site* specific information as required by *Owner*.
- .11 As-Built Drawings recording as-built conditions, instructions, changes for structure, equipment, wiring, plumbing, and the like, as called for in Section 01 77 00 and Divisions 21, 22, and 23 and Divisions 26 and 28, prior to being concealed.
- .2 Make above material available to the *Consultant* upon request.

1.17 CONCEALED SERVICES

- .1 Conceal wiring, conduit, pipes and ductwork in finished areas, unless otherwise indicated in the *Contract Documents*.

1.18 TRADEMARK AND LABELS

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

1.19 WASTE AUDITS/PLANS FOR WASTE REDUCTION

- .1 Comply with requirements of the Authorities Having Jurisdiction.
- .2 Deliver to nearest appropriate depot materials accepted for recycling by the *Region* or the Authorities Having Jurisdiction over the *Place of the Work*, including but not limited to cardboard, paper, plastic, aluminum, steel, and glass. Deliver to nearest appropriate depot scrap and excess gypsum wallboard for recycling of this material. All costs associated with this requirement shall be included in the *Contract Price*.

1.20 INTERFERENCES

- .1 Coordinate placement of equipment to ensure that components will be properly accommodated within spaces provided prior to commencement of the *Work*.
- .2 Take complete responsibility for remedial *Work* that results from failure to coordinate aspects of *Work* prior to its fabrication/installation.
- .3 Ensure that accesses and clearance required by the Authorities Having Jurisdiction and/or for easy maintenance of equipment are provided in layout of equipment and services; notify the *Consultant* if indicated clearances are in conflict.
- .4 Prepare coordination and interference drawings in accordance with Section 01 33 00.

1.21 NOT IN CONTRACT ITEMS AND ITEMS SUPPLIED BY OWNER

- .1 NIC (Not In *Contract*) shall be used to designate various items of equipment that require coordination for installation although are not Provided as part of the *Work*.

- .2 SBO (Supplied by *Owner*) shall be used to designate various items of equipment that will be supplied by the *Owner* for installation by the *Contractor* as part of the *Work*.
- .3 Install items indicated as supplied by *Owner* (SBO) during the *Work*. Coordinate shipping and delivery with the *Owner*. Store items supplied by the *Owner* at the *Place of the Work* and protect from damage. Install completely, and leave in full operating condition, in accordance with manufacturer's directions.

1.22 SEISMIC DESIGN AND REQUIREMENTS

- .1 Design building components, assemblies and systems of the *Work*, as applicable, to meet seismic requirements pertinent to the location of the *Place of the Work* in accordance with the Ontario Building Code and comply with requirements of the Authorities Having Jurisdiction.
- .2 Post-Disaster Building: Conform to Ontario Building Code requirements for building classification,
- .3 'Post Disaster Building'. Elements of structures, non-structural components and equipment shall be designed in accordance with Ontario Building Code requirements for seismic design, connections, and seismic restraint for 'Post-Disaster Buildings'.
- .4 Vibrating equipment shall receive seismically designed vibration isolation. Only non-vibrating equipment are permitted to be secured to the structure. Structural connection shall be by means of direct connection to the structure by bolting, using rigid seismic restraints, or taught cable restraints. Connection to structure shall occur only at locations capable of withstanding the forces applied.
- .5 The proposed connections and general design of Products, equipment and systems shall be described in shop drawing format with identification and location of forces imposed on the structure. The shop drawings shall be stamped by a Professional Engineer qualified to practice in the *Place of the Work* and have the appropriate understanding of the issues at hand. The shop drawings shall be submitted for review to the *Consultant* prior to putting the *Work* in hand. The *Consultant* shall review these shop drawings for loads imposed on the structure.
- .6 The Contractor shall ensure that the Professional Engineer responsible for preparation of seismic engineered submittal reviews the *Work* and submits letters of general conformity for those parts of the *Work* in accordance with engineered submittal requirements of Section 01 33 00.

1.23 ELECTRONIC FILES

- .1 Electronic files (CAD) will not be released until Electronic Files Transfer Form, appended to this section, has been completed and returned to the *Consultant*. Requests for release of electronic files for Structural, Mechanical, Electrical, Civil or Landscape will require to be completed on their release forms upon request.
 - .1 *Subcontractors* and *Suppliers* requiring AutoCAD files shall make arrangements with the *Contractor*. The *Consultant* will not *Provide* AutoCAD files directly to *Subcontractors* or *Suppliers*.
 - .2 The *Consultant* will require a copyright waiver, and/or CAD data disclaimer, and/or BIM data disclaimer to be signed by the *Contractor* prior to delivery of such AutoCAD files.
 - .1 Copies of each of these disclaimers are appended to this Section for reference.
- .2 The *Consultant* or other *Consultants/subconsultants* may charge a fee for providing the electronic files as indicated in the CAD data disclaimer or otherwise at the *Consultant's* or other *Consultant's/Subconsultant's* discretion.

- .1 Payment, where required, shall be made directly to the other *Consultant/Subconsultant*, and not through the *Prime Consultant*.
- .3 CAD files shall only be released once payment has been made as stipulated on Electronic Files Transfer Form.

PART 2 - PRODUCTS

PART 3 - EXECUTION

CAD DATA DISCLAIMER

PROJECT NAME Vaughan Fire Station 1-12
PROJECT ADDRESS 9541 Weston Road, Vaughan

1. There is a retrieval / preparation fee associated with the release of electronic file requests. The fee is **\$250.00 plus applicable taxes per drawing**. The release of the drawings will be provided once this signed agreement and receipt of payment by e-transfer is provided to accounts@tbrownarch.com.
2. The release of electronic files by **Thomas Brown Architects Inc.** does not imply transfer of copyright and ownership. Electronic files shall remain the property of Thomas Brown Architects Inc., and in no case shall the transfer of these electronic files be considered a sale.
3. The copyright of this CAD data belongs to **Thomas Brown Architects Inc.** and it may not be altered or modified or copied or transferred to another company or individual, either in part or whole, without express written permission from **Thomas Brown Architects Inc.**. This material is being furnished for reference purposes only and has not been specially prepared for use by the recipient.
4. The information on the electronic files is considered instruments of service of **Thomas Brown Architects Inc.** and shall not be used for other projects, for additions to this *Project*, or completion of this *Project* by others.
5. This computer aided design (CAD) data is being provided at the request of and for the convenience of the recipient only. It may be incomplete, contain unintentional inaccuracies, or be partially obsolete. **Thomas Brown Architects Inc.** makes no warranties, either expressed or implied, of its merchantability and fitness for any particular purpose. The user is further warned that, while all digital CAD data appears to be extremely accurate, this apparent accuracy is an artifact of the techniques used to generate it and is in no way intended to imply actual accuracy. The user of this data takes full responsibility for the accuracy and correctness of all measurements, areas, inventories, etc. extracted from this data either manually or with the use of a computer.
6. The user is advised that any translation of CAD data from one computer system or environment to another can and often does result in the loss of important data. This loss can include, but may not be limited to: portions of text and dimensions; the existence, location or scale of symbols or other elements of graphics - the internal structure of data, including layers and data attributes; and the style or weight of lines. **Thomas Brown Architects Inc.** makes no representations as to the usability of this CAD data on any system.
7. Users of this computer data are advised to review all current versions, as well as subsequent versions, of *Project* documentation for inconsistencies and revisions. It is the responsibility of the user to identify and make all required revisions or corrections to this data. **Thomas Brown Architects Inc.** will not issue updates to CAD data.
8. **Thomas Brown Architects Inc.** reserves the right to remove all indications of its ownership and/or involvement from each electronic file.
9. The User agrees not to modify or alter the electronic documents in any way.
10. The User agrees not to use or reuse the electronic documents in any manner except as expressly permitted by this agreement.
11. By acceptance of this electronic media and the files it contains, the user agrees, to the fullest extent of the law, to indemnify and hold **Thomas Brown Architects Inc.** harmless from any damage, cost or liability, including but not limited to reasonable attorney's fees and cost of defense, arising from any changes made to these files by anyone other than **Thomas Brown Architects Inc.** or from reuse of files and data without the prior written consent of **Thomas Brown Architects Inc.**
12. While reasonable care has been used to ensure that the transfer medium and the material are free of computer viruses, **Thomas Brown Architects Inc.** accepts no responsibility for any loss or damage that might result from the transmission of computer viruses in this process.
13. **Thomas Brown Architects Inc.** believes that no licensing or copyright fees due to others on account of the release of electronic files, but to the extent that any are, the user of the files will pay the appropriate fees and hold **Thomas Brown Architects Inc.** harmless for such claims.
14. If shop drawings are issued by the *Contractor* which appears to have made unaltered use of the CAD files issued by **Thomas Brown Architects Inc.**, they will be returned without review. Under no circumstances can it be assumed that **Thomas Brown Architects Inc.** working drawings are sufficiently detailed to become documents for final manufacturing - in other words, shop drawings.

16. *Contractor* to identify which drawings are being requested and filled out in the chart provided.

[illegible]

We, the undersigned below, agree to all of the terms and conditions set forth in this Disclaimer.

Project: _____ Project Number: _____

Name of Contractor: _____

Address: _____

Name (Print): _____ Title: _____

Signature: _____ Date: _____

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

1.2 SECTION INCLUDES

- .1 1.1 General requirements
- .2 1.2 Section Includes
- .3 1.3 Cash Allowances

1.3 CASH ALLOWANCES

- .1 The *Contract Price* includes the cash allowances identified in the Schedule of Prices of the Bid Form.
- .2 Refer to GC 4.1 of the General Conditions of the Contract for provisions governing cash allowances.
- .3 Expenditures from Cash Allowance Stipulated Sum shall be directed by the *Consultant* in writing through a *Cash Allowance Disbursement Authorization* Form authorized by the *Owner* in writing.
- .4 Unexpended amounts of cash allowances shall be deducted from the *Contract Price* at completion of the *Work*.
- .5 Cash allowances cover the net cost to the *Contractor* of services, products, construction machinery and equipment, freight, unloading, handling, storage, installation, and other authorized expenses incurred in performing the *Work* stipulated under the cash allowances.
- .6 Cash allowances do not include the *Value Added Taxes* payable by the *Owner* to the *Contractor*.
- .7 Where cash allowances are noted for purchase only, the cost for storage at the *Place of the Work* and installation shall be part of the responsibility of the *Contractor* and all costs associated with the storage and installation shall be included in the *Contract Prices* and not in the cash allowance. Storage at the *Place of the Work* and installation shall be in accordance with the manufacturer's instructions.
- .8 The *Contractor* is responsible for coordination of parts of the *Work* to be paid for by cash allowance with the remainder of the *Work*, including *Shop Drawings* and other submittals, in the same manner as with its *Subcontractors*.
- .9 The *Contract Price*, and not the cash allowances, shall include the *Contractor's* overhead and profit in connection with all cash allowances.
- .10 The value of *Work* performed under a cash allowance is eligible to be included in progress payments. Copies of invoices pertaining to expenditures against the cash allowance shall be appended to applications for progress payments.
- .11 The *Contractor* shall prepare a schedule for the ordering of items called for under the cash allowances to avoid delaying the progress of the *Work*. Schedule shall be in accordance with Section 01 33 00 - Submittal Procedures.
- .12 The *Contractor* is required to notify the *Consultant* in writing at such time as when 75% of the total cash allowance stipulated price has been expended.

- .1 Inspection and Testing Services. The *Contractor* shall obtain a minimum of 3 quotes and *Provide* to the *Consultant* and the *Owner* for review prior to issuance of Cash Allowance Authorization (see also Sentence 13 below). Contractor shall proceed with obtaining 3 quotes at contract Award.
 - .2 Supply and Installation of Bunker Gear Grid
 - .3 Supply and Installation of Nederman Exhaust System
 - .4 Supply and Installation of PA System
 - .5 Supply and Installation of Fire Monitoring System
 - .6 Supply of Laundry System – Bunker Gear Washer
 - .7 Supply and Installation of CCTV and Security
 - .8 Supply and Installation of I.T. Cabling
 - .9 Supply and Installation of Murphy Beds.
 - .10 Supply and Installation of Dorm Beds.
 - .11 Gas Service Connection Supply and Installation of Gas Meter Assembly Connection. General Contractor shall coordinate with Authorities Having Jurisdiction.
 - .12 Water Service Connection
 - .13 Hydro Connection.
 - .14 EASR Registration for Generator
 - .15 Unforeseen Soil Conditions. The scope of this item is intended to cover the costs associated with the remediation of any existing unsuitable material or items discovered not otherwise identified in the Tender Documents.
- .13 Inspection and Testing Services quotes shall be submitted based on the following minimum number of visits / reports etc:

Activity		Estimated # of Visits
1	Below Grade	
1.1	Soils Compaction Testing - raising the subgrade trenches, infiltration gallery backfill, and foundation walls, etc.	10
1.2	Subgrade Inspection - building footprint, parking lot, retaining walls, etc.	5
1.3	Soils Compaction Testing - slab base course, parking lot basecourse, basecourse and interior walls	10
1.4	Concrete Testing (footings, foundation, retaining wall)	16
1.5	Concrete Cylinders/Cubes Pick Up	16
1.6	Compressive Strength Test	48
1.7	Grain Size Analysis	2
1.8	Standard Proctor Tests	4
1.9	Sieve Analysis	5
1.10	Soil Characterization Sampling and Analysis	3
1.11	Soil Characterization Report	1
1.12	Excess Soil Destination Report	2
2	Paving Systems	

2.1	Asphalt Paving Soils Compaction Inspection	2
2.2	Asphalt Full Marshall Test	2
2.3	Review of HL3 and HL8 Shop Drawing	1
3	Building Envelope	
3.1	Concrete Testing (Floor Slabs)	4
3.2	Concrete Cylinders/Cubes Pickup	4
3.3	Compressive Strength Test	12
3.4	Masonry Mortar Testing	4
3.5	Block Masonry Group Testing	4
3.6	Fireproofing, Fire Stop and Smoke Seal Inspection	3
3.7	Roofing/Metal Flashing Inspection	5
3.8	Thermal Insulation / Air Vapour Barrier Inspection	4
4	Steel	
4.1	Structural Steel Reinforcing Inspection	8
4.2	Structural Steel Inspection	5
4.3	Steel Deck Inspection	2

- .14 Contractor shall provide the Inspection and Testing Quote Breakdown / Structure for Submission of Proposals for Review:

1	Foundation Inspection	
	Number of Site Visits & Rate	
2	Sub-grade Inspection	
	Number of Site Visits & Rate	
3	Soil Characterization Report Sampling	
	Number of Site Visits & Rate	
4	Field Concrete Inspection	
	Number of Site Visits & Rate	
5	Field Compaction Inspection	
	Number of Site Visits & Rate	
6	Field Asphalt Inspection	
	Number of Site Visits & Rate	
7	Steel Inspection	
	Number of Site Visits & Rate	
8	Field Masonry Inspection	
	Number of Site Visits & Rate	
9	Reinforcing Steel Inspection	
	Number of Site Visits & Rate	
10	Roof System Inspection	
	Number of Site Visits & Rate	
11	Waterproofing Inspection	
	Number of Site Visits & Rate	
12	Air/Vapour Barrier Inspection	
	Number of Site Visits & Rate	
13	Laboratory Testing Fees	
	Soil Analysis - Soils Characterization Report	
	Soil Leachate Analysis - Soils Characterization Report	
	Cylinder Compressive Strength	
	Grout/Mortar Cube Compressive Strength	

	Gradation Analysis	
	Standard Proctor Determination	
	Marshall Properties	
	Asphalt Content and Gradation	
14	Professional Fees and Disbursements	
	Director	
	Project Manager	
	Environmental Technician	
	Steel Inspector	
	TOTAL	

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Or equivalent
- .4 1.4 *Product Substitution Procedures*

1.3 OR EQUIVALENT

- .1 Equivalent means an alternative product, material or manufacturer proposed by the Contractor during the course of the Contract and demonstrated to the Owner's and/or the Consultant's satisfaction as being equivalent to the particular product, material or manufacturer prescribed by the Contract Documents.
- .2 *Acceptable Equivalents* mean that a named *Product* alternate or equivalent, if selected for use in lieu of indicated or specified *Product*, meets or exceeds performance, appearance, general arrangement, dimensions, availability, code and standards compliance, and colour of specified *Product*. The *Contractor* shall be responsible for all costs and modifications associated with the inclusion of named *Product* alternate or equivalent at no additional cost to the *Owner*.
- .3 The process for the Contractor's proposal and the Consultant's review of the proposed alternates or equivalents shall be the same process as for proposing and reviewing product substitutions.
- .4 Confirm delivery of specified items prior to proposing alternates or equals.

1.4 PRODUCT SUBSTITUTION PROCEDURES

- .1 Base the *Work* of this *Contract* and the *Contract Price* upon using the new materials and *Products* specified.
- .2 Where materials and *Products* are specified only by reference to standards, *Provide* any material or *Product* that meets the standard.
- .3 Materials and *Products* specified by their proprietary names or catalogue number shall form the basis for the *Work*. Substitutes for these *Products* may be proposed in accordance with the provisions of this Section and must be authorized by the Consultant in writing.
- .4 Where a material or *Product* is specified by naming two or more acceptable materials or proprietary *Products*, *Provide* any one of the specified materials or *Products*. If compliance with a referenced standard is also specified, the material or *Product* selected shall meet the standard.
- .5 Substitutions will be considered only when submitted in sufficient time to permit proper investigation by the *Consultant*, and under the conditions specified in this Section.
- .6 Requests for substitution may only be considered if submitted within 30 Days after the *Contract* award. Requests for substitutions submitted after 30 Days after the *Contract* award may not be considered.

- .7 There is no obligation on the part of the *Consultant* or the *Owner* to accept any proposed substitutions that, in the *Consultant's* or the *Owner's* opinion, acting reasonably, do not meet the requirements of the *Contract Documents*, including this Section.
- .8 Substitutions proposed may be considered on the condition that the proposed substitute materials and *Products*, having been brought to the attention of, and considered by, the *Consultant* as equivalent to those specified, will not increase the *Contract Price* or the *Contract Time*.
- .9 When proposing substitutions, the *Contractor* shall submit with each application, the material and *Product* names and complete specifications substantiating compliance of the proposed substitution with the requirements of the *Contract Documents*, including:
 - .1 *Product* Identification.
 - .2 Detailed, item by item comparison between the properties and characteristics of the specified material or *Product*, and the proposed substitution.
 - .3 Manufacturer's name, address, and telephone number.
 - .4 Manufacturer's material or *Product* literature.
 - .5 Performance, technical and test data.
 - .6 Reference standards.
 - .7 *Product* limitations.
 - .8 Samples.
 - .9 List of existing installations.
 - .10 Changes to the *Contract Time*, if any.
 - .11 Changes to the *Contract Price* if any.
- .10 In making a request for substitution, the *Contractor* represents that:
 - .1 The *Contractor* has personally investigated the proposed *Product* or method, and has determined that it is equal or superior in all respects to that specified;
 - .2 The *Contractor* will *Provide* the same guarantee for the substituted *Product* or method as for the *Product* or method specified or indicated;
 - .3 The *Contractor* will coordinate the installation of an accepted substitution into the *Work*, making such changes as may be required for the *Work* to be complete in all respects;
 - .4 The *Contractor* waives all claims for additional costs related to the substitution; and,
 - .5 The cost data provided by the *Contractor* as part of the *Contractor's* substitution proposal is complete and includes all related costs including, but not limited to:
 - .1 Coordination and supervision;
 - .2 Installation and independent inspection and testing;
 - .3 Any change in the cost of other affected areas; and,
 - .4 Costs for any detailed design or related engineering work.

- .11 Should the proposed substitution be accepted, either in part or in whole, the *Contractor* assumes full responsibility when the substitution affects any other part of the *Work*.
- .12 The *Contractor* shall ensure that substitutions are accommodated by space allotted for the specified materials, *Products*, methods or processes.
- .13 The cost of changes in the work of all Specification Sections necessitated by the use of proposed substitutions will not be considered or approved as a change in the *Work* and no increase in the *Contract Time* will be considered or approved.
- .14 Substitutions that have not been accepted through the process described in this Section and are shown on *Shop Drawings*, will be rejected, whether or not the *Shop Drawings* have been reviewed.
- .15 Credits arising from accepted substitutions will be credited to the *Contract Price* by way of a *Change Order* in accordance with Section 01 26 00 - Contract Modification and Requests for Interpretation
- .16 No substitutions shall be permitted without prior written recommendation by the *Consultant* and prior written approval by the *Owner*, acting reasonably.
- .17 The *Consultant's* decision concerning acceptance or rejection of proposed substitutions is final.
- .18 For all proposed substitutions, the *Contractor* shall complete and submit a Substitution Request Form in the format listed in Section 01 25 01 – Substitution Request Form.

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

From: _____ **RFS No:** _____
To: _____ (RFS No. To be completed by Consultant)
Copies: _____ **Issue Date:** _____

Product, Material or Equipment Required of the Contract Documents:

Specification Section: _____ Drawing No./Detail: _____
Description: _____

Requested Substitute Product, Material or Equipment:

Description: _____

Attachments Included: ☐ Drawings ☐ Product Data ☐ Samples ☐ Test Reports
☐ Other: _____

Reason for Substitution: _____

Expected Lifespan: _____ Warranty Duration _____

Maintenance Regime: _____

Has this item been used in a similar application? ☐ Yes ☐ No

Describe Application: _____

Describe Results: _____

Owner Contact and Location: _____

Comparisons of the Specified Item and the Proposed Substitution:

Compare significant qualities of size, weight, durability, performance and visual effect:

—
—

Describe any changes required in other elements of the *Work* to accommodate the proposed substitution, including work performed by the *Owner*, Contractor and/or its Subcontractors:

—
—

What effect will the proposed substitution have on the work schedule in comparison to the work schedule without approval of the proposed substitution?

–
–

Cost comparison of the proposed substitution to the originally specified item, including correlating modifications required to other work:

–
–

Net cost to the *Owner*: _____

Changes in *Contract Time*: _____

Signatures:

Permission to make any substitution after award of the *Contract* shall be effected by *Change Order*. It shall not relieve the *Contractor* from the responsibility for any deficiency that may exist in the substituted *Product* or any departures or deviations from the *Contract Documents* as modified by such *Change Order*.

Except as otherwise expressly specified by the *Contractor* in the request for substitution and expressly approved in such *Change Order*, the *Contractor* shall be deemed to warrant, by its request, that the proposed substitute will satisfy all standards and requirements which would have been satisfied by using the original *Product*, material or equipment specified in the *Contract Documents* and the *Change Order* shall not be deemed to modify the *Contract Documents* with respect thereto.

If any substitution will affect a correlated function, adjacent construction, or the work of other Subcontractors, the necessary changes and modifications to the affected work shall be considered as an essential part of the proposed substitution, to be accomplished by the *Contractor* without additional time or expense to the *Owner* if and when accepted.

Contractor's Signature: _____

Date: _____

Consultants' Action:

Consultant's Name: _____

Consultant's Signature: _____ *Date:* _____

☐ Accepted ☐ Rejected ☐ More information required.

Comments: _____

Consultant's Name: _____

Consultant's Signature: _____ *Date:* _____

☐ Accepted ☐ Rejected ☐ More information required.

Comments: _____

Consultant's Name: _____

Consultant's Signature: _____ *Date:* _____

☐ Accepted ☐ Rejected ☐ More information required.

Comments: _____

Consultant's Name: _____

Consultant's Signature: _____ *Date:* _____

☐ Accepted ☐ Rejected ☐ More information required.

Comments: _____

Consultant's Name: _____

Consultant's Signature: _____ *Date:* _____

☐ Accepted ☐ Rejected ☐ More information required.

Comments: _____

End of Section

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Related Sections
- .4 1.4 Changes
- .5 1.5 *Change Order*
- .6 1.6 Valuation of Changes and *Contractor's* Mark-Up
- .7 1.7 Delays
- .8 1.8 Request for Interpretation (RFI)

1.3 RELATED SECTIONS

- .1 Section 01 21 00 - Cash Allowances
- .2 Section 01 25 00 - Product Substitution Procedures

1.4 CHANGES

- .1 Refer to Part 6 – Changes in the Work of the General Conditions of the *Contract*.
- .2 The *Owner*, through the *Consultant*, without invalidating the *Contract*, may make changes in the *Work* consisting of additions, deletions, or other revisions to the *Work* by *Change Order* or a *Change Directive*.
- .3 The *Contractor* shall not perform a change in the *Work* without a *Change Order* or a *Change Directive*.
- .4 The *Consultant* will prepare and issue Notices of Change, *Change Orders*, and *Change Directives*.
- .5 Communication and correspondence related to all changes shall, at all times, be through the *Consultant*.

1.5 CHANGE ORDER

- .1 Refer to GC 6.2 – Change Order of the General Conditions of the *Contract*.
- .2 When a change in the *Work* is proposed by the *Owner* or the *Consultant* or required by conditions at the *Place of the Work* or *Authorities Having Jurisdiction*, the *Consultant* shall *Provide* a notice describing the proposed change in the *Work* to the *Contractor*, to be known as a *Notice of Change*.
- .3 *Changes in the Work* proposed by the *Contractor* shall be in accordance with Section 01 25 00 - Product Substitution Procedures. Proposed changes not in accordance with the requirements of Section 01 25 00 shall not be considered.
- .4 Upon receipt of a *Notice of Change* from the *Consultant*, the *Contractor* shall present, in a form acceptable to the *Consultant* and within ten (10) *Working Days* of the date on the *Notice of*

Change, a method of adjustment or an amount of adjustment for the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change in the *Work*.

- .5 The *Contractor* shall number its pricing quotes in one sequence in order submitted to the *Consultant*.
- .6 When the *Owner* and the *Contractor* agree to the adjustments in the *Contract Price* and *Contract Time*, or to the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a *Change Order*, signed by the *Owner* and the *Contractor*. The value of the *Work* performed as the result of a *Change Order* shall be included in applications for progress payment as expenditures.

1.6 VALUATION OF CHANGES AND CONTRACTOR'S MARK-UP

- .1 Valuation and the *Contractor's* mark-up for overhead and profit for changes in the *Work* shall be calculated in accordance with the provisions of the General Conditions.

1.7 DELAYS

- .1 Refer to GC 6.5 - Delays of the General Conditions of the *Contract*.

1.8 REQUEST FOR INTERPRETATION (RFI)

- .1 A request for interpretation (RFI) is a formal process used during the *Work* to obtain an interpretation of the *Contract Documents*.
 - .1 An *RFI* shall not constitute notice of claim for a delay or increase to the *Contract Price*.
- .2 Submittal procedures:
 - .1 *RFI* form:
 - .1 Submit *RFI* on "Request for Interpretation" form as approved by the *Consultant*.
 - .2 Where *RFI* form does not *provide* sufficient space for complete information to be provided thereon, attach additional sheets as required.
 - .3 Submit with *RFI* form necessary supporting documentation. The *Consultant* shall not respond to an *RFI* where necessary information is missing, insufficient, unclear, or ambiguous.
 - .2 *RFI* log:
 - .1 Maintain log of *RFIs* sent to and responses received from the *Consultant*, complete with corresponding dates.
 - .2 Submit updated log of *RFIs* with each meeting for coordination.
 - .3 Submit *RFIs* sufficiently in advance of affected parts of the *Work* so as not to cause delay in the performance of the *Work*. Costs resulting from failure to do this will not be paid by the *Owner*.
 - .4 *RFIs* shall be submitted only to the *Consultant* and copied to the *Owner*.
 - .5 *RFIs* shall be submitted only by the *Contractor*. *RFIs* submitted by *Subcontractors* or *Suppliers* shall not be accepted.
 - .6 Number *RFIs* consecutively in one sequence in order submitted.
 - .7 Submit one distinct *RFI* per *RFI* form.

- .8 The *Consultant* shall review *RFIs* from the *Contractor* submitted in accordance with this Section, with the following understandings:
 - .1 The *Consultant's* response shall not be considered as a *Change Order* or *Change Directive*, nor does it authorize changes in the *Contract Price* or *Contract Time* or changes in the *Work*.
 - .2 Only the *Consultant* shall respond to *RFIs*. Responses to *RFIs* received from entities other than the *Consultant* shall not be considered.
- .9 Allow ten (10) *Working Days* for review of each *RFI* by the *Consultant*.
 - .1 The *Consultant's* review of *RFI* commences on date of receipt by the *Consultant* of *RFI* submittal and extends to date *RFI* returned by the *Consultant*.
 - .2 When the *RFI* submittal is received by the *Consultant* before noon, review period commences that *Day*; when *RFI* submittal is received by the *Consultant* after noon, review period begins on the next *Working Day*.
 - .3 If, at any time, the *Contractor* submits a large enough number of *RFIs* such that the *Consultant* cannot process these *RFIs* within ten (10) *Working Days*, the *Consultant*, will confer with the *Contractor* within one (1) *Working Day* of receipt of such *RFIs*, and the *Consultant* and the *Contractor* will jointly prepare an estimate of the time necessary for processing same as well as an order of priority between the *RFIs* submitted. The *Contractor* shall accommodate such necessary time at no increase in the *Contract Time* and at no additional cost to the *Owner*.
 - .4 When *RFI* submittal shall be reviewed by one or more of *Consultant's* subconsultants, increase the review period by five (5) *Working Days* for each separate subconsultant, in which case, the *Consultant* will notify the *Contractor* of the additional time applicable for the review of the *RFI*.
- .10 The *Contractor* shall satisfy itself that an *RFI* is warranted by undertaking a thorough review of the *Contract Documents* to determine that the claim, dispute, or other matters in question relating to the performance of the *Work* or the interpretation of the *Contract Documents* cannot be resolved by direct reference to the *Contract Documents*. The *Contractor* shall describe in detail this review on the *RFI* form as part of the *RFI* submission. *RFI* submittals that lack such detailed review description, or where the detail provided is, in the opinion of the *Consultant*, insufficient, shall not be reviewed by the *Consultant* and shall be rejected.

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Schedule Of Values
- .4 1.4 Form Of Submittal
- .5 1.5 Review And Re-Submittal
- .6 1.6 Schedule Of Values Form Sample

1.3 SCHEDULE OF VALUES

- .1 Submit a Schedule of Values to the *Consultant* at least 10 Working Days prior to submitting first application for payment. Refer to attached sample Schedule of Values in subsection 1.6 of this Section for required breakdowns in each Division.
 - .1 For item 01 77 00 - Contract Closeout Procedures and Submittals, *Project Manuals*, *Warranties* and *As-Built Drawings*, the *Contractor* is required to carry a value 2% of the *Contract Price* in accordance with Section 01 77 00.
 - .2 Division 1 – General Conditions shall be broken down as provided in the example below. Lump Sum Values will not be accepted and will not be used for *Contract* modifications or Delays.
- .2 Upon request by the *Consultant*, support values given with data that will substantiate their correctness.
- .3 Submit quantities of designated materials.
- .4 Refer to the General Conditions of the *Contract* for details of payment procedure.
- .5 Schedule of Values will be used only as basis for *Contractor's* application for payment.

1.4 FORM OF SUBMITTAL

- .1 Submit Schedule of Values on 8½" x 11" white paper, in accordance with sample schedule included in this Section at the end of each month.
- .2 With the submission of the initial Schedule of Values, the *Contractor* shall submit an initial Cash Flow Projection for the *Project*. With each application for payment, the *Contractor* shall submit an updated Cash Flow Projection.

1.5 REVIEW AND RE-SUBMITTAL

- .1 After review by the *Consultant*, revise and resubmit Schedule (and Working Schedule of Material Values), as required.
- .2 Resubmit revised schedule in same manner.

1.6 SCHEDULE OF VALUES FORM SAMPLE

- .1 The following schedule of values form provided is to be used as a guide in providing the proper breakdown for each division.
- .2 General Contractor and subcontractors shall provide breakdowns between material and labour costs, as well as costs of component breakdowns as illustrated in the sample form. (i.e – Brick Masonry, Block Masonry, Insulation, Masonry Accessories, etc).

Client: Client Name		Document 01 29 73						
Project Name: Project Name								
Project Number: ####								
Consultant: Thomas Brown Architects Inc.		Application for Payment #: N/A						
Contractor: Name of Contractor		Issue Date: September 23, 2020						
		For Period Ending: TBD						
Spec. Section	Item	Contract Amount	% to Date	Previous Amount	Amount This Draw	Completed to Date	Balance to Complete	
Division 1 General Conditions								
00 61 00	Bonding	\$	-	0.0%	\$	-	\$	-
00 73 16	Insurance	\$	0.0%	\$	-	\$	-	\$
01 30 00	General Site Administration	\$	0.0%	\$	-	\$	-	\$
01 30 00	General Project Administration	\$	0.0%	\$	-	\$	-	\$
01 31 00	Mobilization	\$	0.0%	\$	-	\$	-	\$
01 31 00	Demobilization	\$	0.0%	\$	-	\$	-	\$
01 50 00	Temporary Power	\$	0.0%	\$	-	\$	-	\$
01 31 00	Site Office Trailer / Setup	\$	0.0%	\$	-	\$	-	\$
01 31 00	Temporary Fencing / Silt Fence Maintenance	\$	0.0%	\$	-	\$	-	\$
01 50 00	Preliminary Survey	\$	0.0%	\$	-	\$	-	\$
01 50 00	Locates	\$	0.0%	\$	-	\$	-	\$
01 31 00	Final Cleanup	\$	0.0%	\$	-	\$	-	\$
01 77 00	Project Closeout Manuals/Documentation	\$	0.0%	\$	-	\$	-	\$
01 77 00	Project Closeout As-Builts	\$	0.0%	\$	-	\$	-	\$
01 91 00	Commissioning & Training	\$	0.0%	\$	-	\$	-	\$
Division 1 General Conditions subtotal:		\$	-	0.0%	\$	-	\$	-
Division 2 Site Improvements								
02 27 00	Erosion & Sediment Control	\$	-	0.0%	\$	-	\$	-
02 27 10	Mud Mat	\$	0.0%	\$	-	\$	-	\$
04 40 20	Armourstone	\$	0.0%	\$	-	\$	-	\$
	Gravel Beds	\$	0.0%	\$	-	\$	-	\$
	Municipal Signage	\$	0.0%	\$	-	\$	-	\$
31 05 17	Aggregates	\$	0.0%	\$	-	\$	-	\$
31 23 10	Excavation	\$	0.0%	\$	-	\$	-	\$
31 23 10	Backfill	\$	0.0%	\$	-	\$	-	\$
32 01 90	Tree Protection	\$	0.0%	\$	-	\$	-	\$
32 11 19	Granular Sub-base	\$	0.0%	\$	-	\$	-	\$
32 11 23	Granular Base	\$	0.0%	\$	-	\$	-	\$
32 12 16	Asphalt Paving	\$	0.0%	\$	-	\$	-	\$
32 13 13	Concrete Curbs, Sidewalks, Pads	\$	0.0%	\$	-	\$	-	\$
	Concrete Apron Slab	\$	0.0%	\$	-	\$	-	\$
	Concrete Apron Slab - Reinforcing	\$	0.0%	\$	-	\$	-	\$
32 14 13.19	Precast Concrete Unit Paving	\$	0.0%	\$	-	\$	-	\$
32 17 23	Traffic Markings	\$	0.0%	\$	-	\$	-	\$
32 31 13	Chain Link Fence	\$	0.0%	\$	-	\$	-	\$
32 33 00	Site Furnishings	\$	0.0%	\$	-	\$	-	\$
32 91 19.13	Topsoil Placement and Grading	\$	0.0%	\$	-	\$	-	\$
32 92 23	Sodding	\$	0.0%	\$	-	\$	-	\$
32 93 00	Trees, Shrubs, plants	\$	0.0%	\$	-	\$	-	\$
33 05 00	Manholes and Catchbasins	\$	0.0%	\$	-	\$	-	\$
33 10 00	Site Services - Water System	\$	0.0%	\$	-	\$	-	\$
33 10 00	Site Services - Water System - Chlorination of System	\$	0.0%	\$	-	\$	-	\$
33 30 00	Site Services - Sanitary Sewers	\$	0.0%	\$	-	\$	-	\$
33 40 00	Site Services - Storm Sewers	\$	0.0%	\$	-	\$	-	\$
33 44 16	Precast Trench Drain Systems Material	\$	0.0%	\$	-	\$	-	\$
33 44 16	Precast Trench Drain Systems Labour	\$	0.0%	\$	-	\$	-	\$
Division 2 Site Improvements subtotal:		\$	-	0.0%	\$	-	\$	-
Division 3 Concrete								
03 10 00	Concrete Formwork - Foundation and Footings	\$	-	0.0%	\$	-	\$	-
03 20 00	Concrete Reinforcing Install - Foundation and Footings	\$	0.0%	\$	-	\$	-	\$
03 20 00	Concrete Reinforcing Supply - Foundation and Footings	\$	0.0%	\$	-	\$	-	\$
03 20 00	Concrete Reinforcing Install - Slab on Grade	\$	0.0%	\$	-	\$	-	\$
03 20 00	Concrete Reinforcing Supply - Slab on Grade	\$	0.0%	\$	-	\$	-	\$
03 30 53	Cast in Place Concrete Supply - Foundation and Footings	\$	0.0%	\$	-	\$	-	\$
03 30 53	Cast in Place Concrete Supply - Slab on Grade	\$	0.0%	\$	-	\$	-	\$
03 41 13	Precast Concrete Hollow Core Planks	\$	0.0%	\$	-	\$	-	\$
03 45 00	Architectural Precast Concrete Cladding	\$	0.0%	\$	-	\$	-	\$
03 50 00	Concrete Sealer	\$	0.0%	\$	-	\$	-	\$
03 50 00	Concrete Finishing	\$	0.0%	\$	-	\$	-	\$
Division 3 Concrete subtotal:		\$	-	0.0%	\$	-	\$	-
Division 4 Masonry								
04 21 00	Brick Masonry Install	\$	-	0.0%	\$	-	\$	-
04 21 00	AVB & Insulation	\$	0.0%	\$	-	\$	-	\$
04 22 00	Concrete Block Masonry Interior	\$	0.0%	\$	-	\$	-	\$
04 22 00	Concrete Block Masonry Exterior	\$	0.0%	\$	-	\$	-	\$
Division 4 Masonry subtotal:		\$	-	0.0%	\$	-	\$	-
Division 5 Metals								
05 21 19	Structural Steel Supply	\$	-	0.0%	\$	-	\$	-
05 21 19	Structural Steel Labour	\$	0.0%	\$	-	\$	-	\$
05 21 19	OWSJ Supply	\$	0.0%	\$	-	\$	-	\$
05 21 19	OWSJ Labour	\$	0.0%	\$	-	\$	-	\$
05 31 00	Steel Roof Decking Material	\$	0.0%	\$	-	\$	-	\$
05 31 00	Steel Roof Decking Labour	\$	0.0%	\$	-	\$	-	\$
05 31 00	Steel Floor Decking Material	\$	0.0%	\$	-	\$	-	\$
05 31 00	Steel Floor Decking Labour	\$	0.0%	\$	-	\$	-	\$
05 31 00	Roof Ladder and Guard Rails	\$	0.0%	\$	-	\$	-	\$
05 41 00	Cold-Formed Metal Structural Stud - Material	\$	0.0%	\$	-	\$	-	\$
05 41 00	Cold-Formed Metal Structural Stud - Labour	\$	0.0%	\$	-	\$	-	\$
05 50 00	Metal Fabrications / Miscellaneous Material	\$	0.0%	\$	-	\$	-	\$
05 50 00	Metal Fabrications / Miscellaneous Labour	\$	0.0%	\$	-	\$	-	\$
05 50 01	Bollard Covers	\$	0.0%	\$	-	\$	-	\$
05 73 10	Glass Railing Systems - Material	\$	0.0%	\$	-	\$	-	\$
05 73 10	Glass Railing Systems - Labour	\$	0.0%	\$	-	\$	-	\$
Division 5 Metals subtotal:		\$	-	0.0%	\$	-	\$	-
Division 6 Woods, Plastics								
06 10 10	Rough Carpentry / Blocking	\$	-	0.0%	\$	-	\$	-
60 20 00	Architectural Wood Work Fabrication & Material	\$	0.0%	\$	-	\$	-	\$
60 20 00	Architectural Wood Work Labour	\$	0.0%	\$	-	\$	-	\$
60 20 00	Countertop / Solid Surface Sills	\$	0.0%	\$	-	\$	-	\$
Division 6 Woods, Plastics subtotal:		\$	-	0.0%	\$	-	\$	-

Division 7 Thermal & Moisture Protection										
07 13 26	Sheet Waterproofing	\$	-	0.0%	\$	-	\$	-	\$	-
07 21 00	Cavity Wall Thermal Insulation	\$	-	0.0%	\$	-	\$	-	\$	-
07 21 00	Below Grade Thermal Insulation - Slab & Foundation Wall	\$	-	0.0%	\$	-	\$	-	\$	-
07 26 13	Above Grade Vapour Barrier	\$	-	0.0%	\$	-	\$	-	\$	-
07 26 16	Below Grade Vapour Barrier	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Panel Cladding - Panel Material	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Panel Cladding - Panel Labour	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Panel Cladding - Insulation Material	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Panel Cladding - Insulation Labour	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Plate Cladding - Panel Material	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Plate Cladding - Panel Labour	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Plate Cladding - Insulation Material	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 16	Aluminum Plate Cladding - Insulation Labour	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 19	Metal Cladding System - Soffit Material	\$	-	0.0%	\$	-	\$	-	\$	-
07 46 19	Metal Cladding System - Soffit Labour	\$	-	0.0%	\$	-	\$	-	\$	-
07 52 16	SBS Modified Bituminous Membrane Roofing	\$	-	0.0%	\$	-	\$	-	\$	-
07 52 16	SBS Modified Bituminous Membrane Roofing - Insulation	\$	-	0.0%	\$	-	\$	-	\$	-
07 52 16	Roofing Pavers	\$	-	0.0%	\$	-	\$	-	\$	-
07 62 00	Metal Flashing	\$	-	0.0%	\$	-	\$	-	\$	-
07 62 00	Roof Anchor Line	\$	-	0.0%	\$	-	\$	-	\$	-
07 81 00	Sprayed Fire-Resistive Materials (SFRM)	\$	-	0.0%	\$	-	\$	-	\$	-
07 84 00	Firestopping and Smoke Seals	\$	-	0.0%	\$	-	\$	-	\$	-
07 92 00	Joint Sealants	\$	-	0.0%	\$	-	\$	-	\$	-
Division 7 Thermal & Moisture Protection subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 8 Openings										
08 11 13	Steel Doors and Frames - Supply	\$	-	0.0%	\$	-	\$	-	\$	-
08 11 13	Steel Doors and Frames - Install	\$	-	0.0%	\$	-	\$	-	\$	-
08 33 00	Rolling Grilles	\$	-	0.0%	\$	-	\$	-	\$	-
08 33 30	Rolling Fire Doors	\$	-	0.0%	\$	-	\$	-	\$	-
08 35 13	Four Fold Metal Doors	\$	-	0.0%	\$	-	\$	-	\$	-
08 36 13	Sectional Overhead Metal Doors	\$	-	0.0%	\$	-	\$	-	\$	-
08 41 00	Aluminum Framed Glazing Systems c/w Glass	\$	-	0.0%	\$	-	\$	-	\$	-
08 71 00	Door Hardware - Material	\$	-	0.0%	\$	-	\$	-	\$	-
08 71 00	Door Hardware - Install	\$	-	0.0%	\$	-	\$	-	\$	-
08 91 19	Architectural Louvers	\$	-	0.0%	\$	-	\$	-	\$	-
Division 8 Openings subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 9 Finishes										
09 29 00	Drywall & Framing	\$	-	0.0%	\$	-	\$	-	\$	-
09 31 00	Tiling - Floor	\$	-	0.0%	\$	-	\$	-	\$	-
09 31 00	Tiling - Wall	\$	-	0.0%	\$	-	\$	-	\$	-
09 21 16	Acoustical Tile Ceiling Systems	\$	-	0.0%	\$	-	\$	-	\$	-
09 65 13	Rubber Base	\$	-	0.0%	\$	-	\$	-	\$	-
09 65 20	Rubber Tile Flooring	\$	-	0.0%	\$	-	\$	-	\$	-
09 68 13	Carpet Tile	\$	-	0.0%	\$	-	\$	-	\$	-
09 91 00	Painting	\$	-	0.0%	\$	-	\$	-	\$	-
Division 9 Finishes subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 10 Specialties										
10 11 00	Visual Display Surfaces	\$	-	0.0%	\$	-	\$	-	\$	-
10 14 00	Interior Signage	\$	-	0.0%	\$	-	\$	-	\$	-
10 21 13	Washroom Partitions	\$	-	0.0%	\$	-	\$	-	\$	-
10 26 13	Corner Guards	\$	-	0.0%	\$	-	\$	-	\$	-
10 28 10	Washroom Accessories & Janitor Accessories	\$	-	0.0%	\$	-	\$	-	\$	-
10 50 30	Turnout Gear Lockers - Wall Mounted	\$	-	0.0%	\$	-	\$	-	\$	-
10 51 13	Prefinished Metal Lockers	\$	-	0.0%	\$	-	\$	-	\$	-
10 51 13	Exterior Signage	\$	-	0.0%	\$	-	\$	-	\$	-
10 51 13	Traffic Signage	\$	-	0.0%	\$	-	\$	-	\$	-
10 51 13	Metal Shelving	\$	-	0.0%	\$	-	\$	-	\$	-
10 75 13	Flagpoles	\$	-	0.0%	\$	-	\$	-	\$	-
Division 10 Specialties subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 11 Equipment										
11 52 13	Projection Screens	\$	-	0.0%	\$	-	\$	-	\$	-
Division 11 Equipment subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 12 Furnishings Equipment										
12 24 16	Roller Window Shades	\$	-	0.0%	\$	-	\$	-	\$	-
12 48 16	Entrance Floor Grilles	\$	-	0.0%	\$	-	\$	-	\$	-
12 58 29.14	Murphy Bed Mattresses	\$	-	0.0%	\$	-	\$	-	\$	-
Division 12 Furnishings subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 14 Conveying Equipment										
14 21 00	Electric Traction Elevators	\$	-	0.0%	\$	-	\$	-	\$	-
Division 14 Conveying Equipment subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 1 General Conditions subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 2. Site Improvements subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 3 - 14 Architectural / Structural		\$	-	0.0%	\$	-	\$	-	\$	-
MECHANICAL SYSTEMS										
Division 21 Fire-Suppression System										
21 00 00	Sprinkler System	\$	-	0.0%	\$	-	\$	-	\$	-
	Fire Extinguishers	\$	-	0.0%	\$	-	\$	-	\$	-
	Manuals/Documentation/As-builts	\$	-	0.0%	\$	-	\$	-	\$	-
Division 21 Fire-Suppression System subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 22 Plumbing										
22 00 00	Plumbing Piping Materials - Below Ground	\$	-	0.0%	\$	-	\$	-	\$	-
	Plumbing Piping Materials - Above Ground	\$	-	0.0%	\$	-	\$	-	\$	-
	Plumbing Piping Labour - A & B	\$	-	0.0%	\$	-	\$	-	\$	-
	Plumbing Fixtures & Accessories Material	\$	-	0.0%	\$	-	\$	-	\$	-
	Plumbing Fixtures & Accessories Labour	\$	-	0.0%	\$	-	\$	-	\$	-
	Plumbing - HWT, EXP, Boilers Material	\$	-	0.0%	\$	-	\$	-	\$	-
	Plumbing - HWT, EXP, Boilers Labour	\$	-	0.0%	\$	-	\$	-	\$	-
	Seismic Restraints	\$	-	0.0%	\$	-	\$	-	\$	-
Division 22 Plumbing subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
Division 23 Heating, Ventilating, and Air Conditioning (HVAC)										
23 00 00	Vehicle Exhaust Extraction Systems	\$	-	0.0%	\$	-	\$	-	\$	-
	Mechanical Equipment Supply (FC, RTU, Split S, ERV)	\$	-	0.0%	\$	-	\$	-	\$	-
	Mechanical Equipment Install (FC, RTU, Split S, ERV)	\$	-	0.0%	\$	-	\$	-	\$	-
	Mechanical Equipment Supply (IRH)	\$	-	0.0%	\$	-	\$	-	\$	-

Mechanical Equipment Install (IRH)	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Gas Piping Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Gas Piping Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Duct Work - Sheet Metal Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Duct Work - Sheet Metal Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Refrigeration Piping	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Insulation Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Insulation Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Packaged Exhaust Fans	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Grilles, Diffusers, and Registers	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Seismic Restraints	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Division 23 Heating, Ventilating, and Air Conditioning subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Division 25 Integrated Automation										
25 00 00 Building Automation Controls Materials	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Building Automation Control Install	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Building Automation Training	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Division 25 Integrated Automation subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Division 22, 23, 35 General Requirements										
Mobilization	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Manuals/Documentation/As-builts	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Testing, Adjusting, and Balancing	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Division 22, 23, 35 General Requirements subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Divisions 21, 22, 23, 25 Mechanical subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Division 26/27/28 Electrical										
Mobilization and ESA Notifications	\$	-	0.0%	\$	-	\$	-	\$	-	\$
ESA Inspections	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Duct Bank - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Duct Bank - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Metering - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Metering - Install	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Generator - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Generator - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Exterior Light Fixtures - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Exterior Light Fixtures - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Interior Light Fixtures - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Interior Light Fixtures - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Device Rough-in - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Device Rough-in - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Branch Conduit - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Branch Conduit - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Branch Wiring - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Branch Wiring - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Distribution Equipment - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Distribution Equipment - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Fire Alarm - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Fire Alarm - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Testing, Adjusting, and Commissioning	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Manuals/Documentation/As-builts	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Division 26/27/28 Electrical subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Divisions 26, 27, 28 Electrical subtotal:		-	0.0%		-		-		-	\$
Base Contract subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Cash Allowances:										
1 Inspection and Testing	\$	-	0.0%	\$	-	\$	-	\$	-	\$
2 Hydro Connection	\$	-	0.0%	\$	-	\$	-	\$	-	\$
3 Supply and Install of Structured Cabling	\$	-	0.0%	\$	-	\$	-	\$	-	\$
4 Gas Meter assembly Connection	\$	-	0.0%	\$	-	\$	-	\$	-	\$
5 Exterior Building Signage	\$	-	0.0%	\$	-	\$	-	\$	-	\$
6 Interior Building Signage	\$	-	0.0%	\$	-	\$	-	\$	-	\$
7 Soil Remediation	\$	-	0.0%	\$	-	\$	-	\$	-	\$
8	\$	-	0.0%	\$	-	\$	-	\$	-	\$
9	\$	-	0.0%	\$	-	\$	-	\$	-	\$
10	\$	-	0.0%	\$	-	\$	-	\$	-	\$
11	\$	-	0.0%	\$	-	\$	-	\$	-	\$
12	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Cash Allowance subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Contract subtotal:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Change Order										
1 CO title	\$	-	0.0%	\$	-	\$	-	\$	-	Approved
2	\$	-	0.0%	\$	-	\$	-	\$	-	\$
3	\$	-	0.0%	\$	-	\$	-	\$	-	\$
4	\$	-	0.0%	\$	-	\$	-	\$	-	\$
5	\$	-	0.0%	\$	-	\$	-	\$	-	\$
6	\$	-	0.0%	\$	-	\$	-	\$	-	\$
7	\$	-	0.0%	\$	-	\$	-	\$	-	\$
8	\$	-	0.0%	\$	-	\$	-	\$	-	\$
9	\$	-	0.0%	\$	-	\$	-	\$	-	\$
10	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Change Order	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Contract amount:	\$	-	0.0%	\$	-	\$	-	\$	-	\$
Issued Change Directives:										
1 CD title		-	0.0%		-		-		-	Approved
2		-	0.0%		-		-		-	
3		-	0.0%		-		-		-	
4		-	0.0%		-		-		-	
5		-	0.0%		-		-		-	
6		-	0.0%		-		-		-	
7		-	0.0%		-		-		-	
8		-	0.0%		-		-		-	
9		-	0.0%		-		-		-	

10		-	0.0%	-	-	-	-
Change Directive subtotal:		\$0.00	0.0%	\$0.00	\$0.00	\$0.00	\$0.00
Contract amount:		\$0.00	71.6%	\$0.00	\$0.00	\$0.00	\$0.00

	Contract Amount	% to Date	Previous Amount	Amount This Draw	Completed to Date	Balance to Complete
Sub Total	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
HST at 13%	-					
Total Contract	-					
Lien on Project						
Deficiency retainage					0%	-
Basic holdback of	10.00%	Finishing holdback			0	
of	10.00%	Current work less holdbacks			0	
Holdback previously released				-		
Holdback released this issue						-
Total holdback released Payable to date					0	
Previously payable (from payable to date on previous certificate)					0	
Payable this issue					0	
HST payable	13.00%				0	
Total:					0	
Adjustment to match invoice:					-	
Total payable:					0	

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 General
- .4 1.4 Identification of Systems
- .5 1.5 Commissioning and Systems Demonstrations
- .6 1.6 Superintendence
- .7 1.7 Dimensions
- .8 1.8 Coordination
- .9 1.9 Building Dimension, Templates, Built-ins, and Coordination

1.3 GENERAL

- .1 The *Contractor* shall *Provide* the *Work* in accordance with the *Contract Documents* and shall be responsible for delays or costs resulting from failure to properly inspect or coordinate the *Work*, and for replacement or corrective work required.

1.4 IDENTIFICATION OF SYSTEMS

- .1 *Provide* identification of electrical and mechanical system installations and other automated systems or equipment in compliance with the *Contract Documents*.

1.5 COMMISSIONING AND SYSTEMS DEMONSTRATIONS

- .1 *Provide* testing, adjusting, balancing and certification and commissioning of mechanical and electrical installations and other automated systems or equipment in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.
- .2 Instruct *Owner's* designated representatives in operation and maintenance of mechanical and electrical installations and other automated systems or equipment, in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.

1.6 SUPERINTENDENCE

- .1 The *Contractor* shall *Provide* a superintendent and necessary supporting staff personnel who shall be in attendance at the *Place of the Work* while *Work* is being performed, with 5 years' experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.
 - .1 The *Contractor* shall *Provide* a superintendent to supervise the *Work* at all times.
- .2 The *Contractor's* superintendent shall have overall authority at the *Place of the Work* and shall speak for the *Contractor* and represent the *Contractor's* interest and responsibilities at meetings at the *Place of the Work* and in dealings with the *Consultant* and the *Owner*.

1.7 DIMENSIONS

- .1 Verify dimensions at the *Place of the Work* before commencing *Shop Drawings*. Before fabrication commences report discrepancies to the *Consultant* in writing. Incorporate accepted variances on *Shop Drawings* and as-built records.

1.8 COORDINATION

- .1 Coordinate and ensure workers, *Subcontractors*, and *Suppliers* cooperate to ensure that the *Work* will be carried out expeditiously and in proper sequence.
- .2 Make adjustments to allow adjustable work to fit within fixed work.

1.9 BUILDING DIMENSION, TEMPLATES, BUILT-INS, AND COORDINATION

- .1 Take necessary dimensions for the proper execution of the *Work*. The *Contractor* shall assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.
- .2 *Provide* forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the *Work* and set in place or instruct separate *Subcontractors* as to their location.
- .3 Supply items to be built in, as and when required together with templates, measurements, *Shop Drawings* and other related information.
- .4 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 to the *Subcontractors*.
- .5 Verify that the *Work*, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the *Contract Documents*, and ensure that work installed in error is rectified at the *Contractor's* expense before construction resumes.
- .6 Check and verify dimensions referring to interfacing of services. Verify such dimensions with interconnected portions of the *Work*.
- .7 Do not scale directly from *Drawings*. Obtain clarification from the *Consultant* if there is ambiguity or lack of information.
- .8 Details and measurements of any work which is to fit or to conform with work installed shall be taken at the *Place of the Work*.
- .9 Advise the *Consultant* of discrepancies and omissions in the *Contract Documents*, that affect aesthetics, or that interfere with services, equipment or surfaces. Do not proceed with work affected by such items without clarification from the *Consultant*.
- .10 Prepare and submit setting drawings, templates and other information necessary for the location and installation of material, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels, in accordance with Section 01 33 00 - Submittal Procedures.
- .11 The *Contractor* shall ensure that the *Subcontractors* directly related *Subcontractors* on *site* of specific locations required for sleeves and openings. The *Contractor* shall be responsible for coordinating such activity to ensure no interruption in the progress of the *Work*.
- .12 The *Contractor* shall prepare interference drawings to properly coordinate the *Work*, where necessitated, in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Administrative
- .4 1.4 *Contract* Start-Up Meeting
- .5 1.5 Pre-Installation Meetings
- .6 1.6 Progress Meetings
- .7 1.7 Pre-Takeover Meeting
- .8 1.8 Post-Construction Meeting
- .9 1.9 Special Meetings

1.3 ADMINISTRATIVE

- .1 The *Contractor* shall schedule meetings as specified herein.
 - .1 Such scheduling shall be in consultation both with the *Owner* and with the *Consultant*.
 - .2 Written notice of each *Site* meeting shall, in general, appear at the conclusion of the minutes of the preceding meeting or, else, shall be issued by the *Consultant*, via memorandum, no less than 24 hours prior to said meeting.
- .2 The *Contractor* shall *Provide* the physical space for the meetings at the *Place of the Work*, generally to be the *Site* office (refer to Section 01 50 00 - Temporary Facilities and Controls for the complete requirements of the *Site* office).
- .3 The *Consultant* will prepare agendas for meetings specified herein.
 - .1 Agendas must include, as a minimum, the agenda items specified in the *Contract Documents*.
- .4 The *Consultant* will distribute written notice of each meeting specified herein, complete with meeting agenda, four *Working Days* in advance of meeting date to the following, each of whom shall be responsible for distributing such notices to other affected parties associated with them (such as, for example, *Subcontractors* in the case of the *Contractor*):
 - .1 The *Contractor*.
 - .2 The *Owner*.
- .5 The *Consultant* will chair and record the minutes of meetings specified herein.
 - .1 The *Consultant* will distribute copies of minutes to the *Owner*, the *Contractor*, and all others in attendance within three *Working Days* after date of meeting.

- .2 Any exceptions taken to, or clarification/correction required of, the various items recorded in the minutes, shall be furnished in writing and copied to all parties listed on the distribution list of the captioned minutes.
- .6 Representatives of parties attending meetings shall be authorized to act on behalf of the parties they represent.
- .7 *Subcontractors and Suppliers* shall not attend meetings unless authorized by the *Consultant* and/or the *Owner*.
- .8 The *Contractor* shall prepare, and distribute to the *Consultant* and the *Owner* at each progress meeting date, the following:
 - .1 Monthly progress reports containing updated schedules, *Shop Drawing* logs, requests for interpretation logs, submittals and budget.
 - .2 2 Week Lookahead schedules shall be submitted 24 hours before the scheduled meeting.

1.4 CONTRACT START-UP MEETING

- .1 Within 10 *Days* after award of the *Contract*, the *Contractor* shall request a meeting of parties in the *Contract* to discuss and resolve administrative procedures and responsibilities prior to the commencement of the *Work*.
 - .1 The *Consultant* will chair and minute the *Contract* start-up meeting, and distribute minutes as described above in subsection 1.3.5.
- .2 Attendees at *Contract* start-up meeting must include the following:
 - .1 *Contractor*.
 - .2 *Contractor's Site* superintendent(s).
 - .3 *Consultant*.
 - .4 *Owner*.
- .3 Agenda to include the following:
 - .1 General:
 - .1 Welcome and Introduction.
 - .2 *Owner's* guidelines and policies.
 - .3 Communications:
 - .1 Appointment of official representatives of the participants on the *Project*.
 - .2 *Project* contact list.
 - .3 Emergency contact list.
 - .4 Correspondence protocols (email, telephone).
 - .4 Schedule of progress meetings.
 - .5 Status of permits, fees and requirements of the *Authorities Having Jurisdiction*.
 - .6 Status of *Contract* execution.

- .7 Insurance, transcripts of policies.
- .8 Workplace Safety and Insurance Board Certificate.
- .9 *Documents at the Place of the Work* (Permit Set, Issued Incorporating Addenda Set / Issued for Construction).
- .2 *Contract Modifications and Instructions:*
 - .1 Requirements for *Contract* Modification and interpretation procedures:
 - .1 Requests for Interpretation.
 - .2 *Supplemental Instruction*.
 - .3 Notices of Change.
 - .4 *Change Directives*.
 - .5 *Change Orders*.
 - .2 Procedures for distribution, approvals, requests for time extension.
- .3 Submittals:
 - .1 Construction schedule.
 - .2 Submittal procedures and schedule of submittals.
 - .3 Requests for Substitutions / Alternates.
 - .4 Delivery of specified equipment and “long-lead” items.
 - .5 *Owner* supplied Items
- .4 Schedule of Values, progress claims, administrative procedures and holdbacks.
- .5 *Site* Policies and Logistics.
 - .1 *Contractor's* safety procedures.
 - .2 *Site* issues and limitations:
 - .1 Parking.
 - .2 *Site* access, loading and storage.
 - .3 Garbage and construction waste handling.
 - .4 Hazardous substances.
 - .3 *Site* security.
 - .4 Temporary Facilities – signs, offices, storage sheds and utilities.
 - .5 Quality control.
 - .6 Infection prevention and control requirements
 - .7 Insect control.
- .6 *Project* Close Out:

- .1 Take-over procedures, acceptance and warranties.
- .2 *As-Built Drawings*.
- .3 Operation and Maintenance manuals.
- .4 *Owner Training*.
- .5 *Substantial Performance of the Work*.
- .6 *Total Performance of the Work*

1.5 PRE-INSTALLATION MEETINGS

- .1 During the course of the *Work* prior to *Substantial Performance of the Work*, schedule pre-installation meetings as required by the *Contract Documents* or as directed by the *Consultant*.
- .2 As far as possible, pre-installation meetings shall be scheduled to take place on the same *Day* as regularly scheduled progress meetings.
- .3 Agenda to include the following:
 - .1 Appointment of official representatives of participants in the *Project*.
 - .2 Review of existing conditions and affected work, and testing thereof as required.
 - .3 Review of installation procedures and requirements.
 - .4 Review of environmental and *Site* condition requirements.
 - .5 Schedule of the applicable portions of the *Work*.
 - .6 Schedule of submission of samples, colour chips, and items for the *Consultant's* consideration.
 - .7 Requirements for temporary facilities, *Site* sign, offices, storage sheds, utilities, fences.
 - .8 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to the *Consultant* for review of the *Work*.
 - .9 Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests.
 - .10 Delivery schedule of specified equipment.
 - .11 Special safety requirements and procedures.
- .4 The following shall be in attendance:
 - .1 The *Contractor*.
 - .2 The *Subcontractors* affected by the work for which the pre-installation meeting is being conducted.
 - .3 The *Consultant*.
 - .4 Manufacturer's representatives, as applicable.
 - .5 Inspection and testing company, as applicable.

1.6 PROGRESS MEETINGS

- .1 During the course of the *Work* prior to *Substantial Performance of the Work*, schedule progress meetings as directed by the *Consultant*.
- .2 Attendees at progress meetings shall include the following:
 - .1 The *Contractor*.
 - .2 The *Contractor's Site* superintendent(s).
 - .3 The *Consultant*.
 - .4 The *Owner*.
- .3 Agenda to include the following:
 - .1 Review, approval of proceedings of previous meeting.
 - .2 Review of items arising from proceedings.
 - .3 Review of progress of the *Work* since previous meeting and the *Contractor's* monthly progress report.
 - .4 Field observations, problems, conflicts.
 - .5 Update construction schedule.
 - .6 Problems that impede compliance with construction schedule.
 - .7 Review of off-*Site* fabrication delivery schedules.
 - .8 Review material delivery dates/schedule.
 - .9 Corrective measures and procedures to regain construction schedule.
 - .10 Revisions to construction schedule.
 - .11 Progress, schedule, during subsequent period of the *Work*.
 - .12 Review submittal schedules.
 - .13 Review status of submittals.
 - .14 Maintenance of quality standards.
 - .15 Pending changes and substitutions.
 - .16 Review of the *Contract* modifications and interpretations, including, but not limited to: requests for interpretation and log, Notices of Change, *Change Orders*, *Supplemental Instructions*, for effect on construction schedule and on the *Contract Time*.
 - .17 Review of status of as-built documents.
 - .18 Other business.

1.7 PRE-TAKEOVER MEETING

- .1 60 *Working Days* prior to application for *Substantial Performance of the Work*, schedule a pre-takeover meeting.
- .2 Agenda to include the following:

- .1 Review, approval of proceedings of previous meeting.
- .2 Review of items arising from proceedings.
- .3 Review of procedures for *Substantial Performance of the Work*, completion of the *Contract*, and handover of the *Work*.
- .4 Field observations, problems, conflicts.
- .5 Review of outstanding *Contract* modifications and interpretations, including, but not limited to: requests for interpretation and log, Notices of Change, *Change Orders*, *Supplemental Instructions*, for effect on construction schedule and on the *Contract Time*.
- .6 Problems which impede *Substantial Performance of the Work*.
- .7 Review of procedures for deficiency review. Corrective measures required.
- .8 Review of arrangements for hydro, heating, and other services.
- .9 Progress, schedule, during succeeding period of the *Work*.
- .10 Review submittal requirements for warranties, manuals, and all demonstrations and documentation required for *Substantial Performance of the Work*.
- .11 Review of keying and hardware requirements.
- .12 Review of status of as-built documents and record drawings.
- .13 Status of commissioning and training.
- .14 Review the *Contractor's* deficiency list and status.
- .15 Cleaning for occupancy.
- .16 Other business.

1.8 POST-CONSTRUCTION MEETING

- .1 Prior to application for completion of the *Contract*, schedule a post-construction meeting. Four Days prior to date for meeting, the *Consultant* will confirm a date for meeting based on evaluation of completion requirements.
- .2 Agenda to include the following:
 - .1 Review, approval of proceedings of previous meeting.
 - .2 Confirmation that no business is arising from proceedings.
 - .3 Confirmation of completion of the *Contract*, and handover of reviewed documentation from the *Consultant* to the *Owner*.
 - .4 Confirmation of completion of Notices of Change, *Change Orders*, and *Supplemental Instructions*.
 - .5 Problems that impede the *Contract* completion.
 - .6 Identify unresolved issues or potential warranty problems.
 - .7 Confirmation of completion of deficiencies.
 - .8 Corrective measures required.

- .9 Confirmation of arrangements for hydro, heating and other services.
- .10 Confirm submittal requirements for warranties, manuals, and demonstrations and documentation for *Contract* completion are in order.
- .11 Review of procedures for communication during post-construction period.
- .12 Handover of reviewed record documents by the *Consultant* to the *Owner*.
- .13 Handover of the *Contract* completion insurance policy transcripts by the *Contractor*.
- .14 Submission of final application for payment.
- .15 Review and finalize outstanding claims, pricing, and allowance amounts.
- .16 Status of commissioning and training.
- .17 Demobilization and the *Place of the Work* restoration.
- .18 Review of requests for interpretation log.
- .19 Other business.

1.9 SPECIAL MEETINGS

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

PART 2- PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 General
- .4 1.4 Layout And Survey
- .5 1.5 Submittals
- .6 1.6 Drainage
- .7 1.7 Record Drawings
- .8 1.8 Survey Reference Points and Legal Survey Markers
- .9 1.9 Survey Layout
- .10 1.10 Construction Layout
- .11 1.11 Field Engineering

1.3 GENERAL

- .1 The *Contractor* shall *Provide* the *Work* in accordance with the *Contract Documents* and shall be responsible for delays or costs resulting from failure to thoroughly inspect or coordinate the *Work*, and for replacement or corrective work required.

1.4 LAYOUT AND SURVEY

- .1 Lines, Levels and Locations for Building:
 - .1 Existing grades, lines and *Site* conditions shown on *Drawings* were taken from survey information established by persons engaged directly by the *Owner*. The accuracy of survey information is not the *Consultant's* responsibility.
 - .2 The *Contractor* shall establish location of property lines. The *Contractor* shall verify necessary lines, levels and *Site* conditions and report any discrepancies from the existing survey or information provided by the *Owner* and/or the *Consultant*. The *Contractor* shall *Provide* batter boards and other means to control the accurate positioning of all building elements.
- .2 *Work* Adjacent to Public Property:
 - .1 Verify before commencing *Work* at adjacent public property, that no plans for altering clearances, set-backs, easements, grades, or otherwise have been made by local *Authorities Having Jurisdiction* subsequent to their approval of the *Contract Documents*, and which would affect the original intent.

1.5 SUBMITTALS

- .1 Before proceeding with the *Work*, the *Contractor* shall employ/engage the services of a land surveyor qualified to practice in the Province of Ontario acceptable to the Owner, to accurately lay out the work of this Section.
- .2 The *Contractor* shall submit the qualifications of land surveyor to demonstrate his/her capabilities and experience (a minimum of 5 years of experience is required). Include lists of completed projects with project names and addresses, names and addresses of architects and owners.
- .3 Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements set out in the *Contract Documents*.
- .4 Submit two (2) copies of certified survey signed by qualified land surveyor.
- .5 Submit two (2) copies of final property survey showing the *Work* performed and record survey data.
- .6 Submit a Certificate of Compliance at completion of *Site* grading stating the "As Constructed" grading elevations, and whether or not they differ from design grades.

1.6 DRAINAGE

- .1 Ensure that positive drainage is provided to roof, floor and *Site* drains and catch basins, once set in their final positions. *Provide* constant slopes for drained surfaces to drains and drainage courses.
- .2 Ensure that allowable construction tolerances and structural tolerances as shown in the *Contract Documents* and *Specifications* do not permit ponding of water.
- .3 Verify the extent of each area served by a drain, or drainage course, to eliminate possible undrained surfaces. Coordinate the *Work* of applicable Sections before each proceeds.

1.7 RECORD DRAWINGS

- .1 Prepare interference and equipment placing drawings to scale to ensure that all components will be properly accommodated within the spaces provided.
- .2 Ensure that clearances required by *Authorities Having Jurisdiction* and/or for easy maintenance of equipment will be shown on the interference drawings.
- .3 Interference drawings shall be prepared before any orders for equipment and/or materials are released to *Suppliers*.

1.8 SURVEY REFERENCE POINTS AND LEGAL SURVEY MARKERS

- .1 Verify existing base horizontal and vertical control points designated on *Drawings*.
- .2 Locate, confirm, and protect control points and legal survey markers prior to starting *Site* work; preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to the *Consultant*.
- .4 Report to the *Consultant* when a reference point or legal survey marker is lost or destroyed or requires relocation because of necessary changes in grades or locations.
- .5 Replace control points in accordance with original survey control.
- .6 Replace legal survey markers lost or destroyed as a result of construction activities.

1.9 SURVEY LAYOUT

- .1 The *Contractor* shall ensure that the land surveyor coordinates with the *Contractor* for layout and protection of grade controls.
- .2 Establish permanent benchmark(s) as required, referred to established benchmarks by survey control points, record locations, with horizontal and vertical data.
- .3 Establish lines and levels, locate and layout, by instrumentation.
- .4 Stake for grading, cuts, fills, and slopes.
- .5 Replace grade controls lost or destroyed as a result of construction activities.

1.10 CONSTRUCTION LAYOUT

- .1 Verify layout information shown on *Drawings*, in relation to the property survey and existing benchmarks. Notify the *Consultant* promptly if discrepancies are discovered.
- .2 Engage a land surveyor to lay out the *Work* using accepted surveying practices. The *Contractor* shall ensure that the land surveyor fulfills the following responsibilities:
 - .1 Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of *Project*.
 - .2 Establish dimensions within tolerances indicated. Do not scale *Drawings* to obtain required dimensions.
 - .3 Inform installers of lines and levels to which they must comply.
 - .4 Check the location, level and plumb, of every major element as the *Work* progresses.
 - .5 Notify the *Consultant* when deviations from required lines and levels exceed allowable tolerances.
 - .6 Verify accuracy of *Site* dimensions shown on *Drawings*.
 - .7 Verify that present, or known future restrictions, are not violated by construction on the *Site* or lines of traverse to all public utilities.
 - .8 Verify accurately the final underground location on *Site* of all buried storm, sanitary, water and electrical duct banks, when applicable.
 - .9 Close *Site* surveys with an error of closure equal to or less than the standard established by the *Authorities Having Jurisdiction*.
- .3 Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- .4 Maintain a log of layout control *Work*. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the *Consultant* when requested.

1.11 FIELD ENGINEERING

- .1 Locate existing permanent benchmarks, control points and similar reference points before beginning the *Work*. Preserve and protect permanent benchmarks and control points during construction operations:
 - .1 Do not change or relocate existing benchmarks or control points without prior written approval of the *Consultant*.
 - .2 Report lost or destroyed permanent benchmarks or control points promptly.
 - .3 Report the need to relocate permanent benchmarks or control points to the *Consultant* before proceeding.
 - .4 Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
 - .5 Record benchmark locations, with horizontal and vertical data, on *Project Record Documents*.
 - .6 Where the actual location or elevation of layout points cannot be marked, *Provide* temporary reference points sufficient to locate the *Work*.
 - .7 Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- .2 *Provide* as-built *Site* survey information after completion of demolition and excavation operations ready for construction
 - .1 Survey grade elevations shall be on a 9 m grid or as required to locate property lines and new building structural grid lines.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Construction Photographs
- .4 1.4 Professional Final Photographs
- .5 1.5 Construction Progress Reporting
- .6 1.6 Scheduling Roles
- .7 1.7 Scheduling software
- .8 1.8 Schedules
- .9 1.9 Construction Schedule Information
- .10 1.10 Format
- .11 1.11 Submission process
- .12 1.12 Baseline Construction Schedule
- .13 1.13 Progress Schedule
- .14 1.14 Baseline Schedule Revisions

1.3 CONSTRUCTION PHOTOGRAPHS

- .1 The *Work* shall include progress photographs of construction taken from eight viewpoints within the areas of the *Work* by a professional photographer retained by the *Contractor*. One photograph is to be taken from each viewpoint per month for the duration of construction and one upon completion of construction. Viewpoint locations to be determined by the *Consultant* at the time of photographing.
- .2 Photographs must show general extent of the *Work* by interior views. Each viewpoint will be selected by the *Consultant*, and the monthly repetitive photographs must be taken from exactly the same viewpoint.
- .3 Submit digital copies of each photograph with each application for payment.
- .4 Title each photograph at the bottom so that nothing pertinent is blocked out. Include on title: *Project* name, *Contractor's* name, direction of view, and date when taken. *Provide* photographer's name only on back of photographs.
- .5 The *Contractor's* professional photographer for construction photographs shall be approved by the *Consultant*.
- .6 All costs associated with the work of this Section shall be included in the *Contract Price*.

1.4 PROFESSIONAL FINAL PHOTOGRAPHS

- .1 Prior to release of deficiency holdback, the *Contractor* shall *Provide* to the *Consultant* the following required professional final photographs:

- .1 Proof photographs of Professional Final Photographs taken from 10 vantage points selected by the *Consultant*.
- .2 Provide 2 DVD copies of Record Photographs in PDF format and in high resolution editable .tiff and .jpg formats.

1.5 CONSTRUCTION PROGRESS REPORTING

- .1 Maintain at the *Place of the Work* a permanent written record of progress of the *Work*. Make the record available to the *Consultant* and Provide copy if requested. Include in record each day:
 - .1 Commencement and completion dates of the work of each trade in each area of *Project*.
 - .2 Attendance of the *Contractor's* and *Subcontractors'* work forces at *Project* and a record of the work they perform.
 - .3 Visits to *Place of the Work* by the *Owner*, the *Consultant*, the *Authorities Having Jurisdiction*, inspection *Suppliers* and testing companies.

1.6 SCHEDULING ROLES

- .1 *Contractor*
 - .1 The *Contractor* shall be responsible for the preparation and maintenance of the Construction Schedule information including the Construction Schedule and other schedules as set out in this Section. The *Contractor* shall be responsible for obtaining planning and scheduling information from its management staff, *Site* supervisory staff, *Subcontractors* and *Suppliers* in a timely manner as an essential part of the preparation and maintenance of the Construction Schedule and other schedules.
 - .2 The *Contractor* shall maintain full responsibility for the implementation and management of the construction activities contained in its schedules.
 - .3 The *Contractor* shall identify to the *Owner* and the *Consultant*, the *Contractor's* designated individual responsible for utilizing the specified scheduling software to prepare and maintain the Construction Schedule and other schedules, herein defined as the *Contractor's* Scheduler. The *Contractor's* Scheduler is required to have a minimum of five years of experience utilizing the specified scheduling software for planning and scheduling of construction projects.

1.7 SCHEDULING SOFTWARE

- .1 The Construction Schedule is to be developed utilizing Microsoft *Project* (latest version). Other third-party scheduling software's are not acceptable.

1.8 SCHEDULES

- .1 Construction Schedule: Within 10 *Working Days* form the date of issuance of the *Owner's* notice to commence the *Work* under this *Contract*, the *Contractor* shall submit a detailed critical path bar chart Construction Schedule with activities itemized to show the orderly planning, organization and execution of the *Work*, which will enable the *Contractor*, the *Consultant* and the *Owner* to monitor the progress of the *Work* and forecast remaining *Work*. Include in the schedule, the milestone dates for completion of each phase of the *Work* and applicable milestones.
- .2 The *Contractor* shall allow for 10 *Working Days* for review and approval by the *Owner* and the *Consultant* of the submitted schedule.

- .3 The Construction Schedule must be in the form of a series of activities and milestones that are logically linked utilizing the critical path methodology.
- .4 The Construction Schedule must clearly represent the applicable sequence of work as outlined in the *Contract Documents*. The Construction Schedule must identify early dates and late dates as well as the *Project* critical path of activities and completion milestones through each phase of the *Project*.
- .5 Organize the Construction Schedule into the *Project's* phases as outlined in the *Contract Documents*. The Construction Schedule must clearly identify the inter-relationships and logic dependencies between the *Work* of different phases.
- .6 At any given point in time, the Construction Schedule must be fully detailed with activities and milestones for the entire *Project* duration.
- .7 The *Contractor* shall *Provide* further refined and expanded schedule information, as the *Work* progresses and submit proposed updates to the schedule at least 10 Working Days in advance of commencement of any impacted work. The *Contractor* shall ensure that the schedule is up-to date so that the *Consultant* and the *Owner* are aware sufficiently in advance of the upcoming work. Dates for the development of this information shall be agreed with the *Owner* and the *Consultant*.
- .8 In addition to the Construction Schedule, prepare and submit the following schedules, as specified in Section 01 33 00 – Submittal Procedures.
 - .1 Submittal Schedule for *Shop Drawings, Product Data* and Samples
 - .2 Submittal Schedule for Mock-ups
 - .3 Submittal Schedule of *Owner* supplied/*Contractor* installed equipment
 - .4 Equipment Delivery Schedule
 - .5 Building Commissioning and Turnover schedule, to be prepared together with the *Owner*

1.9 CONSTRUCTION SCHEDULE INFORMATION

- .1 Submission of the Construction Schedule shall constitute the representation by the *Contractor* that:
 - .1 The *Contractor* has distributed the proposed Construction Schedule to the *Subcontractors* for their review and comment.
 - .2 Seasonal weather conditions have been considered and included in the planning and scheduling of the *Work* influenced by high and low ambient temperatures and/or precipitation to ensure completion of the *Work* in accordance with the *Contract Documents*.
 - .3 The *Contractor* has incorporated any other special conditions in planning the *Work* such as specified non-work periods, etc.
 - .4 The *Work* has been coordinated and scheduled to permit time for work associated with the cash allowances included as part of this *Contract*.
- .2 Include the dates for the commencement and completion of each major task for each distinct part of the *Project* construction. Activities shall be itemized to show the orderly planning, organization and execution of the *Work*, which will enable the *Contractor* and the *Owner* to monitor the progress of the *Work* and forecast remaining *Work*.

- .3 Include activities in the Construction Schedule for the commencement and completion of each major element of all *Contractor* and *Subcontractor* work.
- .4 Include specific activities and milestones in the Construction Schedule for work under the responsibility of the *Owner* that must coordinate with the *Contractor's* work including but not limited to *Owner* supplied equipment, commissioning, *Substantial Performance of the Contract* and *Total Performance of the Contract*.
- .5 Include specific activities and milestones in the Construction Schedule for work under the responsibility of the *Consultant* that must coordinate with the *Contractor's* work including but not limited to inspections and approvals. Such activities will be identified by the *Contractor* and the *Consultant*.

1.10 FORMAT

- .1 Prepare the Construction Schedule in the form of a time-scaled, horizontal bar chart that clearly identifies the *Project* critical path of activities and completion milestones for the distinct phases and sub- phases of the *Project*. *Provide* a separate bar identifying the start and finish of each significant element of construction as required to define a clear progression of activities through the distinct phases/sub- phases of the *Project* as specified in the *Contract Documents*.
- .2 Show sufficient detail to identify the major activities and milestones dates for overall planning and coordination purposes. Activities (with the exception of the contingency for unforeseen delays and delays resulting from changes to the *Contract*) shall have a maximum duration of four weeks. Show milestones for the start and completion of each major work area, building system and phase or sub- phase of the *Work*.
- .3 Ensure that work of all disciplines (i.e. mechanical, electrical and all other trades) is included and logically linked within the Construction Schedule. Show manufacturing time and delivery dates (milestones) for major equipment and materials. Show deliveries of the *Owner's* supplied equipment required to meet the Construction Schedule.
- .4 Activities listed in the Construction Schedule must be in sufficient detail to include time for decisions / approvals required by the *Owner* and/or *Consultant* for *Shop Drawings*, mockups, sample submissions, deliveries, cash allowance requirement schedule, off *Site* fabrication, erection, on *Site* installation and any other events or sub-activities which may pertain to the activities of the Construction Schedule.
- .5 Construction Schedule information must be in sufficient detail to allow for accurate assessment of percentage completion and coordination with other tasks within the *Project* Master Schedule.
- .6 *Provide* a horizontal time scale identifying the first day of each week as Monday. Show in the Construction Schedule the intended *Working Days* and holidays used as the basis for the Construction Schedule information and critical path calculations.
- .7 Activity descriptions must be as a consistent and clear as possible in terminology. Start activity descriptions with verbs.
- .8 Include as part of the Construction Schedule information, "dependency logic" information indicating the major predecessor and successor links between schedule activities. When requested, identify the crewing assumptions for the Construction Schedule activities and dependency logic that is governed by or representing crewing availability.

1.11 SUBMISSION PROCESS

- .1 Submit the Construction Schedule information to the *Owner* within 10 *Working Days* from date of award of *Contract*. The Construction Schedule information must be consistent with the milestones.
- .2 The *Owner* and the *Consultant* will have 10 *Working Days* from initial submission, to review and adjust the Construction Schedule, in consultation with the *Contractor*. The *Contractor* shall revise and resubmit the Construction Schedule for further review and comment. Upon final review, that Construction Schedule will be defined as the "Baseline" version of the Construction Schedule.

1.12 BASELINE CONSTRUCTION SCHEDULE

- .1 The Baseline Construction Schedule shall form the basis for *Contractor* and *Owner* planning and progress tracking.
- .2 No changes to the Baseline Construction Schedule reflecting later completion dates of activities or target milestones will be accepted as a revision to the Construction Schedule, unless accepted by the *Owner* in writing.
- .3 Neither the review of the Baseline Schedule or other date submitted by the *Contractor* pursuant to this Section, nor any other action on the part of the *Consultant* under this Section shall in any way be deemed as a representation by the *Owner* that the *Contractor*, by following a particular schedule or sequence of operation, can or will complete the *Work* by the time(s) required by the *Contract* or by any other time(s). The review of any Baseline Schedule or other date does not relieve the *Contractor* of its obligation to complete the *Work* by the *Contract Time*.
- .4 Submit two paper copies on 11 x 17 inch (Ledger), plus electronic copy in native format from the agreed upon scheduling software. The *Owner* and the *Consultant* will review the schedule and return the reviewed copy.

1.13 PROGRESS SCHEDULE

- .1 On a monthly basis, update the Construction Schedule showing projected percentage of completion of each item as of the first day of the month. Indicate progress of each activity to date and projected start and finish dates for each activity. Upon submission this will be deemed the Progress Schedule.
- .2 Include the complete sequence of construction activities.
- .3 Show approved changes occurring since the previous submission of the Progress Schedule:
 - .1 Changes in scope/time
 - .2 Activities modified since previous submission
 - .3 Revised projections of progress and completion
 - .4 Other identifiable changes
- .5 Submit the Progress Schedule with each application for payment, clearly indicating progress of *Work* to date for which money is being claimed
- .6 Submit a separate narrative report to define:
 - .1 Problem areas, anticipated delays, and the impact on the schedule
 - .2 Corrective action recommended and its effect

- .3 Indicate slippage from the schedule, its impact on completion of the phase and the total *Project*, and possible corrective actions. Appropriate corrective action may include, but not be limited to, assignment of additional labour, trade *Subcontractors* or equipment, shift or overtime work at no additional cost to the *Owner*.
- .7 Submit a separate six week "look-ahead" narrative report indicating major activities to be undertaken or constructed, areas of work, and any impacts upon the *Owner* over the next 6 weeks.

1.14 BASELINE SCHEDULE REVISIONS

- .1 The update of the Construction Schedule, as required, to reflect actual progress up to the monthly cut-off date shall not be considered a revision to the Baseline Schedule. All other changes, including, but not limited to, the following shall be considered Baseline Schedule revisions:
 - .1 Adding and/or deleting activity relationships
 - .2 Adding and/or deleting activities
 - .3 Changes to original durations
 - .4 Changes to *Contract* Milestone dates or Constraint dates
 - .5 Performance of work out of sequence
 - .6 Scope Changes through *Change Orders*
- .2 If, as a result of the monthly Progress Schedule submission, it appears the Progress Schedule no longer represents the actual progress of the *Work*, the *Contractor* shall request a revision to the Baseline Schedule in accordance with GC 3.5 of the General Conditions of the *Contract*.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Administrative
- .4 1.4 Bonds, Certificates And Schedules
- .5 1.5 Schedule Of Submittals
- .6 1.6 Submission Procedures
- .7 1.7 *Product* Data Sheets
- .8 1.8 *Shop Drawings*
- .9 1.9 Samples
- .10 1.10 Certificates And Certification Submittals
- .11 1.11 *Project* Firestopping Manual And Coordination
- .12 1.12 Coordination And Interference *Drawings*

1.3 ADMINISTRATIVE

- .1 Submit to the *Consultant* all submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as not to cause any delay in the *Work*. Failure to submit in ample time will not be considered sufficient reason for an extension of the *Contract Time*, and no claim for extension by reason of such default will be allowed.
- .2 Submit only those submittals specifically required by the *Contract Documents*, or those specifically requested by the *Consultant*. Any submittals submitted that are not specifically required by the *Contract Documents*, or requested by the *Consultant*, will be returned to the *Contractor* at the *Contractor's* expense without being reviewed.
- .3 The *Work* affected by a submittal shall not proceed until the review of that submittal is complete.
- .4 Submittals that contain substitutions will be rejected. Substitutions are permitted only when approved in accordance with Section 01 25 00 -Product Substitution Procedures.
- .5 The *Contractor's* review of submittals:
 - .1 The *Contractor* shall review submittals prior to submission to the *Consultant*. This review represents that the necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the *Work* and all *Contract Documents*.
 - .2 Submittals must bear stamp of the *Contractor* and signature of a responsible official in the *Contractor's* organization indicating in writing that such submittals have been checked and coordinated by the *Contractor*. The *Contractor's* review shall be performed by qualified personnel who have detailed understanding of those elements being reviewed and of the conditions at the *Place of the Work* proposed for installation.

- .3 The *Contractor* shall check and sign each submittal and make notations considered necessary before submitting to the *Consultant* for review. Where submittal is substantially and obviously in conflict with requirements of the *Contract Documents*, reject submittal without submitting to the *Consultant* and request resubmission from the subcontractor.
- .4 The *Contractor* shall assume sole responsibility for any conflicts occurring in the *Work* that result from lack of comparison and coordination of submittals required for the *Work*.
- .5 The *Contractor* shall Notify the *Consultant* in writing of changes made on submittals from the *Contract Documents*. The *Consultant's* review of submittals shall not relieve the *Contractor* from its responsibility for changes made from the *Contract Documents* not covered by written notification to the *Consultant*.
- .6 Submittals that clearly have not been reviewed by the *Contractor*, or are not stamped, signed, dated, and identified as to the specific *Project*, will be returned without being reviewed.
- .7 No changes to the *Work* or the *Contract Documents* shall be made by way of submittals.
- .8 Changes to the *Work* shall only be made following procedures specified in the *Contract Documents* for changes in the *Work*.
- .9 Submittals that include changes to the *Work* or the *Contract Documents* shall be stamped "REVISE AND RESUBMIT" by the *Consultant* and returned to the *Contractor*.
- .6 The *Consultant's* review of submittals:
 - .1 Review of submittals by the *Consultant* is for the sole purpose of ascertaining conformance with the general design concepts and the general intent of the *Contract Documents*. This review shall not mean that the *Consultant* approves the detail design inherent in the submittals, responsibility for which shall remain with the *Contractor*. Such review shall not relieve the *Contractor* of responsibility for errors or omissions in the submittals, or responsibility for meeting requirements of the *Contract Documents*.
 - .2 The *Contractor* shall be responsible for dimensions to be confirmed and correlated at the *Place of the Work* for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the *Work*.
 - .3 The *Consultant's* review and markings on submittals do not authorize changes in the *Work* or the *Contract Time*, and will be accommodated at no additional cost to the *Owner*. If, in the opinion of the *Contractor*, the *Consultant's* markings on submittals constitute a change in the *Work* or will effect a change in the *Contract Time*, then the *Contractor* shall so notify the *Consultant* in writing and request an interpretation following the procedures for requests for interpretation in accordance with Section 01 26 00 - Contract Modification and Requests for Interpretation. If the *Consultant* finds that the *Consultant's* markings on submittals do constitute a change in the *Work* or will effect a change in the *Contract Time*, then a *Change Order* will be prepared therefore. The time taken to process such a request for interpretation shall not, in and of itself, constitute a change in the *Work* nor increase the *Contract Time*.
 - .4 Submittals received but not required by the *Contract Documents* or requested by the *Consultant* will not be reviewed by the *Consultant* and will be marked 'NOT REVIEWED' by the *Consultant* and returned to the *Contractor*.
- .7 Prepare submittals using SI (metric) units.
- .8 Verify that field measurements and affected adjacent work are coordinated.

- .9 The *Contractor's* responsibility for errors and omissions in the submissions is not relieved by the *Consultant's* review of submittals.
- .10 The *Contractor's* responsibility for deviations in the submission from the requirements of the *Contract Documents* is not relieved by the *Consultant's* review of submittals.
- .11 The *Contractor* shall make submittals with reasonable promptness and in an orderly sequence so as to cause no delay in the *Work*. The *Contractor* shall be responsible for delays, make up time lost and pay added costs, at no additional cost to the *Owner*, incurred because of not making submittals in due time to permit proper review by the *Consultant*.
 - .1 Once submitted, a submittal shall not be re-submitted until original submission has been reviewed by the *Consultant* and returned to the *Contractor*.
- .12 Submittals that contain substitutions will be rejected. Substitutions are permitted only on substitution submittals as specified in Section 01 25 00 - Product Substitution Procedures.
- .13 The *Contractor* shall not proceed with work affected by a submittal, including ordering of *Products*, until relevant submittal has been reviewed by *Consultant*.
- .14 Keep copies of reviewed submittals at the *Place of the Work* in an organized condition. Only submittals that have been reviewed by the *Consultant* and include the *Consultant's* Submittal Review Form, as applicable, are permitted at the *Place of the Work*.
- .15 The *Work* must conform to reviewed submittals subject to the requirements of this Section. Remove and replace materials or assemblies not matching reviewed submittals at no increase in the *Contract Time* and at no additional cost to the *Owner*.
- .16 Engineered submittals:
 - .1 Submittals for items required to be engineered shall be prepared under the direct control and supervision of the *Contractor's Professional Engineer*, legally qualified to practice professional engineering in the Province of Ontario and having the minimum professional liability insurance and requirements as required by the Professional Engineers of Ontario, who shall also apply his/her professional seal and signature to submittals prepared under their direct control and supervision.
 - .2 Include with engineered submittal, *Professional Engineer's* certificate of insurance.
 - .3 Design includes life safety, sizing of supports, anchors, framing, connections, spans, and as additionally required to meet or exceed requirements of applicable Building codes, standards, regulations, and requirements of the *Authorities Having Jurisdiction*.
 - .4 Engineered submittals shall include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented by the submittal. Prepare calculations in a clear and comprehensive manner so that they can be easily reviewed. Incomplete or haphazard calculations will be rejected.
 - .5 The *Contractor* shall ensure that the *Professional Engineer* responsible for the preparation of engineered submittals undertakes periodic field review, including review of associated mock-ups, at locations wherever the work as described by the engineered submittal is in progress, during fabrication and installation of such work, and submits a field review report after each visit. Field review reports shall be submitted to the *Consultant*, to *Authorities Having Jurisdiction* as required, and in accordance with the Ontario Building Code.
 - .6 Field reviews shall be at intervals as necessary and appropriate to the progress of the work described by the submittal to allow the *Professional Engineer* to be familiar with the progress

and quality of such work and to determine if the work is proceeding in general conformity with the *Contract Documents*, including reviewed *Shop Drawings* and design calculations.

- .7 Upon completion of the parts of the *Work* covered by the engineered submittal, the *Contractor* shall ensure that its *Professional Engineer* responsible for the preparation of the engineered submittal and for undertaking the periodic field reviews described above, prepares and submits to the *Consultant* and *Authorities Having Jurisdiction*, as required, a letter of general conformity for those parts of the *Work*, certifying that they have been provided in accordance with the requirements both of the *Contract Documents* and of the *Authorities Having Jurisdiction* over the *Place of the Work*.
- .8 Costs for such field reviews and field review reports and letters of general conformity are included in the *Contract Price*.

1.4 BONDS, CERTIFICATES AND SCHEDULES

- .1 Prior to commencement of the *Work*, the *Contractor* is required to *Provide* to the *Owner* a copy of the *Contractor's* current Certificate of Clearance from the Workplace Safety and Insurance Board.
- .2 No later than 10 *Working Days* prior to, and as a condition of, the first application for progress payment, the *Contractor* is required to submit the following to the *Consultant*:
 - .1 A copy of the *Contractor's* Certificate of Clearance from the Workplace Safety and Insurance Board provided to the *Owner* in accordance with subsection 1.4.1 (above).
 - .2 A schedule of values for the parts of the *Work* showing values for each part of the *Work* distributed over each section of the Technical *Specifications* to the satisfaction of the *Consultant*. Make revisions to the schedule as required until acceptance by the *Consultant* is achieved.
 - .3 A construction progress schedule in accordance with subsection 1.8 of this Section (below).
 - .4 Bonding information shall be submitted to the *Owner* in accordance with the requirements of the *Contract Documents*.

1.5 SCHEDULE OF SUBMITTALS

- .1 Before commencement of the *Work*, submit to the *Consultant* a detailed schedule of submittals required by the *Contract Documents* correlated to the construction progress schedule specified under subsection 1.8 of this Section (below).
 - .1 Schedule shall be accompanied by a checklist, correlated to both the schedule of submittals and the schedule of inspections and tests (specified under Section 01 45 00 - Quality Control), listing the following:
 - .1 *Shop Drawings*.
 - .2 Samples.
 - .3 Mock-ups.
 - .4 Reviews, tests and inspections by:
 - .1 Manufacturers.
 - .2 *Authorities Having Jurisdiction*.
 - .3 Inspection and testing companies.

- .5 Demonstration and training.
- .2 Indicate dates for submitting, review time, resubmission time, float time, and last date for meeting construction schedule.
- .3 The *Consultant* will review submittal schedule and advise the *Contractor* if volume and timing of submittals will permit timely review and response. The *Consultant* may require modifications to submittals schedule in order to allow adequate time for review of submittals. Adjust submittals schedule and construction schedule as required to comply with the *Consultant's* requirements.
- .4 Make provisions in schedule for at least 10 *Working Days* for the *Consultant's* review of submittals. When submittals have to be reviewed by one or more of the *Consultant's Subconsultants*, add 5 more *Working Days* for a total of 15 *Working Day* review period.
- .5 If the *Consultant* requires resubmission of submittals, allow for an additional 10 *Working Days* review for each resubmission.
- .6 If, at any time, the *Contractor* submits a large enough number of submittals such that the *Consultant* cannot process these submittals within 10 *Working Days*, the *Consultant*, in consultation with the *Contractor* within 3 *Working Days* of receipt of such submittal, will *Provide* the *Contractor* with an estimate of the time necessary for processing same. The *Contractor* shall accommodate such necessary time at no increase in the *Contract Time* and at no additional cost to the *Owner*.
- .7 The *Contractor* shall periodically resubmit the submittal schedule to correspond to changes in the construction schedule. Such resubmissions shall maintain the minimum 10 *Working Day* period for the *Consultant's* review.
- .8 Schedule submissions of submittals well in advance of scheduled dates for installation, to *Provide* lead time for reviews and possible resubmissions and for placing orders and securing delivery so as to avoid delays in the *Work*.

1.6 SUBMISSION PROCEDURES

- .1 Coordinate each submittal with requirements of the *Work* and the *Contract Documents*. Individual submittals shall include related information.
- .2 Distribute copies of submittals to parties whose work is affected by submittals except the *Consultant* and *Owner* before final submission for review by the *Consultant*.
- .3 Accompany submittals with transmittal letter, containing:
 - .1 Date.
 - .2 *Project* title and number.
 - .3 *Contractor's* name and address.
 - .4 *Contractor's* review stamp.
 - .5 Identification and quantity of each submittal.
 - .6 Other pertinent data.
- .4 Each submittal shall be identified numerically by relevant *Specification* Section number with a numeric indicator for multiple submittals by that Section followed by revisions number, for example 04 05 19-01-R0.
- .5 Submit original PDF documents only: scanned documents shall not be accepted.

- .6 Make any changes in submittal that the *Consultant* may require, consistent with the *Contract Documents*, and resubmit as directed by the *Consultant*.
- .7 Notify the *Consultant*, in writing when resubmitting, of any revisions other than those requested by the *Consultant*.
- .8 After the *Consultant*'s review, distribute copies to affected parties.

1.7 PRODUCT DATA SHEETS

- .1 Submit *Product* data sheets as follows:
 - .1 One copy digitally in pdf format to the *Consultant*
- .2 Submit *Product* data sheets as called-for by the *Contract Documents* or as the *Consultant* may reasonably request where *Shop Drawings* will not be prepared due to a standardized manufacture of a *Product*. Manufacturers' catalogue cuts will be acceptable in such cases, providing that they are 213 mm x 275 mm (8-1/2" x 11") originals, and that they indicate choices including sizes, colours, model numbers, options and other pertinent data, including installation instructions. Submissions showing only general information will not be accepted.
- .3 Where requirements of the *Contract Documents* are more stringent than design proposed on *Product* data sheets, the requirements of the *Contract Documents* take priority.
- .4 Upon completion of review by the *Consultant*, one marked set of *Product* data sheets will be returned to the *Contractor* in digital format for reproduction and distribution.
- .5 Retain one complete set of prints of reviewed *Product* data sheets for issuance to the *Owner* immediately prior to *Substantial Performance of the Work*, in an acceptable, bound manner and in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.

1.8 SHOP DRAWINGS

- .1 The *Contractor* shall submit *Shop Drawings* digitally in PDF format to the *Consultant*.
- .2 The *Contractor* shall *Provide* all *Shop Drawings* called for in the *Contract Documents* or as the *Consultant* may reasonably request.
- .3 The *Contractor* shall submit copies of reviewed *Shop Drawings* to *Authorities Having Jurisdiction* as required.
- .4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes, and all other information necessary for completion of the *Work*.
- .5 Where articles or equipment attach or connect to other articles or equipment, clearly indicate that such items have been coordinated, regardless of where in the *Contract Documents* the adjacent items are specified or indicated. Indicate cross references to the *Contract Documents*.
- .6 *Shop Drawings* must clearly define the division of responsibility. No *Products*, items or equipment, or description of work, shall be indicated to be supplied, or work to be done, "By Others" or "By Purchaser." It shall also be understood that any items, equipment, or description of the work shown on the *Shop Drawings* must form a part of the *Contract Documents* unless specifically noted to the contrary. *Shop Drawings* that do not clearly define the division of responsibility will be returned to the *Contractor* for same before being accepted for review by the *Consultant*.
- .7 *Shop Drawings* must include:
 - .1 Fabrication and erection dimensions.

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

- .1 *Shop Drawings* requiring no changes will be marked 'REVIEWED', and shall be submitted for *As-Built Drawings* purposes.
 - .2 *Shop Drawings* requiring several changes will be marked 'REVIEWED as NOTED' and shall be revised and submitted for *As-Built Drawings* purposes.
 - .3 *Shop Drawings* requiring substantial changes will be marked 'REVISE AND RESUBMIT' and shall be revised and resubmitted until the *Consultant* stamps drawings with 'REVIEWED' or 'REVIEWED as NOTED'.
- .10 The *Consultant* will require a maximum of 10 *Working Days* from receipt of *Shop Drawings* for processing of same. The *Contractor* shall make allowances in the scheduling of the *Work* for this period of time for each submission and shall, also, make allowances in the schedule for the following potentialities:
- .1 If, upon review, adjustments are made on the *Shop Drawings* by the *Consultant* and they are returned to the *Contractor* marked "Revise and Resubmit," the *Shop Drawing* shall be revised as required and clean copies resubmitted to the *Consultant* for an additional review. The *Consultant* will, for each resubmission, require a maximum of 10 *Working Days* from receipt for processing of *Shop Drawings*.
 - .2 No claim for an increase in the *Contract Time* or claim for a change in the *Work* shall be considered or approved as a result of any of the following:
 - .1 The time taken for processing of *Shop Drawings* by the *Consultant* unless longer than 15 *Working Days* after receipt of same.
 - .2 The time taken by the *Contractor* for revision and resubmission of *Shop Drawings*.
 - .3 Any adjustments made on the *Shop Drawings* by the *Consultant* that are consistent with the intent of the *Contract Documents*.
- .11 Make the changes in the *Shop Drawings* as the *Consultant* may require, consistent with the *Contract Documents*. When resubmitting, notify the *Consultant* in writing of any revisions made other than those requested.
- .12 If, upon review by the *Consultant*, no errors or omissions are discovered or if only minor corrections are made, all submitted copies of the shop drawing will be returned to the *Contractor* marked as "Reviewed" or "Reviewed as Noted", and fabrication or installation of the work may proceed.
- .13 Upon completion of review by *Consultant*, the marked set of *Shop Drawings* will be returned to *Contractor* in digital format for reproduction and distribution.
- .14 Retain one complete set of prints of reviewed *Shop Drawings* for issuance to the *Owner* immediately prior to *Substantial Performance of the Work*, in an acceptable, bound manner and in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.
- .15 Submit copies of reviewed *Shop Drawings* to *Authorities Having Jurisdiction* as required.

1.9 SAMPLES

- .1 Submit for review samples as requested in the *Contract Documents*. Label samples as to origin and intended use in the *Work*.
- .2 Unless otherwise directed by the *Consultant*, deliver samples prepaid to the *Site* office and notify the *Consultant* in writing of the availability of sample for review.

- .3 Notify the *Consultant* in writing at the time of submission of any deviations in the samples from the requirements of the *Contract Documents*.

1.10 CERTIFICATES AND CERTIFICATION SUBMITTALS

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

1.11 PROJECT FIRESTOPPING MANUAL AND COORDINATION

- .1 The *Contractor* shall assign a firestopping and smoke seal firestopping coordinator to coordinate the firestopping details and systems required in the *Work*. Applicator shall designate a single individual as *Project* foreperson who shall be present at the *Place of the Work* throughout the *Work*.
- .2 Firestopping manual:
 - .1 The *Contractor* shall, together with its firestopping and smoke seal coordinator, prepare a preliminary fire stopping manual, inclusive of all firestopping systems in the *Work*, to be submitted to the *Consultant* prior to the installation of any firestopping and smoke seal work.
 - .2 Manual shall include:
 - .1 *Project* key plans of each level, with enlarged key plans at areas where required, which identify and tag each anticipated penetration and fire stopping location and type (i.e. multiple metallic pipes through gypsum board wall assembly; single metallic pipe through concrete floor assembly, etc.)
 - .2 *Product* data sheets: data and installation instructions for *Products* providing descriptions sufficient for identification at the *Place of the Work*.
 - .1 Materials list of *Products* proposed for use in the *Work*; complying with listed systems designs.
 - .2 Manufacturers' detailed drawing showing joint assemblies and firestopping materials, identified with Manufacturers' name and number or designation, fire rating achieved, and date of listing.
 - .3 Manufacturers' installation instructions and recommendations.
- .3 Shop Drawings:
 - .1 Submit *Shop Drawings* indicating fire resistance rated assembly number, required temperature, hose stream, and flame rating, material thicknesses, installation methods and materials of firestopping and smoke seals, primers, supports, damming materials as applicable, reinforcements, anchorages, fastenings and methods of installation for each condition to be encountered.
 - .2 Designate on *Shop Drawings* static through penetrations and dynamic joint systems, relative positions, expansion and control joints in rated slabs and walls, and firestopping details.
 - .3 Engineered *Shop Drawings*, for engineering judgements:
 - .1 Where *Project* conditions require modification to an accredited third-party testing agency's listed system design to address a particular firestopping condition that is not covered by a listed system, submit engineered *Shop Drawings* detailing the

modifications to the listed system design as an engineering judgment or equivalent fire resistance-rated assembly, for each *Project* location and condition.

- .2 Submit the manufacturer's engineering judgment identification number and *Shop Drawing* details prepared by *Professional Engineer*. The engineering judgment submittal shall include both *Project* name, *Project* location, and *Subcontractor's* name who will install firestop system as described in engineering judgement *Shop Drawings*.
- .3 *Provide* complete details of specific application of listed system and its modifications upon which the engineered judgement is based upon.
- .4 For perimeter fire barrier systems:
 - .1 Submit engineered *Shop Drawings* for engineering judgements covering perimeter fire barrier systems. Identify each cladding assembly type in contact with each perimeter fire barrier system.
- .4 Fire resistance rating test listings for firestopping and smoke seal systems.
- .3 Firestopping manual shall be submitted within 20 *Working Days* of *Contract* award.
- .4 Prior to concealment of firestopping conditions above a ceiling or by another assembly or finish, the *Contractor* shall submit an updated firestopping manual including *As-Built Drawings* that identify firestopping conditions and penetrations.
- .5 Closeout submittals:
 - .1 Submit closeout submittals in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.
 - .2 Submit the following certification documents with closeout submittals:
 - .1 Manufacturer's certification: The *Contractor* shall submit the manufacturer's certification that installed firestopping and smoke seal *Products* are suitable for the use indicated and comply with specified requirements.
 - .2 Installation certification: The *Contractor* shall submit the installer's certification that all joint firestopping system installations are completed and that installations comply with listed systems designs.
 - .3 As-built copy of the firestopping manual.

1.12 COORDINATION AND INTERFERENCE DRAWINGS

- .1 The *Contractor* shall be responsible for preparing and submitting to the *Consultant* for review, a consolidated set of installation coordination/interference drawings for the building showing how the building systems (including, but not limited to, domestic heating and cooling piping, air distribution systems, air control boxes, reheat coils, fire protection piping, electrical distribution, fire alarm systems, lighting, communication cabling, security cabling, new and existing structural work and conduit runs) will fit together above ceiling areas and in exposed ceiling, to allow ceiling heights required by the *Contract Documents* and by maintenance and control access.
 - .1 The *Contractor* shall ensure that each *Subcontractor* whose work is affected by the information presented on the coordination and interference drawings signs-off on the drawings prior to submission to the *Consultant*. The *Contractor* shall ensure that each

Subcontractor agrees to coordinate its parts of the *Work* to preserve the coordination and interference guidelines represented by the coordination and interference drawings.

- .2 Prepare sleeve drawings for work of Divisions 03 and 05, and Divisions 21, 22, and 23, and Divisions 26 and 28 showing size and location of penetrations through load bearing elements. Submit sleeving drawings in electronic form to the *Consultant* for review not less than 10 *Working Days* prior to construction of affected work.
- .3 Prepare embedded conduit drawings, showing size and location of penetrations through load bearing elements. Submit embedded conduit drawings in electronic form to *Consultant* for review not less than 10 *Working Days* prior to construction of affected work.
- .4 Prepare insert setting drawings for work to be cast into concrete and/or mortared into masonry elements. Submit insert setting drawings in electronic form to the *Consultant* for review not less than 10 *Working Days* prior to construction of affected work.
- .5 Coordinate placement of equipment to ensure that components will be properly accommodated within spaces, which shall be provided by the *Contractor* prior to commencement of *Work*. In areas where equipment and services are exposed, care shall be taken to organize and layout services in an organized and orderly manner. Where possible services are to run parallel or at right angles to one another as required. The *Consultant* may request that service layout be reconfigured to suit sightline concerns during the coordination drawings review phase. These drawing changes are to be executed at no additional cost to the *Owner*.
- .6 The *Contractor* shall be fully responsible for any remedial work that results from failure to coordinate the *Work* prior to fabrication and installation.
- .7 Ensure that accesses and clearance required by *Authorities Having Jurisdiction* and/or for easy maintenance of equipment are Provided in layout of equipment and services.
 - .1 Indicate required access points, clearances, and sizes for equipment and pieces of equipment required in the *Work*. Note areas where access is compromised by interferences with other services for review by the *Consultant*. Do not proceed with installation of equipment in such compromised areas until a proposed means of providing access has been accepted by the *Consultant*.
- .8 Prepare and circulate coordination, interference and sleeving drawings prior to placing orders for equipment and materials.
- .9 Coordination and interference drawings shall be circulated for mark-ups by *Subcontractors* responsible for work of Divisions 03, 05, 09, Divisions 21, 22, and 23, and Divisions 26, and 28.
- .10 Coordinate preparation and submission of coordination and interference drawings with *Shop Drawings*.
- .11 Show cross sections in key areas, as required, and as defined by the *Consultant*. Show rebar, structural elements, piping, air handling and heating systems distribution, sprinkler system distribution, lighting, gypsum board wall and ceiling assemblies, acoustical isolation, *Products* and systems involving life safety, conveying systems, electrical distribution.
- .12 Show ductwork as two lines. Show cross sections in key areas, as required, and as directed by the *Consultant*. Show re-bar, structural elements, air handling and heating systems distribution, gypsum board wall and ceiling assemblies, acoustical isolation, *Products* and systems involving life safety, conveying systems, and electrical distribution.

- .13 Coordination and interference drawings shall be produced in uniform scale on media that will allow overlays to be assembled. Upon incorporation of details, drawings shall be submitted to the *Consultant* for review. Areas of conflict or interference shall be resolved by the *Contractor* in a mutually agreed manner with *Subcontractors* and resubmitted on coordination and interference drawings until accepted by the *Consultant*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL SUMMARY

- .1 Section Includes
 - .1 Administrative and procedural requirements for meeting the energy and air tightness targets established for this project
 - .2 Identification of construction activities and tasks related to energy efficiency and air tightness
 - .3 Monthly and project close-out reporting requirements

1.2 RELATED SECTIONS

- .1 01 45 00 - Quality Control
- .2 01 57 20 - Temporary Indoor Air Quality Control
- .3 07 05 23 - Air Tightness Testing
- .4 23 05 93 - Testing, Adjusting, Balancing
- .5 23 08 00 - HVAC System Commissioning

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Contractor Responsibilities
 - .1 Unless otherwise indicated as the responsibility of another identified entity, the Contractor shall provide coordination of the trades, and the sequence of construction to ensure all energy efficiency and air tightness requirements relating to construction activities and tasks have been met. Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
 - .2 The Contractor shall provide the necessary orientation for all subcontractors.
 - .3 The Contractor shall ensure that all applicable materials and products meet the requirements relating to energy efficiency and air tightness. Compliance shall be demonstrated by providing the documentation required in the corresponding specification section.
 - .4 The Contractor shall implement and maintain the temporary indoor air quality protection measures required in section 01 57 20.
 - .5 The Contractor shall acquire photos throughout construction as requested by the Owner and Energy Consultant.
 - .6 The Contractor shall work with the Owner, Architect, Commissioning Agent, Mechanical Consultant and Energy Consultant to coordinate, schedule and accommodate all testing, inspection, and quality assurance activities. For reference, testing activities will include:
 - .1 Whole-building air tightness testing,
 - .2 Heating, cooling and ventilation air distribution system measurement and balancing.
 - .7 The Contractor shall allow enough time for testing, evaluation, alterations and re-testing so as not to interrupt the Progress Schedule for the Project.

- .8 The Contractor shall cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
 - .1 Provide access to the Work,
 - .2 Furnish incidental labour and facilities necessary to facilitate inspections and tests.
- .2 Subcontractors shall comply with all procedure and submittal requirements as detailed within the related specifications sections as they pertain to their scope of work.
- .3 Pre-Construction Meeting: After award of contracts and prior to mobilization onsite, the Contractor shall schedule a meeting with the Owner and Design Team to discuss the execution and documentation requirements as detailed within the related specification sections. Please note that this meeting is separate from any training (e.g. air tightness) sessions that are required in other sections.
- .4 Site Review Report Responses: The Energy Consultant will conduct inspections intermittently throughout construction. Feedback will be provided to the Contractor in the form of Site Review reports. The Contractor shall respond to all high and medium priority issues identified in the report within 5 working days from the time it was issued. The response shall be in written format and correspond to the item numbers used in the original report. If required, the Contractor shall provide photos and/or other supporting documentation that has been requested to demonstrate that the identified issues have been addressed.

1.4 QUALITY ASSURANCE

- .1 Materials and workmanship will be subject to inspection at any time. Cooperate in permitting access for inspection to all places where work is being done or stock is being stored. Refer to Section 01 45 00 and related Sections.
- .2 Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- .3 Owner's quality control inspection and testing is specified in the technical sections and will be paid for directly by the Owner except as otherwise specified. Contractor to pay for inspections and re-testing to verify acceptability of corrected work.

1.5 SUBMITTALS

- .1 Photographs
 - .1 Upon Project completion, the Contractor shall upload all required photographs taken during construction to an FTP or Cloud-based site setup by the Architect or Passive Building Consultant.

PART 2 – PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

- END OF SECTION -

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Requirements
- .2 1.2 Section Includes
- .3 1.3 Related Documents
- .4 1.4 Summary
- .5 1.5 Definitions
- .6 1.6 Administrative Requirements
- .7 1.7 Action Submittals
- .8 1.8 Informational Submittals
- .9 1.9 Quality Assurance
- .10 2.1 Materials, General
- .11 2.2 Building Product Disclosure And Optimization
- .12 2.3 Low-Emitting Materials
- .13 2.4 Indoor Water Use Reduction
- .14 3.1 Nonsmoking Building
- .15 3.2 Construction Waste Management
- .16 3.3 Construction Indoor-Air-Quality Management

1.3 RELATED DOCUMENTS

- .1 Drawings and general provisions of the *Contract*, including General and Supplementary Conditions and Division 01 *Specification* Sections, apply to this Section.

1.4 SUMMARY

- .1 Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for the *Project* to obtain "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) **Silver** certification based on USGBC's LEED v4 BD+C.
 - .1 Specific requirements for LEED are also included in other Sections.
 - .2 Some LEED prerequisites and credits needed to obtain LEED certification depend on *Product* selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable *Product* requests.
 - .3 A copy of the LEED checklist is included in Section 01 35 21 for information only.
 - .1 Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on aspects of *Project* that are not part of the *Work* of the *Contract*.

- .4 Definitions included in the "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) Reference Guide and online amendments apply to this Section.
- .2 Related Requirements:
 - .1 Section 01 32 00 - Construction Progress Documentation - Schedule.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 50 00 - Temporary Facilities and Controls for temporary heating and cooling requirements.
 - .4 Section 01 35 90 - Indoor Air Quality Management.
 - .5 Section 01 35 50 – LEED Waste Management & Disposal.
 - .6 Section 01 78 23 - Operation and Maintenance Data.
 - .7 Section 01 78 39 – As-Built Documents
 - .8 Section 01 91 00 - Commissioning Requirements.
 - .9 Divisions 02 through 49 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.5 DEFINITIONS

- .1 Bio-Based Materials: Materials that meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials shall be tested using ASTM D 6866 and be legally harvested, as defined by the exporting and receiving country.
- .2 CDPH Standard Method v1.1: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1–2010, for the emissions testing and requirements of products and materials.
- .3 Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, and distribution.
- .4 Chain-of-Custody Certificates: Certificates signed by manufacturers and fabricators certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.
- .5 Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.
- .6 Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer's product and the product's supply chain.
- .7 Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.
 - .1 Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.

- .2 Industry-Wide (Generic) EPD: Provide Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- .3 Product-Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicitly recognized by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- .8 Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life.
- .9 Health Product Declaration Open Standard (HPD): A standard format for reporting product content and associated health information for building products and materials.
- .10 Indoor Air Quality (IAQ) Management Plan: Plan developed by the *Contractor* to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "IAQ Guidelines for Occupied Buildings Under Construction."
- .11 Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.
- .12 Material Cost: The dollar value of materials being provided to the *Site*, after the *Contractor's* mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.
- .13 Materials Reuse: Reuse includes salvaged, refurbished, or reused products.
- .14 Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; and nonrenewable resource depletion.
- .15 Recycled Content: Recycled content is the sum of postconsumer recycled content plus one-half the preconsumer recycled content, based on cost.
 - .1 "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - .2 "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- .16 Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the *Project Site*.
- .17 Volatile Organic Compounds (VOC) Emissions Test: Refer to CDPH Standard Method v1.1 definition.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 The *Work* of this *Project* includes a completed building and application for LEED certification. The *Work* will not be complete until the *Owner* has accepted USGBC's final review of LEED certification.
 - .1 Provide documentation required by LEED and USGBC's review.
- .2 *Provide* materials and procedures necessary to obtain LEED prerequisites and credits required in this Section and other Sections of this *Contract*. Other Sections may specify requirements that contribute to LEED prerequisites and credits. Refer to other Sections for additional materials and procedures necessary to obtain LEED prerequisites and credits.
- .3 Respond to questions and requests for additional information from the Consultant and the USGBC regarding LEED credits until the USGBC has made its determination on the *Project's* LEED certification application.
- .4 LEED Online Submittals: Upload LEED documentation submittal data directly to USGBC *Project* "LEED Online" website . Complete online forms at least monthly and as necessary to document LEED credits for submittals required by all applicable Sections.
- .5 LEED Conference: Schedule and conduct a conference at a time convenient to Owner and Consultant within 21 *Working Days* prior to commencement of the work. Advise the *Consultant*, the *Owner's* Commissioning Authority of scheduled meeting dates.
 - .1 Attendees: Authorized representatives of the *Owner*, the *Owner's* Commissioning Authority, the *Consultant*, and their consultants; *Contractor* and its superintendent; major *Subcontractors*; *Suppliers*; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with *Project* and authorized to conclude matters relating to the *Work*.
 - .2 Agenda: LEED goals for the *Project*, the *Contractor's* action plans, and discussion of targeted LEED Prerequisites and Credits.
 - .3 Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED Credits.

1.7 ACTION SUBMITTALS

- .1 General: Submit additional LEED submittals required by other Specification Sections.
 - .1 Submit each LEED submittal simultaneously with applicable *Product* submittal.
- .2 LEED Documentation Submittals:
 - .1 General, Sustainable Materials Attributes Form: *Project* submittals must be accompanied by a completed Sustainable Materials Attributes Form. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the Sustainable Materials Attributes Form.
 - .1 *Provide* location and distance from *Project* of material manufacturer and point of extraction, harvest, or recovery for each raw material.
 - .2 EAp3, Building-Level Energy Metering: Product data for meters, sensors, and data collection system used to provide continuous metering of building energy-consumption performance.

- .3 MRp2/MRc5, Construction and Demolition Waste Management: Comply with submittal requirements of Section 01 35 50 – LEED Waste Management and Disposal.
- .4 MRc2, Building Product Disclosure and Optimization: Environmental Product Declarations complying with LEED requirements.
- .5 MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 1, Raw Material Source and Extraction Reporting.
 - .1 Corporate sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
- .6 MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices.
 - .1 Extended Producer Responsibility: *Product* data and certification letter from *Product* manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
 - .2 Bio-Based Materials: Product data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.
 - .3 Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - .4 Materials Reuse: Receipts for salvaged and refurbished materials used for *Project*, indicating sources and costs.
 - .5 Recycled Content: *Product* data and certification letter from *Product* manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for *Products* having recycled content. Include statement of costs.
- .7 MRc4, Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.
 - .1 Material ingredient reports for products that comply with LEED requirements for material ingredient reporting, including but not limited to the following:
 - .1 Manufacturer Inventory.
 - .2 Health Product Declaration.
 - .3 Cradle to Cradle certifications.
 - .4 Declare product labels.
- .8 MRc4, Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.
 - .1 Documentation for products that comply with LEED requirements for material ingredient optimization, including but not limited to the following:
 - .1 GreenScreen Benchmarks.
 - .2 Cradle to Cradle certifications.
 - .3 REACH optimizations.

- .9 EQp2/EQc3/EQc4, Indoor Air Quality: Comply with submittal requirements of Section 01 35 90 – Indoor Air Quality Management.
- .10 EQc2, Low-Emitting Materials: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, for the following materials:
 - .1 Paints and coatings.
 - .2 Adhesives and sealants.
 - .3 Flooring.
 - .4 Products containing composite wood or agrifiber products or wood glues.
 - .5 Ceilings, walls, thermal, and acoustic insulation.
 - .6 Exterior applied materials.

1.8 INFORMATIONAL SUBMITTALS

- .1 Qualification Data: For the *Contractor's* LEED coordinator.
- .2 *Project* Materials Cost Data: *Provide* statement indicating total cost and shop labor for materials used for *Project*. Costs exclude Site labor, overhead, and profit. Include breakout of costs for the following categories of items:
 - .1 Wood construction materials.
 - .2 Passive plumbing materials.
 - .3 Passive mechanical (HVAC) materials.
 - .4 Passive electrical materials.
 - .5 Earthwork and exterior improvements, hard costs.
- .3 LEED Action Plan Components: *Provide* preliminary submittals within seven *Working Days* of date established for commencement of the Work indicating how the following requirements will be met:
 - .1 MRp2/MRc5, Waste management plan, complying with Section 01 35 50 - LEED Waste Management & Disposal.
 - .2 EQp2/EQ3/EQ4, Indoor air quality plan, complying with Section 01 35 90 - Indoor Air Quality Management.
- .4 LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
 - .1 MRp2/MRc5, Waste reduction progress reports complying with Section 01 35 50 "LEED Waste Management & Disposal."
 - .2 MRc2, Building product disclosure and optimization – environmental product declarations.
 - .3 MRc3, Building product disclosure and optimization – sourcing of raw materials.
 - .1 General: Manufacturing locations.

- .2 Option 1: Corporate sustainability reports.
- .3 Option 2:
 - .1 Extended producer responsibility.
 - .2 Bio-based materials.
 - .3 Certified wood products.
 - .4 Materials reuse.
 - .5 Recycled content.
- .4 MRc4, Building product disclosure and optimization – material ingredients.
- .5 EQc2, Low emitting materials.
 - .1 Low Emitting Materials Tracking Sheet monitoring the *Project's* progress towards targeted LEED Indoor Environmental Quality Credits. Tracking Sheet to be presented at construction meetings.
- .6 EQc3, Indoor air quality, during construction, complying with Section 01 73 33 - Indoor Air Quality (IAQ) Management. EQc4, Indoor air quality assessment, complying with Section 01 73 33 - Indoor Air Quality (IAQ) Management.

1.9 QUALITY ASSURANCE

- .1 LEED Coordinator: The *Contractor* shall engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL

- .1 *Provide Products* and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the *Contractor* shall determine additional materials and procedures necessary to obtain LEED credits indicated. The *Contractor* shall determine a combination of credit options best suited for achieving credits required.
- .1 Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the *Project*, like formwork for concrete.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

- .1 MRc2, Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Option 1. Provide at least 20 permanently installed *Products* (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:
 - .1 Product-Specific Declaration: Valued as one quarter (1/4) of a product.
 - .2 Industry-Wide (Generic) EPD: Valued as one half (1/2) of a product.
 - .3 Product-Specific Type III EPD: Valued as one whole product.

- .2 MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 1, Raw Material Source and Extraction Reporting. Provide at least 20 permanently installed *Products* (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:
 - .1 Corporate sustainability reports.
- .3 MRc3, Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices. *Provide Products* that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building *Products* in the *Project*:
 - .1 Extended producer responsibility program.
 - .2 Bio-based materials.
 - .3 Certified Wood: Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - .1 Rough carpentry.
 - .2 Miscellaneous carpentry.
 - .3 Heavy timber construction.
 - .4 Wood decking.
 - .5 Metal-plate-connected wood trusses.
 - .6 Structural glued-laminated timber.
 - .7 Finish carpentry.
 - .8 Architectural woodwork.
 - .9 Wood paneling.
 - .10 Wood veneer wall covering.
 - .11 Wood flooring.
 - .12 Wood lockers.
 - .13 Wood cabinets.
 - .4 Recycled content.
 - .1 Exceptions: Do not include furniture, fire protection, operational plumbing, operational mechanical, and operational electrical components, and specialty items, such as elevators and equipment, in the calculation.
- .4 MRc4, Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.
 - .1 Use at least 20 different permanently installed *Products* from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:
 - .1 Manufacturer Inventory.

- .2 Health Product Declarations (HPDs).
- .3 Cradle to Cradle (C2C) certifications.
- .4 Declare product labels.
- .5 MRc4, Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.
 - .1 Use products that document their material ingredient optimization using the paths below for at least 25%, by cost, of the total value of permanently installed *Products* in the *Project*, which meet one of the following disclosure criteria:
 - .1 GreenScreen benchmarks.
 - .2 Cradle to Cradle certifications.
 - .3 REACH optimizations.

2.3 LOW-EMITTING MATERIALS

- .6 EQc2, Low-Emitting Materials, General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 *Working Days* measured as specified in the CDPH Standard Method v1.1 as follows:
 - .1 0.5mg/m3 or less,
 - .2 between 0.5 and 5.0 mg/m3, or
 - .3 0.50 mg/m3 or more.
- .7 EQc2, Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

Product Type:	Allowable VOC Content (g/L):
Bond Breaker	350
Clear wood finishes - Varnish	275
Clear wood finishes – Sanding Sealer	275
Clear wood finishes - Lacquer	275
Colorant – Architectural Coatings, excluding IM coatings	50
Colorant – Solvent Based IM	600
Colorant - Waterborne IM	50
Concrete – Curing compounds	100
Concrete – Curing compounds for roadways & bridges	350
Concrete surface retarder	50
Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100

Faux finishing coatings – Decorative Coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings – Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50
Form release compounds	100
Graphic arts (sign) coatings	150
Industrial maintenance coatings	100
Industrial maintenance coatings – High temperature IM coatings	420
Industrial maintenance coatings – Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings – Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450
Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac – Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings – repair	340
Swimming pool coatings – other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood preservatives	350
Low solids coatings	120

- .8 EQc2, Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings must comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- .9 EQc2, Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005:

Architectural Applications:	Allowable VOC Content (g/L):
-----------------------------	------------------------------

Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire retread	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Sheet applied rubber lining operations specialty	850
Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80
Sealants:	
Architectural sealant	250
Marine deck sealant	760
Nonmember roof sealant	300
Roadway sealant	250
Single-ply roof membrane sealant	450
Other sealant	420
Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750
Other	
Other adhesives, adhesive bonding primers, adhesive primers or any other primers	250

- .1 Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

- .10 EQc2, Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, 90 percent of adhesives and sealants must comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- .11 EQc2, Low-Emitting Materials, Flooring: Flooring must comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- .12 EQc2, Low-Emitting Materials, Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- .13 EQc2, Low-Emitting Materials, Ceilings, Walls, Thermal, and Acoustic Insulation: Ceilings, walls, and thermal insulation must comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- .14 EQc2, Low-Emitting Materials, Exterior Applied Materials: At least 90 percent of exterior applied materials, measured by volume, must comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- .1 The following materials are prohibited and do not count toward total percentage compliance:
 - .1 Hot-mopped asphalt for roofing.
 - .2 Coal tar sealants for parking lots and other paved surfaces.
- .15 Additional Low-Emitting Requirements:
 - .1 If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
 - .2 If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
 - .3 Methylene chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, or sealants.

2.4 INDOOR WATER USE REDUCTION

- .16 WEp2, Indoor Water Use Reduction, Appliances: Provide ENERGY STAR or performance *Equivalent* appliances.
- .17 WEp2/WEc2, Indoor Water Use Reduction, Plumbing Fixtures: Do not exceed water flow requirements indicated in Division 22 – Plumbing.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

- .18 EQp2, Environmental Tobacco Smoke Control: Smoking shall not be permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.
- .1 Refer to Section 01 73 33 - Indoor Air Quality (IAQ) Management.

3.2 CONSTRUCTION WASTE MANAGEMENT

- .19 MRp2 MRc5, Construction and Demolition Waste Management: Comply with Section 01 35 50 - LEED Waste Management & Disposal.

3.3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

- .20 EQc3/EQc4, Construction Indoor Air Quality Management Plan: Comply with Section 01 35 90 – Indoor Air Quality Management.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.
- .2 This Section describes requirements applicable to all Division.

1.2 SECTION INCLUDES

- 1.1 General Instructions
- 1.2 Section Includes
- 1.3 Reference standards
- 1.4 Responsibility
- 1.5 Safety activities
- 1.6 Posting of documents
- 1.7 Correction of non-compliance
- 1.8 Hazardous work
- 1.9 *Work* stoppage
- 1.10 Fire protection

1.3 REFERENCE STANDARDS

- .1 Safety Province of Ontario: Occupational Health and Safety Act, R.S.O. 1990 (“the Act”), as amended, O. Reg. 213/91 - Construction Projects, WHMIS Regulations, and the regulations made under the Environmental Protection Act.

1.4 RESPONSIBILITY

- .1 The *Contractor* shall be responsible for health and safety of persons on *Site*, safety of property on *Site* and for protection of persons adjacent to the *Site* and the environment to extent that they may be affected by conduct of the *Work* and comply with all requirements of the *Authorities Having Jurisdiction*.
- .2 The *Contractor* shall comply with and enforce compliance by employees with safety requirements of the *Contract Documents*, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with the *Site*-specific Health and Safety Plan.
- .3 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of the *Work*, the *Contractor* shall follow procedures in place for Employee's Right to Refuse *Work* in accordance with the requirements of the *Authorities Having Jurisdiction*. Advise the *Consultant* verbally and in writing.

1.5 SAFETY ACTIVITIES

- .1 Perform *Site* specific safety hazard assessment related to *Project*.
- .2 Schedule and administer Health and Safety meeting with the *Consultant* prior to commencement of the *Work*.
- .3 Perform the *Work* in accordance with section 01 41 00 - regulatory requirements and the requirements set out in this Section.

1.6 POSTING OF DOCUMENTS

- .1 Ensure that applicable items, articles, notices and orders are posted in conspicuous location on *Site* in accordance with Acts and Regulations of the *Authorities Having Jurisdiction*, and in consultation with the *Consultant*.

1.7 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by the *Authority Having Jurisdiction* or by the *Consultant*.
- .2 *Provide* the *Consultant* with a written report of action taken to correct non-compliance of health and safety issues identified.
- .3 The *Consultant* and/or the *Owner* may stop the *Work* if non-compliance of health and safety regulations is not corrected.

1.8 HAZARDOUS WORK

- .1 Blasting or other use of explosives shall not be permitted without prior receipt of written approval from the *Consultant*.
- .2 Use powder actuated devices only after receipt of written permission from the *Owner*.

1.9 WORK STOPPAGE

- .1 Give precedence to safety and health of public and *Site* personnel and protection of environment over cost and schedule considerations for the *Work*.

1.10 FIRE PROTECTION

- .1 *Provide* and maintain temporary fire protection equipment during performance of the *Work* required by insurance companies and governing codes, regulations and bylaws of the *Authorities Having Jurisdiction*.
- .2 Burning rubbish and construction waste materials shall not be permitted on *Site*.
- .3 Maintain placed or installed fire resistive construction to protect the portions of the *Work* during construction.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 Section Includes

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Objectives
- .4 1.4 Description Of Work
- .5 1.5 Related Work Specified Elsewhere
- .6 1.6 Reference Standards
- .7 1.7 Code Of Practice
- .8 1.8 Definitions
- .9 1.9 Leed® Construction Coordinator
- .10 1.10 Leed® Kick-Off Meeting
- .11 1.11 Leed® Orientation Meeting
- .12 1.12 Postings
- .13 1.13 Submittals
- .14 1.14 Site Assessment
- .15 1.15 Construction Waste Management Plan
- .16 1.16 Inspections And Maintenance

1.3 OBJECTIVES

- .1 Minimize the amount of solid waste (including land-clearing debris) generated by construction, renovation and demolition (CRD) activities.
- .2 The *Contractor* is responsible for providing and managing all aspects of CRD activities, including but not limited to:
 - .1 Collection and separation of all construction waste, including waste generated by *Subcontractors*.
 - .2 *Provide* all necessary disposal bins to accommodate on *Site* waste separation.
 - .3 *Provide* off-*Site* waste separation at no additional cost to the *Owner*.
- .3 The *Contractor* shall ensure that *Subcontractors* comply with minimum waste diversion requirements and policies defined by the *Contractor*.
- .4 Of the solid waste (including land-clearing debris) that is generated by CRD activities, the *Contractor* shall divert more than 75% from landfill (through reuse and recycling) via on- or off-*Site* sorting practices.
- .5 Meet the requirements of LEED® Canada-NC Version v4.1 Prerequisite “Construction and Demolition Waste Management Planning” credit.

- .6 Comply with all applicable Environmental Protection Act of Ontario regulations relating to construction waste management including Ontario Regulation 102/94 and Ontario Regulation 103/94.

1.4 DESCRIPTION OF WORK

- .1 The *Contractor* shall identify, implement and document measures to achieve the waste management objectives listed in subsection 1.3 above.
- .2 Follow a strategy based on the following 3R's hierarchy: Reduce the generation of waste materials at the *Site*, Reuse waste materials on other construction *Sites* (when feasible), and Recycle waste materials as feedstock for manufacturing processes that create new products. Identify opportunities to reuse and recycle waste in accordance with the requirements of Ontario Regulation 102/94 and this Section.
- .3 Complete and adhere to Demolition and Construction Waste Management Off-Site Sorting Worksheets (Schedule A) included in Section 01 35 50.1: Summarize all shipments of waste materials from the *Site*. Refer to subsection 1.15 for further details.
- .4 Complete and adhere to Demolition and Construction Waste Management On-Site Sorting Worksheets (Schedule B) included in Section 01 35 50.1. Initiate the reuse/recycling process by separating the various types of waste materials at the *Site* in accordance with the requirements of Ontario Regulation 103/94 and these specifications. Refer to section 1.15 for further details.

1.5 RELATED WORK SPECIFIED ELSEWHERE

- .1 Comply with Section 01 35 20 - General LEED Requirements.

1.6 REFERENCE STANDARDS

- .1 Ontario Environmental Protection Act. Ontario Regulation 102/94: Waste Audits and Waste Reduction Workplans.
- .2 Ontario Ministry of the Environment (MOE). A guide to Waste Audits and Reduction Workplans for Construction and Demolition Projects as Required under Ontario Regulation 102/94.
- .3 Ontario Environmental Protection Act. Ontario Regulation 103/94: Industrial, Commercial and Institutional Source Separation Programs.
- .4 Ontario Ministry of the Environment (MOE). A guide to Source Separation of Recyclable Materials for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings as Required Under Ontario Regulation 103/94.
- .5 Canadian Construction Association. Standard Construction Document CCA 27- 1997: A guide on Construction Environmental Management Planning.
- .6 Canadian Construction Association. Standard Construction Document CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.
- .7 Canada Public Works and Government Service Canada 2002 National Construction Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.
- .8 CaGBC, "Materials & Resources Credits" Leadership in Energy and Environmental Design Reference Guide for New Construction & Major Renovations (LEED® Canada Reference Guide for Green Building Design and Construction v4.1)

1.7 CODE OF PRACTICE

- .1 Comply with Canadian Construction Association's "Code of Practice" outlined in Standard Construction Document CCA 27-1997 to encourage improved waste management practices.

1.8 DEFINITIONS

- .1 Solid Waste: Any waste material (including land-clearing debris) that is sent from the *Site* to another location for disposal.
- .2 Land-Clearing Debris: Waste materials resulting from land-clearing that include pre-existing development materials and plant matter, but do not include soil.
- .3 Reused Waste: Waste materials that are sent to a location off-*Site* (eg. Another construction project or product supplier) where they are used in their original form (i.e. without additional processing).
- .4 Recycled Waste: Waste materials that are sent off-*Site* to a recycling facility where they are used to displace virgin materials as feedstock for manufacturing processes that create new products.
- .5 Landfill Waste: Waste materials that are sent to a landfill site for disposal. This includes incinerated material.

1.9 LEED® CONSTRUCTION COORDINATOR

- .1 The *Contractor* shall designate an individual to be responsible for all aspects for LEED® coordination during construction (including construction waste management).
- .2 The *Contractor's* LEED® Construction Coordinator shall be responsible for:
 - .1 Arranging waste management service agreements with waste haulers and waste receiving facilities
 - .2 Supervising on-*Site* waste management activities on a daily basis
 - .3 Coordinating waste management tasks with *Subcontractors* to ensure timely and orderly progress of the work
 - .4 Preparing waste management documentation and submittals
 - .5 Reporting waste management progress to the *Consultant*
- .3 The *Contractor* shall ensure that the LEED® Construction Coordinator is regularly on-*Site* during construction.

1.10 LEED® KICK-OFF MEETING

- .1 Prior to start of construction, the *Contractor* shall hold a kick-off meeting with its LEED® Construction Coordinator and the *Consultant* to review the Construction Waste Management Program requirements. This meeting must include a review of:
 - .1 Construction Waste Management Objectives
 - .2 Construction Waste Management Requirements and Procedures
 - .3 Construction Waste Management Postings and Submittals

1.11 LEED® ORIENTATION MEETING

- .1 Prior to mobilization on-*Site*, the *Contractor's* LEED® Construction Coordinator (in conjunction with the *Consultant*) shall hold an orientation meeting with the construction team to explain the Construction Waste Management Program requirements to the *Subcontractors*. This meeting must include a review of:
 - .1 Construction Waste Management Objectives
 - .2 Waste Estimates and Waste Diversion Estimates
 - .3 Material Separation Requirements and Procedures
 - .4 The *Contractor's* LEED® Construction Coordinator shall hold a Questions & Answers session to clarify the requirements and procedures for all *Subcontractors*.

1.12 POSTINGS

- .1 The *Contractor's* LEED® Construction Coordinator shall post up-to-date copies of the Off-*Site* and On-*Site* Sorting Worksheets in a location that is easily accessible for review by all *Site* workers and visitors.

1.13 SUBMITTALS

- .1 Demolition and Construction Waste Management On-site Sorting Worksheet – Schedule B
 - .1 For materials sorted on-*Site*, indicate the dates the bin was delivered to and removed from the *Site*, the waybill number, and the bin volume and weight. Specify the material type, the weight of the material that was recycled and the weight landfilled, and the name of the receiving facility where the waste was ultimately sent.
 - .2 The Worksheet is to be submitted to the *Consultant* on a monthly basis. Include copies of waybills for all loads and other documentation from the receiving facility to corroborate that the waste was (or will be) recycled/salvaged.
 - .3 The Worksheet is to be submitted to the *Consultant* on a monthly basis with all loads accounted for. For all loads, include copies of waybills and other documentation from the receiving facility to corroborate that the waste was (or will be) recycled/salvaged.
 - .4 Pre-construction: the recycling service provider is to submit a list of the receiving facilities utilized and the end use(s) of each material accepted for recycling and method for processing received materials (e.g. the wood accepted was made into wood chips then made into particleboard).

1.14 SITE ASSESSMENT

- .1 The *Contractor* shall allocate sufficient area on the construction *Site* for the placement of material separation bins in an accessible, efficient arrangement.
- .2 The *Contractor* shall provide "blue box" recycling bins near the construction trailer for recycling waste generated by *Site* workers and visitors.

1.15 CONSTRUCTION WASTE MANAGEMENT PLAN

- .1 The *Contractor* shall create a Construction Waste Management (CWM) Plan to be implemented by the *Contractor* and *Subcontractors*. The plan must include, but not be limited to the following procedures:

.1 Waste Reduction

- .1 Invitation to *Suppliers* to retrieve/retain packaging after delivery (for reuse).
- .2 Prevent damage of materials due to mishandling, improper storage, and contamination.
- .3 Use prefabricated assemblies built at a central facility (when possible) to avoid waste generation at the *Site*.

.2 Waste Diversion

- .1 Contact local salvaging/recycling facilities and arrange for recycling services. Only facilities operating under a Certificate of Approval as required by the Environmental Protection Act of Ontario are acceptable. Incineration is not to be considered a means of diversion from landfill for LEED purposes.
- .2 Provide on-*Site* bins for the collection, handling, and storage of waste that are properly sized to accommodate expected waste quantities.
- .3 Follow the material acceptance requirements of the salvaging/recycling facilities so that materials are properly sorted, grouped, and packaged.
- .4 Provide separate, properly labeled containers for each of the following material types:
 - .1 Land clearing debris
 - .2 Asphalt
 - .3 Portland cement concrete / masonry / stone
 - .4 Steel and other metals
 - .5 Wood
 - .6 Gypsum (e.g. drywall)
 - .7 Cardboard
 - .8 Plastic
 - .9 "Blue box" Recyclables
 - .10 Mixed waste
 - .11 Other types (as required by salvaging/ recycling facilities)
- .5 Provide separate containers for "blue box" waste (generated by site workers) collected in a mixed condition that will be separated for recycling off-*Site*. The waste deposited in this container must include:
 - .1 Aluminum food or beverage cans
 - .2 Glass bottles and jars for food or beverage
 - .3 PET bottles for food or beverages
 - .4 Steel food or beverage cans
 - .5 Cardboard and paper products
 - .6 Protect materials from damage and contamination.

.3 Waste Tracking

- .1 Coordinate delivery of separated materials to approved salvage or recycling facilities.
 - .2 Retain waybills for inclusion in monthly waste diversion reports.
 - .3 Itemize costs or credits associated with the diversion and disposal of waste materials.
 - .4 Assemble documentation from each receiving facility to corroborate that the waste was (or will be) actually recycled/salvaged.
 - .5 Receive Facility Letters
- .2 Submit the CWM Plan prior to the start of construction for approval by the *Consultant*.

1.16 INSPECTIONS AND MAINTENANCE

- .1 Conduct daily inspections of material separation bins to check for and remedy cross-contamination.

PART 2 - PRODUCTS

Not Applicable.

PART 3- EXECUTION

Not Applicable.

END OF SECTION

Schedule A - Demolition and Construction Waste Management Off-Site Storing Worksheet

Documentation Period:											
Project Name:											
Project Location:											
Completed By:											
Company:											

No.	On-site Date	Off-site Date	Waybill No.	Bin Size (yd ³)	Total Weight (metric tonnes)	Material Type (e.g. Wood, Metal, Concrete, Drywall, Land clearing debris)	Weight of Recycled Materials (metric tonnes)	Weight of Landfilled Materials (metric tonnes)	Receiving Facility
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

I/We hereby certify that the information provided is complete, correct and complies with Ontario regulation 102.

Signature of Authorized Official:	Title:	Date:
-----------------------------------	--------	-------

Schedule B – Demolition and Construction Waste Management On-site Sorting Worksheet

Documentation Period:	
Project Name:	
Project Location:	
Completed By:	
Company:	

No.	On-site Date	Off-site Date	Waybill No.	Bin Size (yd ³)	Total Weight (metric tonnes)	Material Type (e.g. Wood, Metal, Concrete, Drywall, Land clearing debris)	Weight of Recycled Materials (metric tonnes)	Weight of Landfilled Materials (metric tonnes)	Receiving Facility
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

I/We hereby certify that the information provided is complete, correct and complies with Ontario regulation 102.

Signature of Authorized Official:		Title:	Date:
-----------------------------------	--	--------	-------

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Objectives
- .4 1.4 Description of Work
- .5 1.5 Related Work Specified Elsewhere
- .6 1.6 Reference Standards
- .7 1.7 LEED® Construction Coordinator
- .8 1.8 LEED® Pre-Construction Meeting
- .9 1.9 LEED® Orientation Meeting
- .10 1.10 Submittals
- .11 1.11 Product Requirements
- .12 1.12 Site Assessment
- .13 1.13 VOC – Products and Materials Identification – Refer to Schedule A (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)
- .14 1.14 Sources of Pollutants – Refer to Schedule B (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)
- .15 1.15 IAQ Pollutant Containment Measures - Refer to Schedule C (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)
- .16 1.16 Housekeeping Measures - Refer to Schedule D (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)
- .17 1.17 Scheduling Measures - Refer to Schedule E (SECTION 01 35 90.1 Indoor Air Quality Management Schedules)
- .18 1.18 HVAC Protection Measures - Refer to Schedule F (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)
- .19 1.19 IAQ Testing
- .20 1.20 Installation of Products
- .21 1.21 Removal of Products

1.3 OBJECTIVES

The *Contractor* shall protect construction workers and future building occupants from indoor air quality problems resulting from construction activities and building materials.

The *Contractor* shall reduce the production and circulation of pollutants during construction.

The *Contractor* shall protect equipment and absorptive materials stored and installed on-*Site* from moisture, dust, and dirt accumulation during construction.

Following construction and prior to occupancy, the *Contractor* shall demonstrate that the building has been suitably prepared for occupancy by performing baseline Indoor Air Quality (IAQ) testing.

The *Contractor* shall ensure that the *Contractor* and its *Subcontractors* shall meet or exceed the requirements of LEED® Canada -NC Version 4.1 credits "Construction IAQ Management Plan", and EQc4 Low-Emitting Materials.

1.4 DESCRIPTION OF WORK

Identify, implement and document (using photographs and compliance checklists) the measures applied to achieve the IAQ management objectives.

Meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008 (Chapter 3).

Control the sources of pollutants by selecting low-emitting *Products*, using appropriate equipment (e.g., power tools that do not burn fossil fuels) and changing work practices (e.g., change techniques to reduce emissions, use vacuum dust collection systems, etc.).

Contain work areas (e.g., close doors, use dust curtains, etc.) to prevent the circulation of pollutants.

Suspend or modify HVAC operation to prevent the circulation of pollutants.

Intensify housekeeping to remove pollutants from the *Site*.

Cover, seal and protect materials stored and installed on-*Site* from moisture, dust and dirt accumulation.

Reschedule work hours to prevent worker exposure to pollutants.

Make suitable preparations for occupancy (Building flush-out period, or Indoor Air Quality Testing).

Complete and implement the IAQ Management Schedules included as a Supplement to this Section (Section 01 35 90.1 – IAQ Management Schedules) with this Specification. Provide all necessary documentation to support implementation.

Replace all filtration media immediately prior to the flush-out and immediately prior to occupancy.

1.5 RELATED WORK SPECIFIED ELSEWHERE

Section 01 35 90.1 – Indoor Air Quality Management Schedules.

1.6 REFERENCE STANDARDS

Sheet Metal and Air Conditioning National Contractors Association (SMACNA); IAQ Guidelines for Occupied Buildings Under Construction. First Edition, 1995.

ASHRAE. ANSI/ASHRAE 52.2-2007: Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.

EPA. EPA Protocol for Environmental Requirements, Testing for Indoor Air Quality Baseline IAQ.

Canadian Green Building Council. "Indoor Environmental Quality Credit 3: Construction IAQ Management Plan and Credit 4: Low-Emitting Materials"

LEED® Canada Reference Guide for Green Building Design and Construction v4.1

1.7 LEED® CONSTRUCTION COORDINATOR

The *Contractor* shall designate an individual to be responsible for all aspects of LEED® coordination during construction (including indoor air quality management).

The *Contractor's* LEED® Construction Coordinator shall be responsible for:

- .1 Supervising on-*Site* indoor air quality management activities on a daily basis
- .2 Coordinating indoor air quality management tasks with *Subcontractors* to ensure timely and orderly progress of the work
- .3 Preparing indoor air quality management documentation and submittals
- .4 Reporting indoor air quality management progress to the *Consultant*

The *Contractor's* LEED® Construction Coordinator shall be on-*Site* regularly (preferably fulltime) during construction.

1.8 LEED® PRE-CONSTRUCTION MEETING

Prior to start of construction, the LEED® Construction Coordinator shall hold a pre-construction meeting with the *Consultant* to review the Indoor Air Quality Management Program requirements. This meeting must include a review of:

- .1 Indoor Air Quality Management Objectives
- .2 Indoor Air Quality Management Description of Work
- .3 Indoor Air Quality Management Postings and Submittals

1.9 LEED® ORIENTATION MEETING

Prior to mobilization on-*Site*, the *Contractor's* LEED® Construction Coordinator (in collaboration with the *Consultant*) shall be responsible to hold an orientation meeting with the construction team to explain the Indoor Air Quality Management Program requirements to the *Subcontractors*. This meeting must include a review of:

- .1 Indoor Air Quality Management Objectives
- .2 Indoor Air Quality Protection Measures

Hold a Questions and Answers session to clarify the requirements and procedures for the *Subcontractors*.

1.10 SUBMITTALS

IAQ Management Schedules

- .1 To be submitted by the *Contractor* prior to the start of construction:
 - .1 Source Control - Schedule B
 - .2 Pathway Interruption - Schedule C
 - .3 Housekeeping - Schedule D
 - .4 IAQ Scheduling - Schedule E
 - .5 HVAC Protection - Schedule F

- .2 All IAQ Management Schedules, other than Schedule A, shall be submitted to the *Consultant* 14 *Working Days* after the *Subcontractor* orientation meeting for review and acceptance.
- .3 Maintain one complete set of IAQ Management schedules at the job *Site*.

Photographs

- .4 Provide photographs as specified in the IAQ Management Schedules.
- .5 Photographs must be taken monthly during construction to prove sustained compliance.
- .6 Photographs must be accompanied by the date taken, and a description of the indoor air quality management measure depicted.

IAQ Management Inspection Log

- .7 All indoor air quality management measures shall be inspected on a weekly basis by the LEED® Construction Coordinator and any deficiencies shall be remedied.
- .8 Inspections shall be recorded in the IAQ Management log and shall denote any deficiencies as well as corrective action taken during the weekly inspections.
- .9 The IAQ Management Inspection Log shall be provided to the *Consultant* for review if requested. This log shall be started when the building is enclosed and shall carry through to building turnover to the *Owner*.
- .10 After building turn-over, a complete copy of the IAQ Management Inspection Logs for the duration of the *Project* shall be provided to the *Consultant* for documentation purposes.

1.11 PRODUCT REQUIREMENTS

The following chart outlines the maximum Volatile Organic Compound (VOC) limits for products used on the interior of the building (i.e. inboard side of the weatherproofing system and applied onsite).

VOC Product Limits

- .1 California South Coast Air Quality Management District Rule #1168;

Architectural Applications	VOC Limit (g/L)
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Wood Flooring Adhesives	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
Vinyl Composition Tile (VCT) and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Grout and Mortar	250
Specialty Applications	VOC Limit (g/L)
Polyvinyl Chloride (PVC) Welding	510
Chlorinated Polyvinyl Chloride CPVC Welding	490

American Bureau of Shipping (ABS) Welding	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Structural Wood Member Adhesive	140
Top and Trim Adhesive	250
Substrate Specific Applications	VOC Limit (g/L)
Metal to Metal	30
Plastic Foams	50
Porous Material (except wood)	50
Wood	30
Fiberglass	80
Sealants	VOC Limit (g/L)
Architectural	250
Non-Membrane Roof	300
Single-Ply Roof Membrane	450
Other	420
Sealant Primers	VOC Limit (g/L)
Architectural, Non-Porous	250
Architectural, Porous	775
Modified Bituminous	500
Other	750

1. Green Seal GS-36 for Commercial Adhesives

Aerosol Adhesives	VOC Weight (g/L minus water)
General purpose mist spray	65% VOCs by weight
General purpose web spray	55% VOCs by weight
Special purpose aerosol adhesives (all types)	70% VOCs by weight

2. Green Seal GS-11 VOC Levels for Paints and Coatings

Paints (GS-11)	VOC Limit (g/L)
Interior Non-Flat Coating	150
Interior Flat Coating	50

3. GS-03 VOC Levels for Anti-Corrosive/Anti-Rust Paint

Anti-Corrosive Paints (GS-03)	VOC Limit (g/L)
Anti-Corrosive Coatings, Gloss	250

Anti-Corrosive Coatings, Semi-Gloss	250
Anti-Corrosive Coatings, Flat	250

4. California South Coast Air Quality Management District Rule #1113;

Table of Standards	VOC Limit (g/L)
Clear Wood Finishes, Varnish	350
Clear Wood Finishes, Sanding Sealers	350
Clear Wood Finishes, Lacquer	550
Clear Brushing Lacquer	680
Concrete-Curing Compounds	350
Floor Coatings	100
Japan/Faux Finishing Coatings	350
Magnesite Cement Coatings	450
Pigmented Lacquer	550
Primers, Sealers, and Undercoaters	200
Shellac, Clear	730
Shellac, Pigmented	550
Stains	250
Waterproofing Sealers	250
Waterproofing Concrete/Masonry Sealers	400
Wood Preservatives	350
Low-Solids Coating	120*

*Measured in grams of VOC per litre of material, including water.

Carpet System Requirements

- .2 All carpet must meet the requirements of the Carpet and Rug Institute's Green Label Plus program.
- .3 All carpet cushion must meet the requirements of the Carpet and Rug Institute's Green Label program.

Flooring Requirements

- .4 All hard surface flooring covered by FloorScore standard must be certified as compliant.
- .5 Or, all hard surface flooring products must comply with testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources using Small Scale Environmental Chambers including 2004 Addenda.

Composite Wood, Agrifibre Products & Laminates

- .6 All composite wood and agrifibre products must not contain added urea formaldehyde resins. Laminating adhesives must not contain urea-formaldehyde.

Filtration Media Requirements

- .7 MERV 8 Filters: To be used on all return grilles for any equipment that is to be operated during construction.
- .8 MERV 13 Filters: Refer to 3.11 HVAC protection Measures (Option 1 and Option 2).

1.12 SITE ASSESSMENT

Conduct a thorough Site assessment to determine areas of concern from an Indoor Air Quality management perspective. Implement IAQ Management measures and document with the appropriate IAQ Management Schedules.

1.13 VOC – PRODUCTS AND MATERIALS IDENTIFICATION – REFER TO SCHEDULE A (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)

The *Contractor* shall provide a list of adhesives, sealants, paints, coatings, carpeting, wood composite, and laminate materials and products that shall be installed within the building vapour barrier, including total quantity in Litres (L)

The *Contractor* shall provide documentation such as Safety Data Sheet (SDS) or other product literature that clearly states the amount of VOC's in grams per L for adhesives, sealants, paints, and coatings.

The *Contractor* shall provide documentation from the manufacturer stating the carpet product(s) complies with the Carpet and Rug Institute's Green Label Testing Program.

The *Contractor* shall provide documentation from the manufacturer for all composite wood and agrifibre *Products* that states they do not contain resins with any added urea-formaldehyde. For laminate *Products*, the *Contractor* shall submit documentation stating the laminate adhesive(s) does not contain urea-formaldehyde.

1.14 SOURCES OF POLLUTANTS – REFER TO SCHEDULE B (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)

Any construction activity that produces odour and/or dust is considered a source of air pollutants. Typical sources of pollutants include:

- .1 Disturbing materials during demolition, repair or construction.
- .2 Materials that produce detectable odour.
- .3 Materials that create dust.
- .4 Equipment that emits products of combustion or creates odour and/or dust.
- .5 Construction activities that disrupt pollutants that have settled.

Possible sources of pollutants include:

BUILDING MATERIALS	Concrete Drywall Engineered Wood Products Cove Base	Epoxy Flooring Roofing Insulation Ceiling Tiles
WET PRODUCTS	Paint and Stains Sealants and Coatings Adhesives Acid Finish	Glazing Caulking Grouting
FURNISHINGS	Carpeting Wood Flooring Furniture	Wall Coverings Cabinets Partitions
SOLUTIONS	Solvents Cleaning Products	Fuels Pesticides
GASOLINE/DIESEL POWERED	Generators Compressors	Heavy Equipment Vehicles

LPG AND OTHER GASES	Portable Heaters Cutting Torch	Welder Soldering Gun
OTHER SOURCES	Standing water/moisture causing mould growth Tobacco smoking within the building Exterior work adjacent to building openings	

- .6 List all potential sources of indoor air pollutants on the construction site. Refer to Source Control Plan – Schedule B.
- .7 Do not permit smoking inside the building where porous materials are installed (drywall, ceiling tiles, carpet, etc.).
- .8 Do not burn garbage.
- .9 Do not fuel equipment inside the building.
- .10 Do not store gasoline or solvents inside the building.
- .11 Do not allow lubricants to spill within the building (e.g. pipe threading oil).
- .12 Promptly clean all spills (fuels, lubricants, paints, adhesives, etc.).
- .13 Restrict outdoor vehicular/equipment traffic and operation where emissions can be drawn into building.
- .14 Reduce on-Site emissions by using equipment that burns propane/natural gas instead of gasoline. Electric equipment eliminates combustion emissions.
- .15 Exhaust pollution sources directly to the outside using temporary or permanent ventilation equipment (refer to HVAC Protection Measures).
- .16 Where exhaust is not feasible and ventilation is required, locally re-circulate air through a portable air cleaner.
- .17 Collect and bag sawdust from woodworking tools.
- .18 Cover and/or seal all indoor sources of odour and dust.
- .19 Use painting techniques that minimize odour (roller instead of spraying)
- .20 Use cleaning practices that minimize dust (vacuum with High efficiency particulate air - HEPA filtered vacuum cleaners instead of sweeping).
- .21 Use cleaning products that minimize pollution, fumes, VOC's, chemicals.

1.15 IAQ POLLUTANT CONTAINMENT MEASURES - REFER TO SCHEDULE C (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)

Prevent the movement of pollutants from the source to other areas in the building as follows:

- .1 Erect dust curtains/doors/barriers
- .2 Use portable fans to exhaust pollutants (e.g. gas engine exhaust) to the exterior through windows, doors, etc. Ensure that other windows or doors will not let pollutants back into building.
- .3 Close windows and doors close to exterior work - do not allow exterior pollutants to enter the building (dust, vehicle emissions, etc.). If windows and doors are not yet installed, temporarily seal openings with plastic, wood, etc.

- .4 Move equipment or pollutant-causing work to locations where IAQ impact is minimized:
 - .1 Avoid high draft or large open areas
 - .2 Use shields and curtains to contain work
 - .3 Locate in small, contained areas
 - .4 Locate outside the building
 - .5 Depressurize the work area using temporary or permanent ventilation equipment (refer to HVAC Protection Measures).
 - .6 Pressurize occupied or completed areas using temporary or permanent ventilation equipment (refer to HVAC Protection Measures).

1.16 HOUSEKEEPING MEASURES - REFER TO SCHEDULE D (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)

Clean frequently to collect dust.

Minimize creation of dust during cleaning by using wetting agents, sweeping compounds, damp rags, wet mop.

Use vacuum equipment with HEPA filtration and/or a wet scrubber.

Clean spills promptly.

Clean or remove excess application of solvent-containing products.

Remove accumulated water and keep the building interior as dry as possible.

Close windows and doors close to exterior moisture or provide temporary enclosures of plastic or wood.

Use ventilation/dehumidification to reduce interior humidity if necessary.

Cover, seal and protect materials stored and installed on-*Site* from moisture, dust and dirt accumulation.

Shall not install any materials with evidence of moisture damage or excessive moisture content.

Shall not place materials directly on the ground. Always elevate materials off the ground to protect from moisture and dirt.

1.17 SCHEDULING MEASURES - REFER TO SCHEDULE E (SECTION 01 35 90.1 Indoor Air Quality Management Schedules)

Schedule construction activities to reduce absorption of VOC's, odours and fumes by porous materials.

Complete applications of wet and odorous materials such as paints, sealants, and coatings before installing absorbent materials such as ceiling tiles, carpets, and fabric-covered furnishings.

Allow for Testing, Adjusting and Balancing to be carried out following construction and before occupancy (refer to HVAC Protection Measures).

Allow for corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning to be carried out following construction and before occupancy.

1.18 HVAC PROTECTION MEASURES - REFER TO SCHEDULE F (SECTION 01 35 90.1- Indoor Air Quality Management Schedules)

General

- .1 Protect all HVAC equipment and ductwork from collecting dust, water and odours.
- .2 Protect acoustic lining, and insulation as well as pre-lined and insulated ductwork from moisture accumulation and damage. This applies both to stored material and installed systems.
- .3 Cover all equipment and stockpiled ducts and fittings with plastic during construction. Close and cover all hatches and access doors when the equipment is not being worked on.
- .4 Shall not use the mechanical room to store or collect construction waste materials.
- .5 Install ceiling tiles prior to final cleaning to prevent dust accumulation in ceiling plenum.
- .6 HVAC protection measures will be reviewed by the *Consultant* during each *Site* visit.
- .7 Correct HVAC protection deficiencies identified by the *Consultant* within 48 hours of notification.
- .8 Clean or replace any equipment or material that is incorrectly stored or improperly protected at no extra cost to the *Owner*.
- .9 Minimum Air filter MERV 8 (minimum efficiency reporting value) ratings shall be determined by ASHRAE 52.2-2007.

Select either 'OPTION 1' or 'OPTION 2' for each ventilation system.

OPTION 1 - Ventilation Equipment NOT Used During Construction (RECOMMENDED): If the *Contractor* does not operate ventilation equipment during construction the following measures MUST be implemented at the *Contractor's* expense.

- .10 Shall not operate any permanent HVAC equipment or systems during construction.
- .11 Seal all openings into the HVAC systems with plastic. While ductwork installation is proceeding, seal all duct openings (open ends) that are not under immediate work. As ductwork installation is completed, seal all supply, return and exhaust openings.
- .12 Seal all equipment openings (inlets and outlets on air handlers, fans, Variable Air Volume (VAV) boxes, etc.) with plastic until ductwork is connected. Seal ductwork as described in subsection 1.15.3.2 above.
- .13 For ceiling plenums, install ceilings and seal all openings into plenum with plastic.
- .14 If the HVAC system protection measures do not meet this *Specification* or if the system is operated during construction, the *Contractor* shall provide duct cleaning, plus all necessary access doors, at no extra cost to the *Owner*.
- .15 When all construction work is complete:
 - .1 Remove plastic from system openings.
 - .2 Install new filters with a MERV = 13 (or higher) in all air handling equipment (package and built-up equipment). Coordinate with the filtration requirements of mechanical specifications.

- .3 Start-up systems.
- .4 Prepare systems for Testing, Adjusting and Balancing Contractor and Commissioning Agent.

OPTION 2 - Ventilation Equipment Used During Construction: If intended to operate any ventilation equipment during construction the following measures must be implemented at the *Contractor's* expense.

- .16 Install filters with a MERV = 13 (or higher) in all air handling equipment. Filter requirements apply to package and built-up equipment for re-circulating and 100% outdoor air systems. *Provide* a duct-mounted filter (external to equipment) if necessary.
- .17 Install filters with a MERV = 8 (or higher) at all return/exhaust grilles. If return/exhaust grilles are not specified with filters, provide temporary filters as required. (Filter requirements apply to all system types: re-circulating, 100% outside air, and exhaust-only.)
- .18 MERV 13 and MERV 8 filters must be installed before any system is operated.
- .19 Temporarily shut down the return/exhaust side of the system during heavy construction/demolition.
- .20 Permanently close off the return/exhaust side of the system in areas with high dust levels. Cover duct openings with plastic in these areas.
- .21 If the HVAC system is operated during construction without proper protection (as outlined in this *Specification*) the *Contractor* must provide duct cleaning, plus all necessary access doors, at no extra cost to the *Owner*.
- .22 When all construction *Work* is complete:
 - .1 Install new filters with a MERV = 13 (or higher) in all air handling equipment (package and built-up equipment). Coordinate with the filtration requirements of the mechanical *Specifications*.
 - .2 Remove all temporary filters at grilles.
 - .3 Prepare systems for Testing, Adjusting and Balancing Contractor and Commissioning Agent.

1.19 IAQ TESTING

The *Contractor* to conduct baseline indoor air quality testing prior to occupancy as per EQc3.2: Construction IAQ Management Plan: Testing Before Occupancy - Option 3: IAQ Testing Prior to Occupancy in accordance EPA Protocol for Environmental Requirements Testing for Indoor Air Quality Baseline (EPA/600/4-90-010)

- .1 IAQ Testing Preparation:
 - .1 Prior to IAQ testing, complete dust and odour generating activities including but not limited to:
 - .1 cutting.
 - .2 sanding.
 - .3 painting.
 - .4 staining.

- .5 sealing.
- .6 caulking.
- .7 sweeping.
- .8 furniture and fixture installation under the *Contract*.
- .2 Complete a full clean of *Project* interior including but not limited to:
 - .1 vacuuming carpet.
 - .2 cleaning exposed surfaces with low-emitting GreenSeal, EcoLogo and/or soap and water solutions. No chlorinated products are permitted.
- .3 Flushout
 - .1 Prior to IAQ Testing; provide a minimum 24hr building flush-out while maintaining a temperature of at least 16C (60 °F) where mechanical cooling is operated and with a relative humidity no higher than 60%.
 - .2 Allow for Testing, Adjusting and Balancing to be carried out before the building flush-out begins.
 - .3 All corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning must be completed prior to flush-out to prevent recontamination.
 - .4 At the beginning of the building flush-out verify that all permanent air filters meet the MERV specification (Refer to HVAC Protection Measures).
 - .5 During the flush-out, operate all systems at 100% outdoor air.

IAQ Testing Deficiencies:

- .2 In the event IAQ test results exceed EPA/600/4-90-010 contaminant limits, the *Contractor* shall be responsible for taking remedial action as recommended by the *Consultant* and for scheduling and repeating procedure until requirements have been met.
- .3 Carry out any addition work, cleaning and re-testing at no cost to the *Owner*.

1.20 INSTALLATION OF PRODUCTS

All filters, plastic and other protection measures shall be properly installed, and installation shall be reviewed by *Consultant* to ensure compliance.

1.21 REMOVAL OF PRODUCTS

All *Products* installed, as a part of the indoor air quality program's temporary measures shall be removed prior to building turnover. Any remedial work required as a result of removing the control measures shall be the responsibility of the *Contractor*.

PART 2 - PRODUCTS

Not Applicable.

PART 3- EXECUTION

Not Applicable.

END OF SECTION

VOC – Products & Materials Identification – Schedule A

Item No.	Specification Section	Assembly /Material	Product	VOC [g/L]	Amount Used [L]	Documentation Included
Example	09 25 00	Gypsum Compound	Drywall Compound	2	15	<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
1						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
2						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
3						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
4						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
5						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
6						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
7						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
8						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
9						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
10						<input type="checkbox"/> MSDS <input type="checkbox"/> Datasheet <input type="checkbox"/> Letter
Authorized Official:			Signature:			
Organization:			Date:			
Role in Project:			Telephone No:			
Project Name:			Project Location:			

Source of Pollutants - Schedule B

Y GENERAL

- ☐ I have read and understand the intent and requirements of Section 01 35 90 – Indoor Air Quality Management as they relate to Source Control.
- ☐ I have reviewed the scope of *Work* for this *Project* and has identified the following as potential sources of indoor air pollutants during construction (provide separate tables for additional sources):

Source	Dust	Odour, VOC's	Spill Potential	Moisture Damage Potential	Gas Emissions	Smoke
Concrete						
Drywall						
Wood						
Insulation						
Paints						
Adhesives						
Duct Sealant						
Sealants						
Carpet						
Smoking						
Construction Heaters						
Vehicles						

Y N/A

- ☐ ☐ LOW EMITTING PRODUCTS (low VOC - Volatile Organic Compounds) shall be used as specified. *Provide Product Literature* listing VOC's [g/L] (MSDS/Datasheet/Manufacturer Letter)
- ☐ ☐ Tobacco smoking shall not be permitted inside the building. (*Provide photos of signage*)
- ☐ ☐ Garbage shall not be burned on-*Site*.
- ☐ ☐ Equipment shall not be fueled-up inside the building.
- ☐ ☐ Gasoline and solvents shall not be stored inside the building. (*Provide photos of correct storage*)
- ☐ ☐ Spills shall be cleaned promptly.
- ☐ ☐ Outdoor traffic shall be restricted where emissions can be drawn into building. (*Provide photos of signage*)
- ☐ ☐ On-*Site* emissions shall be reduced by using equipment that uses propane/natural gas instead of gasoline. Electric equipment shall be used wherever possible. (*Provide photos*)
- ☐ ☐ Pollution sources shall be exhausted to the outside using temporary or permanent ventilation equipment. If HVAC systems are used, they shall be operated using 100% outdoor air to exhaust pollution. (*Provide photos*)
- ☐ ☐ Where exhaust is not feasible and ventilation is required, a portable air cleaner shall be used. (*Provide photos*)
- ☐ ☐ Sawdust from woodworking tools shall be collected and bagged regularly. (*Provide photos*)
- ☐ ☐ Indoor sources of odour and dust shall be covered/sealed. (*Provide 3 photos*)

- ☐ ☐ Painting techniques that minimize odour shall be used (rolling instead of spraying). (Provide photos)
- ☐ ☐ Cleaning practices that minimize dust shall be used (vacuuming instead of sweeping, use of wet rags). (Provide photos)
- ☐ ☐ Low toxicity cleaning solutions shall be used.

Y PHOTOGRAPHS AND DOCUMENTATION

- ☐ I shall provide three photographs of each applicable Source Control Measure. These photographs shall be taken on three different occasions during construction. Each photograph shall have a date and a description of the control measure depicted.

Authorized Official:	Signature:
Organization:	Date:
Role in Project:	Telephone No:
Project Name:	Project Location:

IAQ Pollutant Containment Plan - Schedule C

Y N/A GENERAL

- ☐ ☐ I have read and understand the intent and requirements of Section 01 35 90 – Indoor Air Quality Management as they relate to Pathway Interruption.
- ☐ ☐ Temporary dust barriers shall be installed in the following areas: (Provide photos)

Location / Room	Location / Room	Location / Room	Location / Room

- ☐ ☐ Portable fans shall be used to exhaust pollutants to exterior through windows, doors, etc.
- ☐ ☐ Exterior openings (windows & doors) shall be sealed/closed to exterior work.
- ☐ ☐ Polluting equipment and work shall be moved to locations where IAQ impact is minimized as follows: (Provide photos)

Equipment / Work	Designated Location / Room

- ☐ ☐ Work areas shall be depressurized using temporary or permanent ventilation equipment.
- ☐ ☐ Occupied/completed areas shall be pressurized using temporary or permanent ventilation equipment.

Y Photographs And Documentation

- ☐ I shall provide three photographs of each applicable Pathway Interruption Measure. These photographs shall be taken on three different occasions during construction. Each photograph shall have a date and a description of the control measure depicted.

Authorized Official:	Signature:
Organization:	Date:
Role in Project:	Telephone No:
Project Name:	Project Location:

Housekeeping Plan - Schedule D

Y N/A General

- ☐ ☐ I have read and understand the intent and requirements of Section 01 35 90 – Indoor Air Quality Management as they relate to Housekeeping.
- ☐ ☐ Cleaning Frequency: Cleaning shall be conducted every _____ Days.
- ☐ ☐ Wetting agents, sweeping compounds, damp rags, and wet mops shall be used to minimize dust creation during cleaning. (Provide photos)
- ☐ ☐ Vacuum equipment with HEPA filtration and/or a wet scrubber shall be used. (Provide photos)
- ☐ ☐ Spills shall be cleaned promptly.
- ☐ ☐ Excess application of solvent-containing products (adhesives, sealants, caulks, etc.) shall be cleaned/removed.
- ☐ ☐ Accumulated water shall be removed.
- ☐ ☐ Ventilation/dehumidification shall be used in high-humidity areas to remove moisture. (Provide photos)
- ☐ ☐ Materials stored and installed on-Site shall be covered, sealed and protected from moisture, dust and dirt accumulation. (Provide photos)
- ☐ ☐ Materials with evidence of moisture damage or excessive moisture content shall not be installed.
- ☐ ☐ Stored materials shall be elevated off the ground to protect from moisture and dirt. (Provide photos)

Y Photographs And Documentation

- ☐ I shall provide three photographs of each applicable Housekeeping Measure. These photographs shall be taken on three different occasions during construction. Each photograph shall have a date and a description of the control measure depicted.

Authorized Official:	Signature:
Organization:	Date:
Role in Project:	Telephone No:
Project Name:	Project Location:

IAQ Source Scheduling - Schedule E

Y N/A General

- ☐ ☐ I have read and understand the intent and requirements of Section 01 35 90 – Indoor Air Quality Management as they relate to Scheduling.
- ☐ ☐ Construction activities shall be scheduled to reduce absorption of VOC's, odours and fumes by porous materials.
- ☐ ☐ Wet and odorous materials such as paints, sealants, and coatings shall be applied before absorbent materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings are installed.
- ☐ ☐ Testing, Adjusting and Balancing shall commence after construction is complete and before occupancy.
- ☐ ☐ Commissioning shall commence after construction is complete and before occupancy.
- ☐ ☐ Corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning shall be completed before occupancy.
- ☐ ☐ Building occupancy shall not be permitted until all work is complete and final cleaning has eliminated dust and odour.

Y Documentation

- ☐ A copy of the construction schedule shall be provided with the IAQ Scheduling Plan.

Authorized Official:	Signature:
Organization:	Date:
Role in Project:	Telephone No:
Project Name:	Project Location:

HVAC Protection - Schedule F

Y N/A General

- ☐ ☐ I have read and understand the intent and requirements of the Indoor Air Quality Management Specification as they relate to HVAC Protection.
- ☐ ☐ Acoustic lining, and insulation as well as pre-lined and pre-insulated ductwork shall be protected from dust accumulation, moisture and damage. This applies both to stored and installed materials. (Provide photos)
- ☐ ☐ All equipment and stockpiled ducts and fittings shall be covered with plastic. (Provide photos)
- ☐ ☐ All hatches and access doors shall be closed/covered when the equipment is not being worked on. (Provide photos)
- ☐ ☐ The mechanical room shall not be used to store or collect construction waste materials. (Provide photos)
- ☐ ☐ Ceiling tiles shall be installed prior to final cleaning to prevent dust accumulation in ceiling plenum. (Provide photos)
- ☐ ☐ HVAC protection deficiencies shall be corrected within 48 hours of notification.
- ☐ ☐ Any equipment or materials that is soiled or damaged from incorrect storage or improper protection shall be cleaned or replaced at no extra cost to the *Owner*.

Y N/A Ventilation Equipment NOT Used During Construction (RECOMMENDED)

- ☐ ☐ I shall NOT operate the following ventilation equipment during construction (provide a separate table for additional equipment):

Equipment (Tag)	Location	Area Served

- ☐ ☐ All openings into the HVAC systems shall be sealed with plastic. (Provide photos)
- ☐ ☐ All duct openings (open ends) that are not under immediate work shall be sealed. (Provide photos)
- ☐ ☐ As ductwork installation is completed, all supply, return and exhaust openings shall be sealed. (Provide photos)
- ☐ ☐ All equipment openings (inlets and outlets on air handlers, fans, etc.) shall be sealed with plastic until ductwork is connected. (Provide photos)
- ☐ ☐ Ceiling plenums openings shall be sealed with plastic. (Provide three photos) Failure to comply with this Section of the *Specification* shall result in duct cleaning and all associated expenses be provided at no extra cost to the *Owner*.
- ☐ ☐ When construction is complete, plastic shall be removed from all system openings.
- ☐ ☐ When construction is complete, system start-up shall be conducted, and systems shall be prepared for the Testing, Adjusting and Balancing *Subcontractor* and the Commissioning Agent.
- ☐ ☐ When construction is complete, air filters with a minimum efficiency reporting value (MERV) = 13 (or higher) shall be installed in all air handling equipment as follows (provide a separate table for additional equipment):

Equipment (Tag)	Filter Manufacturer	Filter Model	Filter MERV

Y PHOTOGRAPHS and DOCUMENTATION

- ☐ I shall provide three photographs of each applicable HVAC Protection Control Measure.
- ☐ These photographs shall be taken on three different occasions during construction. Each photograph shall have a date and a description of the control measure depicted.

Authorized Official:	Signature:
Organization:	Date:
Role in Project:	Telephone No:
Project Name:	Project Location:

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Requirements
- .4 1.4 References to Regulatory Requirements
- .5 1.5 Precedence
- .6 1.6 Codes
- .7 1.7 Industry Standards
- .8 3.1 Applicable Laws, Ordinances and Regulations

1.3 REQUIREMENTS

- .1 This Section includes regulatory requirements applicable to the *Contract Documents* and the *Project* and *Work* and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the *Contract Documents*.
- .2 The *Contractor* shall comply with the laws, ordinances, rules, regulations, or codes of the *Authorities Having Jurisdiction* (“Codes”) which are or become in force during the performance of the *Work* and which relate to the *Work*, to the preservation of the public health, and to construction safety.
- .3 The Codes referenced in the *Contract Documents* shall have full force and effect as though set out in full in these *Specifications*. Nothing in the *Contract* shall be construed to permit *Work* not conforming to applicable Code requirements.
- .4 The Codes and other authorities referenced in the *Contract Documents* are not a comprehensive list of all Codes applicable to the *Work*. The Codes listed in the *Contract Documents* are referenced for the information and convenience of the *Contractor* only. The *Consultant* does not represent that all Codes applicable to the *Work* have been cited or adequately described in the *Contract Documents*. The *Contractor* shall be solely responsible for compliance with all Codes applicable to the *Work* and relevant to the *Contractor's* means and methods of performing said *Work*.

1.4 REFERENCES TO REGULATORY REQUIREMENTS

- .1 General:
 - .1 References to the Codes, standards or regulatory requirements made on *Drawings* or in *Specifications* are considered an integral part of *Contract Documents* as minimum requirements.
- .2 All Codes, and lawful orders of all public *Authorities Having Jurisdiction* of the *Work*, are hereby incorporated into these *Contract Documents* as if repeated in full herein and are intended to be included in any reference to Code or Ontario Building Code, unless otherwise specified in the *Contract Documents*.

- .3 The *Contractor* is assumed to be and shall be familiar with the requirements of the Codes, including having readily available access to these requirements.
- .4 References on the *Drawings* or in the *Specifications* to "code", "Code" or "building code" similar terms, not otherwise identified, shall mean the *Codes* specified above, together with all additions, amendments, changes, and interpretations adopted by code of the *Authorities Having Jurisdiction* over the *Project*.

1.5 PRECEDENCE

- .1 Where specified requirements differ from the requirements of the applicable *Codes*, ordinances and standards, the more stringent requirements shall take precedence with no change in *Contract Price* or *Contract Time*.
- .2 Where the *Contract Documents* require or describe *Products* or execution of better quality, higher standard or greater size than required by applicable *Codes*, ordinances and standards, the *Contract Documents* shall take precedence.
- .3 Where no requirements are identified in the *Contract Documents*, comply with all requirements of applicable *Codes*, ordinances and standards of governing *Authorities Having Jurisdiction*.

1.6 CODES

- .1 Application of the Codes:
 - .1 Whenever there is a conflict between general and specific requirements in the *Code*, the specific requirements shall be followed.
 - .2 Where differences exist between *Codes* affecting the *Work*, the more stringent requirements shall apply.
 - .3 Where *Codes* are referred to in the different Sections of the *Specifications*, it is understood by the *Contractor* that they apply fully as if cited herein.
 - .4 All *Work* performed must be in accordance with applicable *Codes*; a copy of each shall be kept at the Place of *Work*.
 - .5 If the *Contractor* observes that the *Drawings* and *Specifications* are at variance with the *Codes*, it shall notify the *Consultant*, in writing within 5 *Working Days*.

1.7 INDUSTRY STANDARDS

- .1 Application:
 - .1 The industry standards applicable to the *Work* are indicated in appropriate individual Sections of these *Specifications*, either by their names and the names of the trade associations, government agencies or other producers of standards, or by well recognized abbreviations thereof:
 - .1 Refer questions on the meaning of abbreviated designations to the *Consultant* for clarification before proceeding with *Work* affected thereby.
 - .2 Any material specified by reference to the number, symbol, or title of a specific standard, such as Commercial Standard, Federal *Specifications*, a trade association standard, or other similar standard, shall comply with the requirements in the latest revision thereof and any amendments or supplements thereto which are or become in force during the performance of the *Work*.

- .3 The standard referred to, except as modified in the *Contract Documents*, shall have full force and effect as though printed in these *Specifications*.
- .4 These standards are not furnished to the *Contractor* since manufacturers and trades involved are assumed to be familiar with their requirements. Where copies of standards are needed for proper performance of the *Work*, the *Contractor* shall obtain such copies which shall be maintained at the Place of *Work* by the *Contractor* and made available for review on request by the *Consultant*
- .5 Where referenced Standard *Specifications* require weather protection, it shall be provided by the *Contractor* at no additional cost to the *Owner* and shall be deemed necessary in order to construct the *Project* within the *Contract Time*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 APPLICABLE LAWS, ORDINANCES AND REGULATIONS

- .1 The *Work* shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of federal, provincial, and local governmental agencies and *Authorities Having Jurisdictions* over the *Project*.
- .2 The *Work* shall be accomplished in conformance with all rules and regulations of public utilities and utility districts.
- .3 Where such laws, ordinances, rules and regulations require more care or greater time to accomplish the *Work*, or require better quality, higher standards or greater size of products, the *Work* must be accomplished in conformance to such requirements with no change to the *Contract Time* and *Contract Price*, except where changes in laws, ordinances, rules and regulations occur subsequent to the Closing Time of the tender.
- .4 No *Change Order* shall be considered for any change in any applicable federal, provincial, or local code or regulation if similar language existed in an alternate applicable regulation in force at the time of the Closing Time of the tender.
- .5 The *Contractor* shall not allow design or construction of any conditions wherein the finished *Work* will not comply with current applicable *Codes*. No *Change Order* shall be considered for the *Work* correction of any *Work* not complying with *Code*.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
.2 1.2 Section Includes
.3 1.3 Abbreviations

1.3 ABBREVIATIONS

- .1 When the following abbreviations are used in the Contract Documents, they have the meaning listed:

A	
&	And
@	At
A	Ampere
AA	Aluminum Association
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturer's Association
AASHO	American Association of State Highway Officials
ABS	Acrylonitrile Butadiene Styrene
AC	Alternating Current
ACG	AABC Commissioning Group
ACI	American Concrete Institute
ACME	Association of Consulting Management Engineers
ACT	Acoustic Ceiling Tile
ACR	Air Conditioning and Refrigeration Field Services
ADA	Americans with Disabilities Act
ADC	Air Distribution and Control
AFF	Above Finish Floor
AFUE	Annual Fuel Utilization Efficiency
AG	Above Grade
AGA	American Gas Association
AHC	Architectural Hardware Consultant
AHJ	Authorities Having Jurisdiction
AHRI	Air Conditioning, Heating & Refrigeration Institute
AHU	Air Handling Unit
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical & Insulating Material Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AJT	UL Class J Time Delay Fuse

AL	Aluminum
ALUM	Aluminum
AMACF	Advanced Main Air Circulating Fan
AMCA	Air Moving and Conditioning Association Inc.
ANSI	American National Standards Institute
AODA	Accessibility for Ontarians with Disabilities Act
AP	Aluminum Panel
API	Atmospheric Pressure Ionization
ARCH	Architectural
ARI	Air-Conditioning, Heating, and Refrigeration Institute
ASC	Application Specific Controllers
ASHRAE	American Society of Heating Refrigerating and Conditioning Engineers
ASL	Above Sea Level
ASME	American Society of Mechanical Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
ATC	Acoustic Tile Ceiling
ATS	Automatic Transfer Switch
AUTO	Automatic
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute (USA)
AWMAC	Architectural Woodwork Manufacturers Association of Canada
AWS	American Welding Society
AWWA	American Water Works Association

B

BO	Bottom Of
B/W	Between
B-AAC	BACnet Advanced Application Controller
BAB	Roof Anchor - Bolt Around Beam
BACnet	Building Automation and Control networks
BAS	Building Automation System
B-ASC	BACnet MS/TP Advanced Application Controller
B-AWS	BACnet Advanced Operator Workstation
BBMD	BACnet/IP Broadcast Management Device
BCup	Copper-Phosphorous Brazing Alloy
BD	Board
BF	Barrier Free
BFPB	Barrier-Free Push Button
BFDO	Barrier-Free Door Operator
BHMA	Builders Hardware Manufacturers Association
BIT	Bituminous
BL or BLK	Block
BLDG	Building

BLKG	Blocking
BMS	Building Management System
BN	Bullnose
B-OD	BACnet Operator Display
B-OWS	BACnet Operator Workstation
BS	Black-Out Window Shade
BTL	BACnet Testing Laboratory
BTU	British thermal unit
BX	Flexible Metal Conduit cable

C

C.B.U	Concrete Block Unit
C.L.	Centerline
C.M.U	Concrete Masonry Unit
C.W.	Curtain Wall
C/W	Complete With
CA	Commissioning Agent
CA ITEM	Cash Allowance Item
CAB	Cabinet
CaGBC	Canada Green Building Council
CATV	Cable Television
CBD	Cement Board
CCA	Canadian Construction Association
CCMC	Canadian Construction Materials Centre
CCRC	Canadian Code for Residential Construction
CCT	Correlated Color Temperature
CCTV	Closed Circuit Television
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CFC	Chlorofluorocarbon
CFM	Cubic feet per minute
CFMA	Construction Financial Management Association
CFUA	Canadian Fire Underwriters Association
CG	Corner Guard
CGA	Canadian Gas Association
CGL	Commercial General Liability
CGSB	Canadian General Standards
CH	Coat Hook
CHAN	Channel
CIQS	Canadian Institute of Quantity
CISC	Canadian Institute of Steel Construction
CISPI	Cast Iron Soil Pipe Institute
CITC	Canadian Institute of Timber Construction
CK	Caulk
CL	Closet

CLA	Canadian Lumbermen's Association
CLG	Ceiling
cm	Centimeter
CMHC	Canada Mortgage and Housing Corporation
CNTR	Counter
CO	Carbon Monoxide
COC	Chain of Custody
COFI	Council of Forest Industries of British Columbia
COL.	Column
CONC	Concrete
CONST	Construction
CONT	Continuous
CONTR	Contractor
CORR	Corridor
COV	Change of Value
CP	Cap Screw
CPCI	Canadian Pre-stressed Concrete Institute
CPMA	Canadian Paint Manufacturers Association
CPT	Carpet
CPTB	Carpet Base
CPVC	Chlorinated polyvinyl chloride
CR	Card Reader
CRCA	Canadian Roofing Contractors Association
CRN	Canadian Registration Number
CRS	Course
CSA	Canadian Standards Association
CSC	Construction Specifications of Canada
CSI	Construction Specifications Institute (USA)
CSPI	Corrugated Steel Pipe Institute
CSR	Vibro-Acoustics Restrained Spring
CSSBI	Canadian Sheet Steel Building Institute
CT	Ceramic Floor Tile
CTB	Ceramic Tile Base
CUA	Canadian Underwriter's Association
cUL	Canadian Underwriters Laboratories
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
CWP	Cold Working Pressure
CWS	Canada-Wide Standard
CWT	Ceramic Wall Tile
Cx	Commissioning
CYL	Cylinder Lock

D

D.F	Drinking Fountain
-----	-------------------

D.O	Door Operator
DB	Dry-bulb temperature
dB	Decibel
dBA	Decibel A-weighting
DC	Door Contact
DDC	Direct Digital Control
DET	Detail
DFO	Department of Fisheries and Oceans
DFT	Dry Film Thickness
DHI	Door Hardware Institute
DIA	Diameter
DIM	Dimension
DIN	Deutsches Institut fur Normung
DIVS.	Divisions
DN	Down
DND	Department of National Defense, Canada
DR	Door
DS	Downspout
DWG	Drawing
DWGS	Drawings
DWR	Drawer
DWV	Drain, Waste and Vent
DX	Direct Expansion
E	
E	East
E.W	Each Way
ECM	Electronic Control Module
ED	Exit Device
EDC	Electronic Door Contact
EDO	Electronic Door Operator
EDS	Electronic Door Strike
EEMAC	Electrical Equipment Manufacturers Association of Canada
EFT	Electrical Fast Transient
EGSA	Electrical Generating Systems Association
EHO	Electronic Hold Open
EIA	Electronic Industries Alliance
EJ	Expansion Joint
EL	Elevation
ELECT	Electrical
ELEV	Elevator
EMC	Electromagnetic compatibility
EMER	Emergency
EMI	Electromagnetic interference
EMS	Electric Motor Starter

EMT	Electrical Metallic Tubing
ENCL	Enclosure
ENTR	Entrance, Entry
EP	Epoxy Paint
EPA	Environmental Protection Agency
EPDM	Ethylene Propylene Diene Monomer rubber
EPX	Epoxy Flooring
EQ	Equal
EQUIP	Equipment
ERV	Energy Recovery Ventilator
ES	Electric Strike
ESA	Electrical Safety Authority
ESD	Electro Static Discharge
EW	Eye Wash
EX or EXIST	Existing
EXP	Exposed
EXT	Exterior
F	
F.A	Fire Alarm
FACP	Fire Alarm Control Panel
FAPS	Fire Alarm Pull Station
FCC	Federal Communications Commission
FCU	Fan Coil Unit
FD	Floor Drain
FDC	Fire Department Connection
FDN	Foundation
FE	Fire Extinguisher
FEC	Fire Extinguisher Cabinet
FF	Factory Finished
FH	Rating Fire & Hose
FHC	Fire Hose Cabinet
FIN	Finish
FLR	Floor
FM	Factory Mutual
FPM	Feet per minute
FR	Fire Retardant
FRR	Fire Resistance Rating
FRS	Fire Route Sign
FS	Folding Seat
FSC	Forest Stewardship Council
FT	Feet, Foot
FT	Foot
FTG	Footing

G

g/L	Grams Per Liter
GA	Gauge
GALV	Galvanized
GANA	Glass Association of North America
GB	Grab Bar
GFI	Ground Fault Interrupter
GFCI	Ground Fault Circuit Interrupter
GL	Glazing
GND	Ground
GPM	Gallons Per Minute
GR	Grade
GWB	Gypsum Wall Board
GWB-AR	Gypsum Wall Board-Abuse Resistant (Inherently MR As Well)
GWB-MR	Gypsum Wall Board-Moisture Resistant
GWMP	Ground Water Management Plan
GYP	Gypsum Board

H

HB	Hose Bib
HCFC	Hydrochlorofluorocarbons
HD	Hand Dryer
HDA	Heavy Duty Asphalt
HDF	High Density Fiberboard
HDPE	High Density Polyethylene
HDW	Hardware
HDWD	Hardwood
HLR	Horizontal Lifeline Fall Protection System - Roof Mounted
HLW	Horizontal Lifeline Fall Protection System - Wall Mounted
HM	Hollow Metal
HMP	Hollow Metal Panel
HOA	Hand-Off-Automatic
HOC	Hold Open Close
HOD	Hold Open Device
HORIZ	Horizontal
HP	Horse Power
HR	Hour
HRC	High Rupturing Capacity
HRD	Hair Dryer
HS	Hardware Schedule
HSN	Hub and Spigot No-hub (see ASTM C564)
HSP	Hose Standpipe
HSS	Hollow Steel Selection
HT	Height
HV	High Voltage

HVAC	Heating, Ventilation, and Air Conditioning
HW	Hot Water
Hz	Hertz
I	
IAP	Insulated Aluminum Panel
IAPMO	International Association of Plumbing and Mechanical Officials
IAQ	Indoor Air Quality
IC	Intumescent Coatings
ICD	Implantable Cardioverter-defibrillator
ID	Identification
IDIA	Inside Diameter
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society of North America
IFB	Impregnated Fibre Board
IG	Insulating Glass
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Association
IGMAC	Insulated Glass Manufacturers Association of Canada
IN	Inch, Inches
INFO	Information
INSUL	Insulated
INSUL	Insulation
INT	Interior
I/O	Input/Output
IP	Internet Protocol
ISO	International Organization for Standardization
IT	Infrastructure Technology
J	
JC	Janitor Closet
JT	Joint
K	
kA	kiloampere
KHz	kilohertz
KP	Kick Plate
kPa	kilopascal
KPD	Key Pad
Kph	kilometers per hour
KVA	kilovolt amps
KVAR	kilovolt-amperes reactive
kW	kilowatt
kwh	kilowatt-hour

KWS kilowatt-second

L

L.F	Linear Foot
L.H	Left Hand
l/s	Liters Per Second
LAM	Laminate
LAN	Local Area Network
LAV	Lavatory
LCD	Liquid Crystal Display
LDA	Light Duty Asphalt
LED	Light-Emitting Diode
LINO	Linoleum
LKR	Locker
LNT	Lintel
LP	Low Point
LPM	Liters Per Minute
LRG	Large
LSRCA	Lake Simcoe And Region Conservation Authority
LTIC	Laminated Timber Institute of Canada
LV	Low Voltage
LVL	Level
LVR	Louver
LVR.O	Louver Opening
LVT	Low Voltage thermostat

M

M	Meter
M.O	Masonry Opening
m/s	Meter Per Second
mA	Milli-Ampere
MAINT	Maintenance
MAS	Masonry
MAT	Mineral Acoustic Tile
MAT'L	Material
MAX	Maximum
MCC	Motor Control Center
MCM	Thousand Circular Mils
MECH	Mechanical
MED	Medium
MERV	Minimum Efficiency Reporting Value
MFG	Manufacturing
MFR	Manufacturer
MI	Mirror
MIA	Marble Institute of America

MIN	Minimum
MIN	Minute
MISC	Miscellaneous
MM	Millimeter
MM	Millimeters
MNR	Ministry of Natural Resources
MOE	Ministry of The Environment
MP	Metal Plate
MPA	Megapascal
MPH	Miles Per Hour
MPMDD	Modified Proctor Maximum Dry Density
MS	Metal Stud
MSS	Manufacturers Standardization Society
MS/TP	Master Slave Token Passing
MSTP	Multiple Spanning Tree Protocol
MTC	Ministry of Transportation and Communications
MTC COORD	Multiple Trade Coordination Required
MTD	Mounted
MTL	Metal
mV	Millivolt
MWLLBD(L)	Murphy Wall Bed - Lateral
MWLLBD(V)	Murphy Wall Bed - Vertical

N

N	North
NAAMM	National Association of Architectural Metal Manufacturers (USA)
NACE	National Association of Corrosion Engineers
NAIMA	North American Insulation Manufacturers Association
NBC	National Building Code of Canada
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards (USDC)
NC	Noise Criterion
NCM	No Centre Mullion
ND	Napkin Dispenser
NDT	Non-Destructive Testing
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFWH	Non-Freeze Wall Hydrant
NG	Natural Gas
NHLA	National Hardwood Lumber Association (USA)
NIC	Not in Contract
NLGA	National Lumber Grades Authority
NO	Number

NO/NC	Normally Open/Normally Closed
NOX	Nitrous Oxide
NPSH	Net Positive Suction Head
NPT	National Pipe Thread
NPD	Kinetics Noise Control
NRC	National Research Council
NS	Non-Slip
NTS	Not to Scale
NWWDA	National Wood Window and Door Association

O

OAT PG	Outdoor Air Temperature Program
O&M	Operations & Maintenance
OBC	Ontario Building Code
OC	On Centre
OCIP	Owner Controlled Insurance Program
OD	Outside Diameter
ODBC	Oracle Database Connectivity
ODP	Qzone Depletion Prevention
ODS	Overhead Door Stop
OEM	Original Equipment Manufacturing
OESC	Ontario Electrical Safety Code
OFC	Ontario Fire Code
OH	Overhead
OHC	Overhead Closer
OHSAA	Occupational Health and Safety Act
OPG	Opening
OPP	Opposite
OPSS	Ontario Provincial Standard Specifications
ORN	Ornamental
OSA	Outside Air
OS&Y	Outside Screw and Yoke
OWSJ	Open Web Steel Joist
OZ.	Ounce

P

PA	Paging System
Pa	Pascal
PANIC	Rated Panic Device
PAR	Parallel
PART	Partition
PB	Push Button
PC	Precast
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute

PDF	Portable Document Format
PDI	Plumbing and Drainage Institute
PE	Pressure Electric (Switch)
PER	Perimeter
PERP	Perpendicular
PF	Picofarad
PH	Potential Hydrogen (Ph Unit of Measure)
PIB	Polyisobutylene
PID	Proportional Integrative Derivative
PL or PLL	Plastic Laminate
PL	Plate
PLAM	Plastic Laminate
PLF	Platform
PNL	Panel
PNT	Paint
POL	Polished
PP	Push Plate
PR	Pair
PREFAB	Prefabricated
PREFIN	Prefinished
PREMANUF	Pre-Manufactured
PRFN	Pre-Finished
PRL	Private Lock
PROF	Profile
PRV	Pressure Reducing Valve
PSI	Pounds Per Square Inch
PSID	Pounds Per Square Inch Differential
PSIG	Pounds Per Square Inch Gauge
P/T	Pressure and Temperature
PT	Porcelain Tile
PTD	Paper Towel Dispenser
PTD/WR	Paper Towel Dispenser & Waste Receptacle
PTFE	Polytetrafluoroethylene
PTL	Push to Lock
PTTW	Permit to Take Water
PVC	Polyvinyl Chloride
PWD	Plywood

Q

QTR.	Quarter
QTY	Quantity

R

R	Radius
R/A	Return Air

RA	Roof Anchor
RAT'G	Rating
RB	Resilient Base
RCA	Reinforced Concrete Apron
RCM	Removable Centre Mullion
RD	Roof Drain
REF	Reference
REQ'D	Required
RES	Residential
REX	Request to Exit
RFCI	RF-Conducted Immunity
RFI	Radio Frequency Interference
RM	Room
RMCAO	Ready mix Concrete Association of Ontario
RMS	Root Mean Square
RO	Rough Opening
RPM	Revolutions per minute
RPU	Remote page unit
R/S	
RSI	R-Value (SI units)
RSL	Resilient
RWL	Rainwater Leader
S	
S	South
SA	Supply Air
SAE	Society of Automotive Engineers
SAT	Supply Air Temperature
SBS	Styrene Butadiene Styrene
SC(OT)	Scupper - Overflow Type
SCADA	Supervisory Control and Data Acquisition
SCHED	Schedule
SCR	Shower Curtain and Rod
SCS	Solid Core Steel
SCW	Solid Core Wood
SD	Soap Dish
SDI	Steel Deck Institute
SDS	Safety Data Sheets
SEAL	Sealer
SECT	Section
SEI CMM	American Software Engineering Institute Capability Maturity Model
SER	Service
SH	Shower Head
SH/C	Shower Head & Control
SHLV	Shelving

SHR	Vibro-Acoustics Spring Hangers
SIM	Similar
SM	Sheet Metal
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SND	Sanitary Napkin Dispenser
SP	Steel Plate
SPDT	Single Pole Double Throw
SPEC	Specification
SPEC'D	Specified
SPMDD	Standard Proctor Maximum Dry Density
SPS	Solid Polymer Surfacing
SPST	Single Pole Single Throw
SQ	Square
SQFT	Square Feet, Square Foot
SR/C	Shower Rod and Curtain
SS	Stainless Steel
SSK	Service Sink
SSPC	Steel Structure Painting Council
SSUR	Solid Surfacing (Material)
SSUR(IS)	Solid Surface (Material) For Island Countertops
SSUR(WS)	Solid Surface (Material) For Window Sills
ST	Stain
STA	Standard
STC	Sound Transmission Class
STD.	Station
STL	Steel
STN	Stone
STOR	Storage
STRUCT	Structural
SUSP	Suspended
SYS	System

T

T&G	Tongue and Groove
T/O	Top Of
TAB	Testing, Adjusting, and Balancing
TB	Thermally Broken
TBB	Tile Backer Board
TBT	Thermally Broken Threshold
TCP	Transmission Control Protocol
TEC	Thermoelectric coolers
TEL	Telephone
TEMP	Temperature
TG	Tempered Glass
TH	Threshold

THD	Total Harmonic Distortion
THRU	Through
TIA	Telecommunications Industry Association
TIAC	Thermal Insulation Association of Canada
TOD	Time of Day
TOFM	Toilet - Floor Mounted
TOS	Top of Structure
TOWM	Toilet - Wall Mounted
TPD	Toilet Paper Dispenser
TRANSP	Transparent
TRCA	Toronto and Region Conservation Authority
TS	Transition Strip
TSSA	Technical Standards & Safety Authority
TTD	Toilet Tissue Dispenser
TTH	Toilet Tissue Holder
TTMAC	Terrazzo, Tile and Marble Association of Canada
TV	Television
TVSS	Transient Voltage Surge Suppressor
TWB	Towel Bar
TWF	Through Wall Flashing
TYP	Typical

U

UL	Underwriters Laboratories (USA)
ULC	Underwriters Laboratories Canada
UNFIN	Unfinished
UNO	Unless Noted Otherwise
UOD	Underside of Deck
UOS	Unless Otherwise Specified
UPS	Uninterruptible Power Supply
UR	Urinal
UOS	Underside of Steel
USAS	United States of America Standards Institute
USB	Universal Serial Bus
USGBC	U.S. Green Building Council
USGPM	Us Gallons Per Minute
USS	Underside of Structure
UTC	Coordinated Universal Time
UV	Ultraviolet

V

V	Volts
VAC	Voltage Alternating Current
VAV	Variable Air Volume
VB	Vapour Barrier

VCT	Vinyl Composite Tile
VDC	Voltage Direct Current
VERT	Vertical
VEST	Vestibule
VFD	Variable Frequency Drive
VIF	Verify
VLAN	Virtual Local Area Network
VOC	Volatile Organic Compound
VP	Vent Pipe

W

W	West
W/	With
W/O	Without
WAN	Wide Area Network
WC	Water Column
WD	Wood
WG	Wired Glass
WHI	Warnock Hersey
WM	Wire Mesh
WO	Window Opening
WOG	Water Oil Gas
WR	Washroom
WRGBB	Water Resistant Gypsum Backing Board
WS	Wall Stop
WS	Window Shade
WSBO	Window Shade & Blackout Blind
WSIB	Workplace Safety and Insurance Board
WT	Wall Tile
WTS	Weatherstripping
WWF	Welded Wire Fabric

X

XLPE	Cross-linked Polyethylene
------	---------------------------

Y

YR	York Region
----	-------------

PART 2 - PRODUCTS

Not Included

PART 3- EXECUTION

Not Included

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- 1.1 General Instructions
- 1.2 Section Includes
- 1.3 Related Requirements
- 1.4 Inspection And Testing
- 1.5 Access to the *Work* and Cooperation
- 1.6 Procedures
- 1.7 Defective *Work*
- 1.8 Scheduling and Reports
- 1.9 Test and Mix Designs
- 1.10 Mill Tests
- 1.11 Mockups
- 1.12 Equipment and Systems
- 1.13 Manufacturer's Field Review

1.3 RELATED REQUIREMENTS

- .1 Pre-installation meetings: in accordance with Section 01 31 19 - Project Meetings.
- .2 Materials and workmanship quality assurance and reference standards: in accordance with Section 01 60 00 - Products and Workmanship.
- .3 Balancing and testing of systems in accordance with Divisions 21, 22, and 23, and Divisions 26, and 28.

1.4 INSPECTION AND TESTING

- .1 The *Owner* and the *Consultant* shall have access to the *Work* at all times. If part of the *Work* is in preparation at locations other than the *Place of the Work*, access to those locations shall be given to such work whenever it is in progress.
- .2 Inspection and testing services will be used to verify compliance with requirements of the *Contract Documents*. These services shall not relieve the *Contractor* of its responsibility for compliance with the *Contract Documents*.
 - .1 Specified tests, inspections, and related actions do not limit the *Contractor's* other quality assurance and control procedures that facilitate compliance with the *Contract Documents* requirements.
 - .2 Requirements for the *Contractor* to *Provide* quality control services required by the *Consultant*, the *Owner*, or the *Authorities Having Jurisdiction* are not limited by provisions of this Section.
- .3 The *Consultant* will, on behalf of *Owner*, appoint inspection and testing companies, representing, reporting and responsible to the *Owner* through the *Consultant*.

- .1 The cost of inspection and testing company services will be authorized as a disbursement from Cash Allowance as specified in Section 01 21 00. The inspection and testing company will submit monthly original invoice to the *Contractor* for review, relating invoices for tests and inspection reports. The *Contractor* shall *Provide* original receipts for disbursements. Invoices and receipts for disbursements for inspection and testing services shall be forwarded by the *Contractor* to the *Consultant* for inclusion in progress payment application.
- .4 Additional testing services required due to changes in materials, proportions of mixes requested by the *Contractor* as well as additional testing services for materials occasioned by lack of identification or by failure of such materials being replaced to meet requirements of the *Contract Documents* or testing of structure or elements including load testing, shall be carried out by the *Contractor* at its own expense.
- .5 Inspection and testing required by codes or ordinances, or by an *Authority Having Jurisdiction*, and made by a legally constituted authority, shall be the responsibility of the *Contractor* and shall be paid for by the *Contractor* at its own expense and not be paid by the *Owner*, unless otherwise specified in the *Contract Documents*.
- .6 Inspection or testing performed exclusively for the *Contractor's* convenience shall be the sole responsibility and expense of *Contractor* and will not be paid by *Owner*.
- .7 Inspection and testing shall be performed by a company qualified to perform the inspections or tests specified or required.
- .8 Requirements of regulatory companies:
 - .1 Testing shall be conducted in accordance with requirements of the Ontario Building Code.
 - .2 Obtain certification where required by the Ontario Building Code and standards.
- .9 Inspection and tests required by codes or ordinances, or by an *Authority Having Jurisdiction*, and made by a legally constituted authority, shall be the responsibility of the *Contractor* and not requested or directed by the *Consultant*. Required inspection and testing shall be paid for by the *Contractor* and not be paid by the *Owner*, unless otherwise specified in the *Contract Documents*.
- .10 The inspection and testing service does not relieve the *Contractor* of its responsibility to perform regular shop and *Site* inspection, and quality control of production.
- .11 Inspection and testing services, field and laboratory testing, shall be required for, but not limited to, the following:
 - .1 Excavation, backfill and compaction; inspection and testing.
 - .2 Founding soils: inspection.
 - .3 Paving systems: inspection and testing.
 - .4 Concrete reinforcement.
 - .5 Concrete.
 - .6 Mortar.
 - .7 Structural steel.
 - .8 Steel deck.
 - .9 Roofing (except metal roofing).
 - .10 Building envelope.

1.5 ACCESS TO THE WORK AND COOPERATION

- .1 The *Contractor* shall allow the Independent Inspection and Testing Agencies access to the *Work*, wherever the *Work* is in progress, or wherever *Products*, materials, or equipment are stored prior to shipping, including to off-*Site* manufacturing and fabrication plants.
- .2 *Provide* access to the *Work* for representatives of inspection and testing companies.
- .3 *Provide* inspection company with materials and installation information as required and/or requested.
- .4 Cooperate with inspection and testing companies and give adequate notification of any changes in source of supply, additional work shifts and other proposed changes.
- .5 No *Product* nor part of the *Work* shall be installed before it is tested when a test is specified or required, nor shall work be executed where a test or inspection is required and the inspector cannot attend.
- .6 Supply labour required to assist inspection and testing company in sampling and making tests.
- .7 Repair work damaged as a result of inspection and testing work.
- .8 The cost of above labour and material shall be borne by the *Contractor*.
- .9 Inspection and testing company services do not relieve the *Contractor* of its responsibility for normal shop and *Site* inspection, and quality control of manufacturing and installation.

1.6 PROCEDURES

- .1 The *Contractor* shall notify the appropriate agency and the *Consultant* sufficiently in advance of the requirement for tests in order that attendance arrangements can be made reasonably.
- .2 Submit samples and/or materials required for testing, as specifically requested in the *Contract Documents*. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the progress of the *Work*.
- .3 The *Contractor* shall *Provide* labour and facilities to obtain and handle samples and materials at the *Place of the Work*. *Provide* sufficient space to store and cure test samples.

1.7 DEFECTIVE WORK

- .1 Where evidence exists that defective workmanship may have occurred, or that the *Work* may have been carried out incorporating defective materials, or tests demonstrate that installed conditions do not comply with the requirements of the *Contract Documents*, the *Consultant* reserves the right to have appropriate inspections, tests, and surveys performed, analytical calculation of structural strength made and the like in order to help determine the extent of defect and whether such work must be replaced. Inspections, tests, and surveys carried out under these circumstances will be made at the *Contractor's* expense, and will not be paid by *Owner*, unless the results indicate that the work so tested, inspected or surveyed is not defective or that, in the *Consultant's* opinion, the work so tested, inspected, or surveyed may be accepted, in which case tests, inspections or surveys will be paid by the *Owner*.
- .2 If the *Contractor* covers, or permits to be covered, work that has been designated for special tests, inspections or approvals before such tests, inspections or approvals have been made, the *Contractor* shall, if so directed by the *Consultant*, uncover the work, have the inspections or tests satisfactorily completed, and make good the work. Such uncovering and making good will not be considered or approved as a change in the *Work*.

- .3 The *Consultant* may order any part of the *Work* to be examined if the *Work* is suspected not to be in accordance with the *Contract Documents*. If, upon examination, such work is found not to be in accordance with the *Contract Documents*, the *Contractor* shall correct such work and pay the cost of the examination and correction neither of which will be considered or approved as a change in the *Work*. If such work is found to be in accordance with the *Contract Documents*, the *Owner* will pay for the cost of examination and replacement as a change in the *Work* in accordance with Section 01 26 00 - Contract Modification and Requests for Interpretation
- .4 Additional testing required because of changes in materials, proportions of mixes requested by the *Contractor* or *Subcontractors* as well as any extra testing of materials occasioned by lack of identification or by failure of such materials being replaced to meet requirements of the *Contract Documents* or testing of structure or elements including load testing, shall be carried out by the *Contractor* at its own expense.
- .5 The *Contractor* shall make good any *Subcontractor's* work damaged by such removals or re-executions at the *Contractor's* expense and promptly.
- .6 If, in the opinion of the *Consultant*, it is not expedient to correct the defective work or the work not performed in accordance with the *Contract Documents*, the *Owner* may deduct from the monies otherwise due to the *Contractor*, the difference in value between the work performed and that required in the *Contract Documents*, the amount of which shall be determined by the *Consultant*.

1.8 SCHEDULING AND REPORTS

- .1 The *Contractor* shall prepare a schedule for inspection and testing company services in accordance with Section 01 33 00 - Submittal Procedures and as follows:
 - .1 Establishing schedule:
 - .1 By advance discussion with the selected inspection or testing company, determine the appropriate time necessary to perform the required services and to issue related reports.
 - .2 Allow for required time within construction schedule.
 - .2 Adherence to schedule:
 - .1 The *Contractor* shall advise inspection and testing companies in advance when inspection and testing of the *Work* is required.
 - .2 Amount of advance notice shall be as required by the inspection and testing company but shall be no less than two *Working Days*.
 - .3 When inspection and testing company is ready to perform inspection and testing according to predetermined schedule, but is prevented from inspection and testing or taking specimens due to incompleteness of the parts of the *Work* scheduled for inspection and testing, extra costs for inspection and testing attributable to the delay may be back-charged to the *Contractor* at no additional cost to the *Owner*.
 - .3 Notify inspection and testing company at least three *Working Days* before work required to be inspected commences, and arrange for a meeting at the *Place of the Work*, to be held one *Working Day* before the work starts with the following present:
 - .1 The *Contractor*, and the *Subcontractor* responsible for the work to be inspected and/or tested, the inspection and testing company representatives, the *Product* manufacturer's representative when required, and the *Consultant*.

.2 Reports and documents

- .1 The *Contractor* shall ensure that the inspection and testing company submits shop inspection and *Site* inspection reports within five *Working Days* of each inspection.
- .2 Distribute reports as follows:
 - .1 *Owner*; two copies.
 - .2 *Consultant*; one copy.
 - .3 *Contractor*; two copies.
 - .4 *Provide* copies to the *Subcontractor* whose work is being inspected and/or tested, or to the manufacturer/fabricator of the material being inspected and/or tested.
- .3 The *Contractor* shall ensure that inspection and testing companies submit a written report for each inspection or test, including pertinent data such as conditions at the *Place of the Work*, dates, test references, locations of tested materials, actual *Product* identification, testing methodology, procedures, and descriptions, *Site* instructions given, recommendations and/or any other information required by standard applicable to reporting of tests and inspections.
 - .1 Report must clearly indicate failure of *Product* or procedures to meet applicable standards, give recommendations for retesting or correction. The *Contractor* shall ensure that the Inspector contacts the *Contractor* and the *Consultant* immediately when *Product* or *Product* assembly fails to meet requirements of the *Contract Documents*.
- .4 Upon completion of portions of the *Work* subject to independent inspection and testing, submit to the *Consultant* duplicate certificates of acceptance of the installation issued by the independent inspection and testing company.
- .3 Copies of all inspection and test reports shall be submitted as part of the *Project Records* Documents in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.

1.9 TEST AND MIX DESIGNS

- .1 Furnish test results and mix designs as required by the *Contract Documents* or as may reasonably be requested by the *Consultant*.
- .2 The procedures for submittal of test results and mix designs shall be the same as those required for *Shop Drawings* in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Test results and mix designs are to be considered as forming part of the *Project Record* Documents in the same manner as *Shop Drawings* in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.
- .4 The costs of tests and mix designs beyond those called for in the *Contract Documents*, or beyond those required by the *Authorities Having Jurisdiction*, shall be appraised by the *Consultant* and may be authorized as a change in the *Work*.
- .5 Specimens and samples for testing, unless otherwise specified in the *Contract Documents*, will be taken by the inspection and testing company; sampling equipment and personnel will be provided by the inspection and testing company; and deliveries of specimens and samples to the testing company will be performed by the testing company unless otherwise specified in the *Contract Documents*.

- .6 Inspection and testing company shall take samples necessary to verify quality as specified. Taking of samples shall not endanger the structure or life safety and shall be taken so as to best represent the *Work* as a whole.
- .7 Samples shall be handled, packaged, stored, and delivered in accordance with specified tests. Sample handling where required shall duplicate conditions at the *Place of the Work* (such as *Site-cured* concrete cylinders).

1.10 MILL TESTS

- .1 Submit mill test certificates required by the *Contract Documents*.
- .2 The procedures for submittal of mill test certificates shall be the same as those required for *Shop Drawings* in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Mill test certificates are to be considered as forming part of the *Project Record Documents* in the same manner as *Shop Drawings* in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.

1.11 MOCKUPS

- .1 The *Contractor* shall ensure that all *Subcontractors* and *Suppliers* prepare mockups for work specifically requested in the *Contract Documents*. Any costs associated with the preparation of mockups shall be included in the *Contract Price*.
- .2 *Provide* field or shop erected example of work complete with specified materials and workmanship.
- .3 Construct in locations acceptable to the *Consultant* unless otherwise indicated in the *Contract Documents*.
- .4 Prepare the mockups for review by the *Consultant* within a minimum of 15 Working Days in advance of the work and in an orderly sequence, so as not to delay the progress of the *Work*.
- .5 Failure to prepare mockups within a minimum of 15 *Working Days* in advance of carrying out the work, will not be considered sufficient reason for an extension of the *Contract Time*, and no claim for extension by reason of such default will be allowed.
- .6 Refer to the respective Specification Sections to determine whether the mockup may remain as part of the *Work* or must be removed.
- .7 Protect and maintain mockups until directed to be removed. Commence work demonstrated in mock-up only after review and acceptance of workmanship from the *Consultant*. Mock-ups may not become part of finished work, except with explicit, prior, written acceptance of the *Consultant*.
- .8 *Work* for which a mockup is required in accordance with the *Contract Documents* shall not proceed until the required mockup has been reviewed by the *Consultant*.
- .9 Resubmit mockups until written acceptance is obtained from the *Consultant*.

1.12 EQUIPMENT AND SYSTEMS

- .1 Submit testing, adjustment and balancing reports for mechanical and electrical systems as required by the *Contract Documents*, and in accordance with Divisions 21, 22, and 23 and Divisions 26, and 28, as applicable.

- .2 The procedures for submittal of adjustment and balancing reports for mechanical and electrical systems shall be the same as those required for *Shop Drawings* in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Adjustment and balancing reports for mechanical and electrical systems are to be considered as forming part of the *Project Record Documents* in the same manner as *Shop Drawings* in accordance with Section 01 77 00 - *Project Closeout Procedures and Submittals*.

1.13 MANUFACTURER'S FIELD REVIEW

- .1 Where manufacturer's field review is specified, the Contractor shall ensure that the manufacturer's representative reviews the relevant parts of the work at the *Place of the Work*, or wherever such affected work is in progress, to ensure that work is being executed in accordance with manufacturer's written recommendations.
- .2 Manufacturer's field review is to ensure that the *Products* specified are being used in the *Work* and are being applied on surfaces prepared in accordance with their recommendations and the requirements of the *Contract Documents*.
- .3 Unless otherwise indicated in the *Contract Documents*, the Contractor shall ensure that the manufacturer's representative undertakes a minimum of one field review, with additional reviews as deemed necessary by the manufacturer, to determine that the work of such sections is in accordance with the manufacturer's written recommendations.
- .4 The Contractor shall ensure that the manufacturer's representative submits a typed-written report on manufacturer's letterhead within two *Working Days* after each field review. The report must document manufacturer's representative's field observations and recommendations. Within two *Working Days* from its receipt, the Contractor shall *Provide* a copy of the manufacturer's report to the *Consultant*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Installation and Removal
- .4 1.4 Temporary Drainage and Dewatering
- .5 1.5 Sanitary Facilities
- .6 1.6 Water Supply
- .7 1.7 Temporary Heating and Ventilation
- .8 1.8 Temporary Power and Light
- .9 1.9 Temporary Telephone
- .10 1.10 Hoisting
- .11 1.11 Plant, Machinery and Scaffolding
- .12 1.12 *Site* Storage and Over Loading
- .13 1.13 *Site* Office
- .14 1.14 Equipment, Tool, and Material Storage
- .15 1.15 Construction Sign
- .16 1.16 Hoarding
- .17 1.17 Weather Enclosures
- .18 1.18 Dust Tight Screens
- .19 1.19 Protection of Building Finishes and Equipment
- .20 1.20 Protection of Concrete Floors to Remain Exposed in Finished *Work*
- .21 1.21 Waste Management
- .22 1.22 Snow Removal
- .23 1.23 Control of Dust, Debris and Noise
- .24 1.24 Traffic Control and Road Maintenance
- .25 1.25 Security
- .26 1.26 Design and Safety Requirements for Temporary Facilities
- .27 1.27 Moisture Control

1.3 INSTALLATION AND REMOVAL

- .1 *Provide* temporary utilities, facilities, and controls in order to execute the *Work* expeditiously.
- .2 Arrange, obtain, and pay cost for permits required for temporary facilities and controls.
- .3 Remove from the *Place of the Work* all such work after use.

1.4 TEMPORARY DRAINAGE AND DEWATERING

- .1 The *Work* includes the removal of collected groundwater and surface water accumulating from precipitation and groundwater infiltration throughout the course of the *Work* until the date of *Substantial Performance of the Work*.
- .2 *Provide* temporary drainage and pumping facilities to keep excavations and the *Place of the Work* free from standing water.
- .3 Shall not discharge onto adjacent properties. Shall not discharge onto adjacent roadways where such discharge may interfere with the safe and normal use thereof or where catch basins do not exist.
- .4 Keep drainage lines and gutters open. No flow of water shall be directed across or over pavements except through pipes or properly constructed troughs. Keep portions of the *Work* properly and efficiently drained during construction and until completion. The *Contractor* shall be responsible for disturbances, dirt and damage which may be caused by or result from water backing up or flowing over, through, from or along any part of the *Work*, or due to operations which may cause water to flow elsewhere.
- .5 Keep trenches and other excavations free of water. Remove water in a manner that will prevent loss of soil and maintain the stability of existing soils.
- .6 Dispose of such water in a manner that will not be hazardous to public health and safety, private property, or to the *Work*.
- .7 Drainage of trenches or other excavation through storm drainage pipe will be allowed only with the express permission of the *Authority Having Jurisdiction*.
- .8 When drainage is permitted in writing to be directed to existing catch basins, regularly and at *Substantial Performance of the Work* inspect such catch basins and remove accumulated debris and sediment.

1.5 SANITARY FACILITIES

- .1 *Provide* sufficient sanitary facilities for workers in accordance with local health authorities.
- .2 Maintain sanitary facilities in clean condition and properly screened from public view.

1.6 WATER SUPPLY

- .1 *Provide* a continuous supply of potable water for use in the *Work*.
- .2 Arrange for connection with the appropriate utility company and pay costs for installation, maintenance, and removal.
- .3 Pay for utility charge at prevailing rates.

1.7 TEMPORARY HEATING AND VENTILATION

- .1 *Provide* and pay for temporary heating, cooling, and ventilating required for the *Work* during the construction period, including attendance, maintenance and fuel.
- .2 *Provide* temporary heat and ventilation as required to:
 - .1 Facilitate continuous uninterrupted progress of the *Work*.

- .2 Protect the *Work* and *Products* against damage and defacement caused by weather, harmful levels of temperature, humidity, and moisture.
- .3 *Provide* ambient temperatures and humidity levels for proper storage, installation and curing of materials, in accordance with specified standards and manufacturer's requirements.
- .4 *Provide* adequate ventilation to meet health regulations for safe working environment.
- .3 Construction heaters used inside buildings must be vented to the outside or be flameless type. Solid fuel salamanders are not permitted.
- .4 Maintain temperatures of minimum 10°C in areas where the *Work* is in progress, unless indicated otherwise in the *Specification* Sections.
- .5 Ventilate heated areas and keep building free of exhaust or combustion gases.
- .6 Heat must be uniformly distributed to avoid hot or cold areas or excessive drying.
- .7 Make good any damage caused by inadequate or excessive heat, at the *Contractor's* expense. Such making good will not be considered or approved as a change in the *Work*.

1.8 TEMPORARY POWER AND LIGHT

- .1 Arrange for temporary power required during construction for the proper execution of the *Work* and the safe and proper operating of power tools. Temporary power to be in accordance with Divisions 26 and 28.
- .2 Arrange for connection with the appropriate utility company. Pay costs for any required permits, for installation, maintenance, and removal.
- .3 Pay for utility charge at prevailing rates.
- .4 Abide by the rules of the Canadian Electrical Code.
- .5 Temporary power and lighting shall be maintained in good working order throughout the course of the *Work*.

1.9 TEMPORARY TELEPHONE

- .1 *Provide* and pay for a temporary telephone, to be located in the *Site* office, and available for use by the *Owner*, the *Consultant* and the *Subcontractors*.
- .2 The *Contractor* shall pay all service and local use charges for the telephone, including installation and removal on completion of the *Work*.
- .3 The *Contractor's* Superintendent shall be equipped with mobile telephone device.

1.10 HOISTING

- .1 *Provide*, operate, and maintain any hoists/cranes required for moving of workers, materials and equipment.
- .2 Hoists/cranes must be operated by a qualified operator only. Proof of operator's qualification shall be provided upon request.

1.11 PLANT, MACHINERY AND SCAFFOLDING

- .1 *Provide* formwork, scaffolding, equipment, tools, machinery including lifts, and incidental appurtenances necessary for the proper execution of the *Work*.

- .2 Erect plant, machinery and scaffolding to permit access to building and the *Work*.
- .3 Use scaffolds in such manner as to interfere as little as possible with other trades' operations.
- .4 Support scaffolds from finished surfaces only after taking precautions to prevent damage. No supports, clips, brackets, or similar devices shall be welded, bolted, or otherwise affixed to any finished member or surface without prior permission from the *Consultant*.

1.12 SITE STORAGE AND OVER LOADING

- .1 Confine the *Work* and the operations of workers to limits indicated by the *Contract Documents*. Do not unreasonably encumber the premises with *Products* or construction machinery and equipment.
- .2 Shall not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the *Work*.
- .3 Handle and store materials so as to prevent damage or defacement to the *Work* and surrounding property.

1.13 SITE OFFICE

- .1 *Provide* a weathertight, lockable office for the use of the *Contractor*, its *Subcontractors*, the *Consultant*, engineers, and the *Owner* when at the *Place of the Work*, and for the purposes of *Site* meetings.
- .2 The *Site* office must have heat, light, and ventilation from sources as outlined above in subsections 1.7 and 1.8.
- .3 *Provide* a meeting table, shelving, file cabinets, and the like, suitable for the storage and review of the *Contract Documents*, *Shop Drawings*, *Change Orders*, *Supplemental Instructions*, and all other record documents as required by the *Contract Documents* and by the *Authorities Having Jurisdiction*.
- .4 The *Site* office shall not be used for the storage of *Products*, or construction machinery or equipment.

1.14 EQUIPMENT, TOOL, AND MATERIAL STORAGE

- .1 *Provide* and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds at the *Place of the Work* in a manner to cause the least interference with the *Work*.
- .3 The *Owner* shall not be responsible for securing *Products* or materials at the *Place of the Work*.

1.15 CONSTRUCTION SIGN

- .1 The *Contractor* shall supply and install the construction sign and nominal 100 mm x 100 mm wood posts and framing, and shall fix the sign to the framing.
- .2 The maximum size of the sign shall be 1200 mm x 2400 mm.
- .3 No other signs, other than for safety, caution, or instruction, shall be permitted without the *Owner's* prior written consent.

1.16 HOARDING

- .1 *Provide* hoarding and barricades as and where required by *Authorities Having Jurisdiction* or required to protect the public, workers, and public and private property from injury or damage.
- .2 Include for the provision of overhead protection and temporary exits and exit signs as may be required during the course of the *Work*.
- .3 Include for the provision of temporary gates and/or doors to *Provide* restricted access to the *Place of the Work* as required.

1.17 WEATHER ENCLOSURES

- .1 *Provide* weathertight closures to unfinished door and window openings, tops of shafts, and other openings in floors and roofs.
- .2 Close-off floor areas where walls are not finished, seal-off other openings, and enclose building interior work area for temporary heat.

1.18 DUST TIGHT SCREENS

- .1 *Provide* dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work, and the public.
- .2 Maintain and relocate protection until such work is complete.

1.19 PROTECTION OF BUILDING FINISHES AND EQUIPMENT

- .1 *Provide* protection for finished and partially finished building finishes and equipment during performance of the *Work*.
- .2 Protect the *Work* from damage, discolouring, and defacement. Maintain protection until the *Work* is complete.
- .3 Protect completed work from soiling, abrasion, punctures, damage, and defacement, and maintain protection until the surrounding or overhead work is complete.
- .4 Keep surfaces free of oils, grease or other materials that may damage or deface them or affect bond of applied *Products*.
- .5 Remove and replace materials damaged or defaced as a result of failure to *Provide* adequate protection, at the *Contractor's* expense.
- .6 Have damaged or defaced work corrected by workers meeting qualification requirements of the *Contract Documents*.
- .7 *Provide* minimum 3 mm thick Masonite board protection, or finish flooring manufacturer approved alternative, to all finished floors.
- .8 The *Contractor* shall be responsible for damage due to lack of, or improper, protection, and shall be required to make good any such damage at its own expense. Such making good will not be considered or approved as a change in the *Work*.

1.20 PROTECTION OF CONCRETE FLOORS TO REMAIN EXPOSED IN FINISHED WORK

- .1 Non-marking protection material shall be placed over concrete floors designated as exposed.

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

1.21 WASTE MANAGEMENT

- .1 Shall not bury rubbish and waste materials at the *Place of the Work*.
- .2 Shall not dispose of waste into waterways or storm or sanitary sewers.
- .3 Shall not burn waste materials at the *Place of the Work*.
- .4 Comply with waste disposal requirements of *Authorities Having Jurisdiction*.
- .5 Remove waste material from the *Place of the Work* daily. If waste is collected in bins, bins to be removed from *Site* once full.
- .6 Arrange and pay for removal of debris and waste from the *Place of the Work*.
- .7 Make arrangements with and obtain permits from *Authorities Having Jurisdiction* for disposal of waste and debris. Pay fees.

1.22 SNOW REMOVAL

- .1 Allow no accumulation of ice and snow within the *Place of the Work*. There shall be no use of salt for de-icing in areas of building work.
- .2 Remove snow from access routes to the *Work* to maintain uninterrupted progress of the *Work*.

1.23 CONTROL OF DUST, DEBRIS AND NOISE

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

- .3 Prevent materials from contaminating air beyond application area, by providing temporary enclosures and ventilation/filtration.
- .4 Limit noise levels in accordance with requirements of *Authorities Having Jurisdiction* and the *Owner*.
- .5 Prevent abrasive-blasting, pressure-washing spray, and other extraneous materials from contaminating air beyond application area.

1.24 TRAFFIC CONTROL AND ROAD MAINTENANCE

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

1.25 SECURITY

- .1 The *Contractor* shall be solely responsible for securing the *Place of the Work* and the *Work*, and for securing areas used for the storage of *Products* or construction machinery and equipment. The *Owner* will have no responsibility in this regard.
- .2 *Provide* and maintain security lighting.
- .3 *Provide* and maintain temporary locks. Premises to be locked after working hours.

1.26 DESIGN AND SAFETY REQUIREMENTS FOR TEMPORARY FACILITIES

- .1 The *Contractor* shall be responsible for design, erection, operation, maintenance, and removal of temporary structural and other temporary facilities. Engage and pay for qualified professional engineering personnel skilled in the appropriate disciplines to perform these functions where required by law or by the *Contract Documents*; and in cases where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.
- .2 Engage and pay for a *Professional Engineer* to design and supervise construction and maintenance of hoardings, covered ways, protective canopies, and *Project* sign(s). Designs provided by the *Consultant* or the *Owner* for such work cover general appearance only.

1.27 MOISTURE CONTROL

- .1 Concrete slabs shall be properly cured and dried before installation of finished flooring assemblies.
 - .1 Allow for one of the following methods:
 - .1 Drying time.
 - .2 Drying action by mechanical methods.

- .3 Moisture mitigation coating as specified below.
- .4 Drying action by other method and/or materials as approved by affected flooring manufacturer.
- .2 Before installation of weather barriers, when materials are subject to wetting, protect as follows:
 - .1 Protect porous materials from water damage.
 - .2 Protect stored and installed material from flowing or standing water.
 - .3 Keep porous and organic materials from coming into prolonged contact with concrete.
 - .4 Remove standing water from decks.
 - .5 Keep deck openings covered or dammed.
- .3 After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
 - .1 Shall not load or install gypsum board or other porous materials or components, or items with high organic content, into partially enclosed building.
 - .2 Keep interior spaces reasonably clean and protected from water damage.
 - .3 Periodically collect and remove waste containing cellulose or other organic matter.
 - .4 Discard or replace water-damaged material.
 - .5 Shall not install material that is wet.
 - .6 Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- .4 After completing and sealing of the building enclosure but prior to the full operation of permanent heating, ventilation, and air conditioning systems, maintain as follows:
 - .1 Control moisture and humidity inside building by maintaining effective drying conditions.
 - .2 Use permanent heating, ventilation, and air conditioning system to control humidity subject to the prior written approval of the *Consultant*.
 - .3 Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Quality Assurance
- .5 2.1 Materials
- .6 3.1 Examination
- .7 3.2 Tree Pruning
- .8 3.3 Tree Protection
- .9 3.4 Tree Repair and Replacement
- .10 3.5 Field Quality Control

1.3 SUMMARY

- .1 Section includes:
 - .1 This section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the *Work*, whether temporary or permanent construction.

1.4 QUALITY ASSURANCE

- .1 Qualifications: The *Contractor* shall engage an experienced tree service firm, minimum five years' experience, that has successfully completed tree protection and trimming work similar to that required for this *Project*. The *Contractor* shall ensure that the tree services firm assigns an experienced, qualified arborist to *Project* and ensures the arborist is present at the *Place of the Work* during execution of tree protection and trimming.
- .2 Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and other Woody Plant Maintenance—Standard Practices (Pruning)."

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 *Products* and remedial care for protection of the trees and plants as specified must be as recommended by a qualified arborist, must comply with references above, with approval of the *Consultant*.
- .2 *Provide* tree protection barrier alternative where indicated on the *Drawings* and subject to the approval by Urban Forestry Services:
 - .1 Snow fencing to be standard 1220 mm (48") high orange safety fence, and 'T' iron rail stakes (38 mm (1-1/2") x 38 mm (1-1/2") x 5 mm (13/64")) primed with one coat of black zinc rich paint.

- .3 Mulch: Clean, straw mulch from local sources free of weeds and hazardous materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine the *Place of the Work* before commencement of work and inform the *Consultant* if *Site* conditions will not permit completion of tree and plant protection work as in accordance with the *Contract Documents*.
- .2 No ground breaking activities or demolition should occur until all tree preservation requirements have been met.
- .3 All *Subcontractors*, *Suppliers*, and *Site* personnel shall be informed of the tree and plant protection measures and guidelines prior to their commencing any activities at the *Place of the Work*.
- .4 The Tree Protection Zone (TPZ) shall be posted with signs.
- .5 Within the Tree Preservation Zone (TPZ) there shall be:
 - .1 No construction;
 - .2 No altering of grade by adding fill, excavating, trenching, scraping, dumping or disturbance of any kind.
 - .3 No storage of construction materials, equipment, soil, construction waste or debris.
 - .4 No disposal of any liquids (i.e.: concrete sleuth, gas, oil, paint).
 - .5 No movement of vehicles, equipment or pedestrians.
 - .6 No parking of vehicles or machinery.
 - .7 No activity of any kind without permission of the arborist
 - .8 Activity of any kind without permission of the arborist

3.2 TREE PRUNING

- .1 Prune trees and plants indicated to remain that are affected by temporary and permanent construction.
- .2 Prune trees to remain to compensate for root loss caused by damaging or cutting root system. *Provide* subsequent maintenance during *Contract* period as recommended by arborist.
- .3 Pruning Standards: Prune trees according to ANSI A300.
 - .1 Type of Pruning: Cleaning, Raising, and Reduction.
- .4 Cut branches with sharp pruning instruments; do not break or chop.
- .5 Chip removed tree branches and dispose of off-*Site*.

3.3 TREE PROTECTION

- .1 Protect trees to be preserved from damage during the *Work* in accordance with the following specifications and make good any damage at no expense to *Owner*.
- .2 The location of the tree preservation zone is clearly indicated on the Tree Preservation Plan. Trees to be protected will be confirmed by the *Consultant*.

- .3 Tree protection shall remain in place until all sitework has been completed, and may not be removed, relocated, or otherwise altered without the written permission of the *Consultant*.
- .4 The trees to be protected shall be fertilized with a deep root application of an approved fertilizer before construction commences on this *Project* as well as a second fertilization in two years.
- .5 The trees to be protected shall be pruned in accordance with Tree Pruning paragraphs above in this Section.
- .6 The *Contractor* shall ensure that the arborist undertakes proper root pruning when and if roots of retained trees are to be exposed, damaged or severed by construction activities. The *Contractor* shall ensure that the arborist supervises the excavation of soil where roots are to be cut. All roots are to be cut cleanly at the excavation zone and backfilled with an appropriate soil mix. Exposed roots shall be covered with soil or mulch as soon as possible to prevent further damage and desiccation. Root pruning prior to excavation will help prevent unnecessary damage to tree roots.
- .7 In areas where mulch may remain following construction the trees shall have minimum 100 mm (4") of mulch installed over the root system before construction starts, and set back from the trunk by rodent guard. Mulch shall be spread evenly under the canopy to the dripline, to the limits of the protection fence, or as otherwise indicated in the *Contract Documents*.
- .8 There shall be a source of water provided to ensure that the trees get adequate water during the dry periods. It will be the responsibility of the *Contractor* to monitor for moisture content in the soil for the duration of the *Work*.
- .9 The protection zone shall not be breached in any way. There shall be no material stored in the preservation zones, no grade changes and no parking.
- .10 Ensure all trees are protected from compaction of roots or damage to trunk or limbs prior to receipt of permits for removal or remedial care as recommended by arborist.
- .11 Obtain necessary permits, reports, and approvals.
- .12 Proceed with execution of specified work, under direction of the *Consultant*.
- .13 No rigging cables will be wrapped around or installed in trees. Do not burn waste near trees and do not flush concrete trucks or cement mixing machines over root system.

3.4 TREE REPAIR AND REPLACEMENT

- .1 Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
- .2 Remove and replace trees indicated to remain that die or are damaged during construction operations that the *Consultant* and the arborist determine are incapable or restoring to normal growth pattern. This shall be done at no additional costs to the Owner.
 - .1 *Provide* new trees of same size and species as those being replaced; plant and maintain as specified by the *Consultant*.
 - .2 *Provide* new trees of 150 mm (6") calliper size and of a species selected by the *Consultant* when damaged trees more than 150 mm (6") in calliper size, measured 305 mm (12") above grade, are required to be replaced. Plant and maintain new trees as specified by the *Consultant*.

- .3 Aerate surface soil, compacted during construction, 3048 mm (10 ft) beyond drip line and no closer than 914 mm (36") to tree trunk. Drill 50 mm (2") diameter holes a minimum of 305 mm (12") deep at 610 mm (24") on centre. Backfill holes with an equal mix of augured soil and sand.
- .4 General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicative existing tree to be replaced. Comply with ANSI Z60.1-2014; and with healthy root systems developed by transplanting or root pruning. *Provide* well-shaped, fully branched, healthy, vigorous stock, densely foliated when in lead and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - .1 Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk, crossing trunks; cut-off limbs more than 19 mm (3/4") in diameter; or with stem girdling roots will be rejected.
 - .2 Collected Stock: Do not use plants harvested from the wild, from native stands, from an established planting, or not grown in a nursery unless otherwise indicated.
- .5 *Provide* trees of sizes, grades, and all sizes complying with ANSI Z60.1-2014 for types and form of trees required. Plants of a larger size may be used if acceptable to the *Project's* landscape architect, with a proportionate increase in size of roots or balls.
- .6 Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1-2014. Root flare shall be visible before planting.

3.5 FIELD QUALITY CONTROL

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Objectives
- .4 1.4 Description of Work
- .5 1.5 Reference Standards
- .6 1.6 Submittals
- .7 3.1 Procedures
- .8 3.2 Inspections and Maintenance
- .9 3.3 Removal of Products

1.3 OBJECTIVES

- .1 Prevent the loss of soil from the construction *Site* resulting from storm water runoff, wind erosion, and construction activities.
- .2 Prevent the sedimentation of storm sewers and receiving waters.
- .3 Prevent air pollution caused by dust and particulate matter.
- .4 Meet or exceed the requirements of LEED® Canada-NC Version v4.1 Sustainable Sites Prerequisite 1 - "Erosion & Sedimentation Control" which specifies compliance with U.S. EPA's construction general permits outlined in Phase I and Phase II of USA's National Pollutant Discharge Elimination System (NPDES) program, OR local erosion and sedimentation control standards and codes of the *Authorities Having Jurisdiction*, whichever is more stringent.

1.4 DESCRIPTION OF WORK

- .1 Implement the Erosion and Sedimentation Control (ESC) measures shown on the *Project Drawings* and described in this Section.
- .2 Install ESC *Products* in accordance with manufacturer's instructions and the prescribed installation procedures in the referenced EPA document.
- .3 Inspect ESC measures on a weekly basis and following all significant storm events. If deficiencies are found, make repairs within 24 hours of detection.
- .4 Maintain an ESC inspection log to document observations, deficiencies, and corrective actions.

1.5 REFERENCE STANDARDS

- .1 U.S. Environmental Protection Agency, construction general permits outlined in Phase I and Phase II of USA's National Pollutant Discharge Elimination System (NPDES) program.

- .2 CaGBC, "Sustainable Sites Prerequisite: Construction Activity Pollution Prevention" Leadership in Energy and Environmental Design Reference Guide for New Construction & Major Renovations (LEED® Canada Reference Guide for Green Building Design and Construction v4.1)

1.6 SUBMITTALS

- .1 ESC Inspection Checklist - Schedule A (appended to this Section as Section 01 74 19.1 – Erosion and Sedimentation Controls Schedules)
 - .1 Prepare the checklist to include all measures shown on the *Drawings* and described in the *Specifications*.
 - .2 Complete a new checklist with each inspection and keep completed checklists with the weekly inspection log documentation.
- .2 ESC Weekly Inspection Log - Schedule B (appended to this Section as Section 01 74 19.1 – Erosion and Sedimentation Controls Schedules)
 - .1 Complete the log on a weekly basis and keep all documentation on-*Site* and available for review by the *Consultant*.
 - .2 The inspection log shall be completed for each inspection and must document deficiencies for all measures indicated as "Not OK" on the inspection checklist.
 - .3 Each deficiency must be initialed, and each log signed, only after all corrective measures have been completed and documented.
 - .4 Submit all ESC documentation (e.g. inspection checklists and inspection log) to the *Consultant* on a monthly basis until the *Project* is substantially completed.
- .3 Photographs
 - .1 A minimum of three digital photographs shall be taken (from various viewpoints) of each ESC measure implemented on-*Site* immediately following installation.
 - .2 Photographs of installed ESC measures must be taken weekly throughout the *Project* and submitted to the *Consultant* on a monthly basis in order to document continued ESC adherence.
 - .3 A minimum of three digital photographs shall be taken (from various viewpoints) of each ESC measure implemented on-*Site* at the end of construction or prior to dismantling, whichever comes first.
 - .4 Photographs must include date time stamp: YYYY:MM:DD; XX:XX
 - .5 Coordinate photograph requirements in accordance with Section 01 35 20 – General LEED Requirements.

PART 2 - PRODUCTS

Not Applicable.

PART 3- EXECUTION

3.1 PROCEDURES

- .1 General Practices
 - .1 Stabilized Construction Entrance (SCE)

- .1 Construct an SCE before construction begins at every point where traffic leaves the *Site* and enters onto a public road and/or any unpaved entrance/exit location where there is a risk of transporting mud or sediment onto paved roads.
- .2 The SCE must be at least 3650mm wide, with room for two vehicles to pass at high traffic areas, and constructed of 50mm diameter clear stone, 150mm diameter rip rap, and filter fabric with the following characteristics:
 - .1 Grab Tensile Strength: 100kg;
 - .2 Elongation Failure: 60%;
 - .3 Mullen Burst Strength: 195kg;
 - .4 Puncture Strength: 56.7kg;
 - .5 Equivalent Opening: Size 40-80.
- .2 Site Arrangement
 - .1 All construction trailers and equipment shall be positioned to reduce the disturbance of *Site*. They shall be located close to the current phase of construction to minimize traffic damage to the *Site*.
- .3 Material Stockpiling
 - .1 If material in stockpile will not be used within 14 *Working Days*, it must be stabilized using one of the following measures:
 - .1 Temporary Seeding
 - .2 Tarps
 - .3 Surface Roughening
 - .2 Install ESC *Products* in accordance with manufacturer instructions and the prescribed installation procedures in the referenced EPA document.
- .2 Stabilization Practices
 - .1 Preservation of Natural Vegetation
 - .1 Establish construction boundaries to limit *Site* disturbance to 12.2m beyond the building perimeter, 1525mm beyond primary roadway curbs, walkways and main utility branches, and 25 feet beyond parking areas.
 - .2 Stakes shall be used to indicate limits of construction, grading and disturbance. Trees must be clearly marked to be preserved and protected from ground disturbances around the base.
 - .2 Buffer Zones
 - .1 Incorporate vegetated strips of land on floodplains, next to wetlands, along stream banks, and on steep, unstable slopes to decrease the velocity of storm water runoff, preventing soil erosion.
 - .2 It may be an area of vegetation left undisturbed during construction, or it can be newly planted. New strips require establishment of permanent seeding and planting.

.3 Mulching

- .1 Hay, grass, woodchips, straw, and/or gravel shall be used in areas prone to erosion during construction and to facilitate the growth of permanent seeding.

.4 Temporary Seeding

- .1 Use temporary seeding to reduce soil erosion by stabilizing area disturbed by construction that will not be brought to final grade within 30 *Working Days*.
- .2 Areas that may require temporary seeding include, but may not be limited to, soil stock piles, dikes, dams, and sides of sediment basins and traps.
- .3 Species used for temporary seeding must be fast growing, be native or adapted, not require permanent irrigation, and not be invasive.
- .4 Till/loosen compacted soil prior to planting seed.

.5 Permanent Seeding

- .1 Shall be applied to any graded or cleared area as Specified on landscaping plan.
- .2 Plant native species of grass, trees, and shrubs during favourable growth conditions; for areas outside of construction activity preferably within 21 *Days* of construction start.
- .3 Species shall not require permanent irrigation after the first two years from planting the species or fertilizers containing phosphorus. Species must not be invasive.
- .4 Use topsoil on areas where topsoil has been removed, where the soil is dense or impermeable, or where mulching and fertilizers alone cannot improve soil quality. Make topsoil layers at least 50mm deep, or similar to the existing topsoil depth.

.6 Sod Stabilization

- .1 Sod shall be applied in alternating strips or other patterns on graded or cleared areas that might erode.
- .2 Roll or compact immediately after installation to ensure firm contact with topsoil. Add lime and phosphorus-free fertilizers to the soil to promote growth.
- .3 Do not plant sod during very hot or wet weather or on slopes greater than 3:1 if they are to be mowed.

.7 Dust Control

- .1 Apply vegetative cover, mulch, spray-on adhesives, calcium chloride, sprinkling, stone, or barriers on open dry areas of soil as specified on the *Contract Drawings*.

.3 Structural Practices

.1 Silt Fence

- .1 Construct posts with a filter fabric media to remove sediment from storm water volumes flowing through the fence.
- .2 The lower edge of the fence is to be vertically trenched and covered by backfill.
- .3 Filter fabric should be a pervious sheet of polypropylene, nylon, polyester, polyethylene, or *Equivalent* and have the following characteristics:

- .1 Filtering Efficiency: 75%-85% (minimum)
- .2 Tensile Strength at 20% Standard Strength: 0.034kg/linear meter (min.)
- .3 (maximum) Elongation Extra Strength: 0.057 kg/linear meter (min.)
- .4 Slurry Flow Rate: 20 L/min/m² (min.)
- .2 Outlet Protection
 - .1 Install stone, riprap, concrete aprons, paved sections, or settling basins at all pipe, interceptor dike, swale, or channel section outlets where the velocity of flow may cause erosion or pools at the outlet of an ESC measure.
- .3 Inlet Protection
 - .1 Install stone, concrete masonry units and stone, filter fabric, or silt fences around catch basins and manhole covers to prevent silting of inlets, storm drainage systems, or receiving channels.
- .4 Surface Roughening
 - .1 Create horizontal grooves, depressions, or steps that run parallel to the contour of the land.
 - .2 Use surface roughening on all slopes, as soon as possible after the vegetation has been removed.
 - .3 Methods of surface roughening are stair-step grading, grooving (using disks, spring harrows, or teeth on a front-end loader), and tracking (driving a crawler tractor up and down a slope, leaving the cleat imprints parallel to the slope contour).
- .5 Check Dams
 - .1 Install check dams in steeply sloped swales, or in swales where adequate vegetation cannot be established, and only in small open channels which will not overflow once dams are constructed.
 - .2 Construct a small, temporary or permanent dam of stone, straw bales, logs or pea gravel-filled sandbags across a drainage ditch, swale, or channel to slow water flow and allow suspended sediment to settle.
- .6 Drainage Swale
 - .1 Construct a channel with a lining of vegetation, riprap, asphalt, concrete, or other material to convey runoff from the bottom or top of a slope.
 - .2 Intercepted runoff shall be diverted to an appropriate outlet with sediment trap if required; swale shall have a positive grade with no dips to collect water.
 - .3 Swale shall be lined using geotextiles, grass, sod, riprap, asphalt, or concrete - based on the volume and velocity of the runoff.

3.2 INSPECTIONS AND MAINTENANCE

- .1 Inspection procedures specified below summarize the EPA document and shall be followed in conjunction with details, *Drawings*, and manufacturer requirements.

- .2 All control measures shall be inspected at least once each week (unless otherwise noted) and following any significant storm event (13mm of precipitation or greater). The inspection log shall be completed for each inspection and kept in an accessible location on *Site* until all corrective measures have been documented. Each completed log must be submitted to the *Consultant* for review.
- .3 All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of report.
- .4 Stabilized Construction Entrance: Apply additional gravel as required, remove sediments and other materials from all areas to minimize clogging. Keep adjacent public roadway(s) free of sediment.
- .5 Site Arrangement: Verify that movement of construction equipment to appropriate area occurs at the same time as movement of construction activities.
- .6 Material Stockpile: Inspect for effective prevention of runoff and erosion. Remove built-up sediment from silt fence when it has reached 1/3 the height of the filter fabric.
- .7 Preservation of Natural Vegetation: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning, and weed and pest control, depending on the specific species and environmental conditions. Remove any debris, and ensure area is protected from traffic.
- .8 Buffer Zones: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning, and weed and pest control, depending on the specific species and environmental conditions. Remove any debris, and ensure area is protected from traffic.
- .9 Soil Retaining Measures: Inspect for structural damage, and repair as required at no cost to the *Owner*.
- .10 Mulching: Inspect to ensure mulching is not loose or removed; apply additional mulch or reseed if necessary. If mulch binder is required, apply at rates specified by the manufacturer. Employ alternative controls if current measures are not effective.
- .11 Temporary Seeding: If plants do not grow quickly or thick enough to prevent erosion, reseed the area as soon as possible. Keep seeded areas adequately moist; if irrigation is required, over-watering shall be avoided. Phosphorus-containing fertilizers are not acceptable.
- .12 Permanent Seeding: Inspect for sufficient growth and water conditions. Replant areas as per installation instructions if cover does not provide erosion control.
- .13 Sod Stabilization: Remove and replace dead sod. Ensure area receives sufficient water; if irrigation is required, do not over-water.
- .14 Silt Fence: Silt fence to be inspected for depth of sediment, tears, loose fabric attachment at the fence posts, channel erosion beneath fence, sagging or collapse, and to ensure the fence posts are firmly in the ground. Built up sediment is to be removed from silt fence when it has reached one-third the height of the fence. Repair such that fence is in original installation condition.
- .15 Outlet Protection: Inspect outlet for erosion and pooling of water. Necessary repairs to be made as required to reduce exit velocity of runoff. If a riprap apron is used, inspect for riprap displacement and damage to filter fabric.
- .16 Inlet Protection: Inspect that measures are in original installed condition. Ensure measures are effectively trapping sediment. Remove accumulated sediment and debris when it reaches ½ the design depth of the trap. Repair protection measures as required.

- .17 Surface Roughening: Inspect for small eroded watercourses, as little as a few inches deep, or washout of roughened grading. Fill, regrade, and reseed immediately.
- .18 Check Dams: Inspect for sediment and debris accumulation and erosion of sides. Sediment should be removed when it reaches one half the original dam height. Repair dams as required.
- .19 Drainage Swale: Inspect for dips or low points along the swale where water is pooling and ensure that runoff is being directed to sediment-trapping measure used onsite.

3.3 REMOVAL OF PRODUCTS

- .1 ESC measures shall not be removed unless approved by the *Consultant*.

END OF SECTION

SCHEDULE A: EROSION AND SEDIMENTATION CONTROL (ESC)
Inspection Checklist

Project Name: _____

Completed By: _____

Date: _____

During Construction: Complete this checklist on a weekly basis as per Section 01 74 19 – Erosion and Sedimentation Control. For each measure, check the “OK” box if there are no repairs or maintenance required; check the “Not OK” box if attention is required as per the inspection/maintenance procedures in the *Specification*. For all measures marked as “Not OK”, the Inspection Log must be completed. List the measures that are deficient in the “Deficiencies” column on the Log, and record the maintenance performed. Submit both the checklist and the log to the *Consultant* on a monthly basis after all maintenance activities have been completed and recorded.

OK	Not OK	Location of Site	Measure
		Around <i>Site</i> perimeter	Preservation of Natural Vegetation (Describe):
		Around <i>Site</i> perimeter	Slit Fence
		Vehicular entrance to the <i>Site</i>	Stabilized Construction Entrance
			Temporary Seeding
			Permanent Seeding
			Sod Stabilization
			Mulching
			Inlet Protection
		Around <i>Site</i> perimeter	Interceptor Dike and Swale
			Outlet Protection
			Check Dams

SCHEDULE B: EROSION AND SEDIMENTATION CONTROL (ESC)
Weekly Inspection Log

Log Start Date: _____

Log End Date: _____

Log Complete By: _____

Project Name: _____

Company: _____

Telephone No.: _____

Inspection Date	General Observations (I.e. Seasonal Conditions)	Location and Deficiency of ESC Measure	Corrective Measures	Initials

I hereby certify that the information provided is complete, correct, and complies with the requirements of EPA Best Management Practices:

Signature	Title	Date

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL SUMMARY

- .1 Section Includes
 - .1 Special requirements for Indoor Air Quality (IAQ) management during construction operations
 - .2 Startup requirements for HVAC equipment prior to occupancy
- .2 Definitions
 - .1 Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air.
 - .2 Interior finishes: Materials and products that will be exposed to the interior, occupied spaces; including flooring, wall covering, finish carpentry, and ceilings. These are all materials that are inside the Project weatherproofing system.
- .3 Reference Standards
 - .1 SMACNA - IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition, Chapter 3, November 2007

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: The Contractor shall provide subcontractor orientation, including a clear delineation of responsibilities for each subcontractor required to implement the proposed IAQ Management Program.
 - .1 Include IAQ management as an agenda item to be discussed regularly at construction meetings.
- .2 Sequencing: The Contractor shall ensure that the building is fully enclosed and watertight prior to the installation of absorptive materials. Stage subcontractors to ensure that dust-generating activities are complete prior to the installation of carpets, ceiling tiles and other final finish materials.
- .3 Scheduling: As the interior finishes are being installed, and prior to equipment start-up, conduct a meeting with the Owner, Consultants, and subcontractors to discuss the proposed approach to staging of finishes, equipment starting up, and commissioning.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 All materials and *Products* shall be inspected upon delivery to the site to ensure there is no pre-existing damage due to dust, moisture, or physical impact.
- .2 Once on the site, all materials and *Products* shall be stored according to 3.1.3.
- .3 All materials used to protect (e.g. skids, tarps, etc.) materials and *Products* shall be reused as practicable and recycled at the end of their useful life.

1.4 SITE CONDITIONS

- .1 The measures stipulated herein are to be implemented as required to address the specific site conditions.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 ADMINISTRATIVE REQUIREMENTS

.1 IAQ MEASURES AND PROCEDURES

.1 Source Control

- .1 Smoking is not permitted inside the building at any time. The Contractor shall post “No Smoking” signs at each entrance and throughout the building to enforce this requirement.
- .2 All toxic chemicals and fuels are to be stored outside of the building.
- .3 Keep idling trucks away from open portions of the building, outdoor air inlets, and open doorways.
- .4 All equipment refueling is to be done outside of the building.
- .5 After close-in, gas powered equipment is not permitted to be used in the building without prior approval from the Consultant. Preference will be given to electric or propane powered equipment.
- .6 All interior paints and finishes, adhesives, sealants applied onsite and used within the weatherproofing system must satisfy the requirements of corresponding specification sections.
- .7 Where practicable, assemble products and assemblies that require the use of adhesives, sealants, paints and coatings offsite (e.g. millwork).
- .8 Where practicable, allow new materials, products and assemblies to off-gas prior offsite or in a dedicated and isolated area within the building prior to installation (e.g. furniture).

.2 Scheduling

- .1 Weatherproof the building from the exterior environment as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, at the earliest possible time.
- .2 Schedule construction operations involving wet and/or odourous materials prior to installation of dry and/or absorbent materials. Install interior absorptive materials only after the building envelope is sealed and weatherproofed.
 - .1 Apply Type 1 interior finishes and allow these finishes to completely cure according to intervals and times stated in respective finish manufacturers printed instructions before commencing installation of any Type 2 materials in same area.
 - .2 Do not store any Type 2 materials in areas where installation or curing of Type 1 materials is in progress.
 - .3 Where the requirements above are not possible, protect Type 2 materials with a polyethylene sheet.

Material and Finish Type	Material Examples
Type 1 Materials and finishes which have potential for short term levels of off-gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing.	Type 1 Materials and finishes include, but are not limited to the following: <ul style="list-style-type: none"> ▪ Composite wood products, including particleboard and plywood from which millwork, wood paneling, doors or furniture may be fabricated ▪ Adhesives, sealants and glazing compounds ▪ Wood preservatives, wood finishes, primers and paints and paint like wall finishes ▪ Control and/or expansion joint fillers, firestopping materials and caulking ▪ Hard finishes requiring adhesives installation including, but not limited to plastic laminate, linoleum and rubber tile ▪ Gypsum board and associated finish processes and products
Type 2 Soft materials and finishes which are woven, fibrous, or porous in nature and may absorb chemicals off-gassed by Type 1 materials and finishes or may be adversely affected by airborne particulate. These materials have the potential to become sinks for deleterious substances which may be released much later, or act as collectors of contaminants that may promote subsequent bacterial growth.	Type 2 Materials and finishes include, but are not limited to the following: <ul style="list-style-type: none"> ▪ Carpet and underpadding, and other woven or fibrous floor finishes ▪ Fabric wall coverings ▪ Insulation materials exposed to the airstream ▪ Acoustic ceiling materials ▪ Furnishings with fabric coverings

- .3 Once installed, protect absorbent materials including, but not limited to, porous insulations, paper-faced gypsum board, ceiling tile, and carpet from dust, dirt and moisture accumulation.
- .4 After carpet is installed, place a protective barrier, such as cardboard or plastic sheet, over all floor areas that will be travelled on by workers prior to the end of construction.

.3 Material and Product Storage

- .1 All porous, absorptive and finish materials are to be covered or contained prior to installation to prevent dust, dirt and moisture accumulation.
- .2 While in storage, materials and products shall be elevated a minimum of 4" above the floor and covered using tarps or plastic sheets.
- .3 Materials and products that will be installed inside the weatherproofing system must be kept dry at all times. The Contractor shall identify and remove all porous building materials that become wet or damaged by moisture within 7 calendar days of such exposure.

.4 Housekeeping Measures

- .1 Clean up accumulated debris on a daily basis.

- .2 Complete a comprehensive cleaning of the entire floor area on a weekly basis. Clean up shall include, at a minimum, the following activities:
 - .1 Removal of all unnecessary debris and waste from the building. Dispose of in accordance with the specifications.
 - .2 Vacuum (preferred) or sweep (using a non-toxic sweeping compound) all floor areas.
 - .3 Inspect storage of all materials and products for compliance with 3.1.3.
- .3 Once the building is closed-in, use walk off mats at all entryways to limit the amount of dirt that is tracked into the building.
- .4 Keep dirt and other pollutants away from outdoor air intakes and building openings.
- .5 Keep mechanical rooms clean and neat. Remove excess dust and debris.
- .6 All standing water that accumulates on interior floors shall be removed on the day that it is observed.
- .5 Pathway Interruption
 - .1 Project equipment and material staging areas shall be located away from critical airflow pathways.
 - .2 Mechanical rooms and air handling equipment areas shall not be used to store construction waste or materials.
 - .3 Use permanent or temporary barriers to isolate areas with heavy dust generating activities from the rest of the building. Used permanent walls, doors or temporary plastic sheet barriers to isolate these areas.
 - .4 Establish at least one centrally located work/cutting room that is isolated from other areas of the building using permanent or temporary barriers. Entryways into this room must be equipped with doors or dust curtains to contain dust. Carryout out all heavy dust-generating activities (e.g. wood cutting) in this room. If required, provide temporary exhaust to the outdoors as required to maintain area at a negative pressure differential compared to surrounding areas to control dust migration.
- .6 Ductwork Protection
 - .1 Stockpiled ductwork not yet installed shall be stored in an area that is clean, dry and has minimum exposure to dust. Ductwork shall be elevated a minimum of 4" above the floor and covered using tarps or plastic sheets.
 - .2 During ductwork installation, the working area shall be clean, dry and protected from the exterior elements.
 - .3 Wipe internal surfaces of ductwork immediately prior to installation to remove dust that has accumulated.
 - .4 All open ductwork must be covered at the end of each day or when not being worked on to prevent the entry of debris into the duct. This can be done using self-adhesive polyethylene or duct end caps.

.7 HVAC Equipment Protection

- .1 HVAC equipment not yet installed shall be stored in an area that is clean, dry and has minimum exposure to dust. Equipment shall be elevated a minimum of 4" above the floor and covered using tarps or plastic sheets.
- .2 Seal supply diffusers and return grills with plastic during construction operations. Ensure that plastic covers remain in place until final building cleaning and prior to HVAC equipment start-up.
- .3 Provide temporary exhaust to areas where heavy construction and dust generating activities are expected to take place. Exhaust systems shall be independent of the building HVAC system to minimize ductwork and equipment contamination.
- .4 HVAC equipment should not be operated during construction. If temporary heating, cooling or ventilation is required, this should be done using temporary equipment. Equipment with firing sections located outside the building (e.g. indirect furnaces) should be given preference over standard propane fired construction heaters.

Note: Should a permanent HVAC system(s) be operated during construction, its operation shall be approved by both the Consultant and Engineer. Prior to start-up, the Contractor shall place temporary filters with a MERV 8 or better effectiveness over all return grills and replace all internal equipment filters prior to start-up. If an un-ducted plenum over the construction zone must be used for return air, the Contractor shall ensure that all ceiling tiles are in place and that temporary filters with a MERV 8 or better effectiveness are placed over return grills in the suspended ceiling. Systems are to be shut down during heaviest periods of construction. Also note that all filtration media in the HVAC system(s) operated during construction must be replaced prior to occupancy.

3.2 HVAC EQUIPMENT STARTUP

- .1 Ventilation System: Remove the protective plastic barriers installed on the ventilation system. Visually inspect the system to ensure the ventilation system is dry and substantially free of dust and debris. Vacuum and clean as required prior to installing registers, grilles and diffusers.
- .2 Filters: Ensure new filtration media as specified in the mechanical drawings and specifications is installed prior to the operation of any equipment.
- .3 Outdoor Air Dampers: As part of the commissioning process, ensure all outdoor air dampers operate as anticipated, including mechanical range of motion, as well as confirming the control system is properly calibrated.
- .4 Drain Pans: Visually inspect all installed drain pans, under normal operation to minimize the potential for water stagnation, and the damage (i.e., mold growth) that could result from water that does not drain properly.

3.3 BUILDING FLUSH-OUT PRIOR TO OCCUPANCY

- .1 Ventilate the building with outside air at the highest rate and duration practical (while still maintaining ventilation requirements for outdoor air flow and humidity control) at the following times:
 - .1 During and shortly after installing products that are known sources of contaminants (e.g., cabinets, carpet padding and painting), using temporary equipment (e.g. spot fans) and,

- .2 After construction ends and prior to occupancy, using the permanent ventilation systems
 - .1 "End of construction" includes, but is not limited to, the completion of the following tasks:
 - .1 All interior finishes are installed
 - .2 All final deficiencies have been rectified
 - .3 Final cleaning is complete
 - .4 HVAC systems have been balanced and are fully functional and operational

Note: Commissioning activities are permitted during the flush-out procedures as long as they do not introduce any additional contaminants into the building.
 - .2 "Prior to occupancy" means prior to the Owner (and/or occupants) moving into and occupying the space.
 - .3 Furniture (e.g. beds and mattresses) are encouraged to be installed prior to the start of the flush-out period to help expedite the off-gassing process.
- .3 The following tasks shall be completed prior to commencing the building flush-out:
 - .1 Remove all ductwork/diffuser protection and any temporary filters present on return air inlets
 - .2 Install new filtration media (in accordance with design requirements) in all HVAC equipment that will be used to carry out the flush-out. Note that systems that deliver 100% outdoor air to the building do not need to have filters replaced.
 - .4 The Flush-Out period shall last at least 14 consecutive Days, from the time "end of construction" has been reached to the date the building is to be turned over to the Owner, to carry out the building flush-out described herein. A building flush-out overlapping with occupancy will not be permitted. The Contractor shall reserve adequate time in the construction schedule to carry-out the flush-out. An internal temperature of at least 16°C and relative humidity no higher than 60% shall be maintained throughout the entire flush-out period.

3.4 ONSITE QUALITY CONTROL

- .1 Site Inspections: Consultant inspections will take place intermittently throughout construction and provide feedback to the Contractor as to the status of the IAQ management.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Availability of Products
- .5 1.5 Delivery, Storage and Handling
- .6 1.6 Concealment
- .7 1.7 Remedial *Work*
- .8 1.8 Location of Fixtures
- .9 1.9 Fastenings
- .10 1.10 Protection of *Work* in Progress
- .11 2.1 Quality
- .12 2.2 Availability
- .13 2.3 Inserts, Anchors, and Fasteners
- .14 3.1 Manufacturer's Instructions
- .15 3.2 Overloading
- .16 3.3 Galvanic/Dissimilar Metal Corrosion
- .17 3.4 Penetrations
- .18 3.5 Workmanship

1.3 SUMMARY

- .1 *Product* quality, availability, and delivery, storage, and handling.
- .2 Existing facilities.
- .3 Workmanship, coordination, and fastenings.
- .4 Manufacturer's instructions.

1.4 AVAILABILITY OF PRODUCTS

- .1 The *Contractor* shall notify the *Consultant* of any delays in the supply of *Products* that may affect the *Contract Time* and the *Consultant* may approve a substitution for a more readily available *Equivalent Products*, at no additional cost to the *Owner*.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 The *Contractor* shall be responsible for the costs of transportation of the *Products* required in the performance of the *Work*.
- .2 Transportation costs of *Products* supplied by the *Owner* will be paid for by the *Owner*.

- .3 The *Contractor* shall be responsible for unloading, handling, and storing all *Products* in accordance with the manufacturers' requirements and recommendations, and in a manner to prevent damage, adulteration, deterioration and soiling.
- .4 Store packaged or bundled *Products* in original and undamaged condition, with manufacturer's seal and labels intact. Shall not remove from packaging or bundling until required in the *Work*.
- .5 Store *Products* subject to damage from weather in weathertight enclosures.
- .6 Store any cementitious *Products* clear of earth or concrete floors, and away from walls.
- .7 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .8 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .9 Removal and replacement of *Products* damaged due to improper delivery, storage, or handling shall not be considered or approved as a change in the *Work*.

1.6 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls, and ceilings, except where indicated otherwise.
- .2 Before installation, inform the *Consultant* if there is a contradictory situation where concealment is not possible. Install as instructed by the *Consultant*.

1.7 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace the parts or portions of the *Work* identified as defective or unacceptable, at the *Contractor's* expense. Coordinate adjacent affected work as required.
- .2 Perform remedial work using specialists familiar with the materials affected. Perform the work in such a manner as to neither damage nor endanger any other portion of the *Work*.
- .3 Any remedial work required will not be considered or approved as a change in the *Work*.

1.8 LOCATION OF FIXTURES

- .1 Consider the location of fixtures, outlets, and mechanical and electrical items indicated as approximate in the *Contract Drawings*.
- .2 Inform the *Consultant* of a conflicting installation and proceed as directed.

1.9 FASTENINGS

- .1 *Provide* metal fastenings and accessories in same texture, colour, and finish as adjacent materials, unless specifically indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the *Contract Documents*.
- .4 Space anchors within their load limit or shear capacity and ensure that they *Provide* positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.

- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.10 PROTECTION OF WORK IN PROGRESS

- .1 Adequately protect items of *Work* completed or in progress. *Work* damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the *Consultant*, at the *Contractor's* expense. Such removal and replacement, or repair, will not be considered or approved as a change in the *Work*.
- .2 Prevent overloading of any part of the *Work*. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated in the *Contract Drawings* or without the written approval of the *Consultant*.

PART 2 - PRODUCTS

2.1 QUALITY

- .1 *Products*, construction materials and equipment, and articles (any of which may be referred to as "Products" throughout the *Contract Documents*) incorporated in the *Work* shall be new, not damaged or defective, and of the best quality (compatible with the *Contract Documents*) for the purpose intended. If requested, the *Contractor* shall furnish evidence as to the type, source, and quality of the *Products* provided.
- .2 Specified options: The *Work* is based on materials, *Products* and systems specified by manufacturer's catalogued trade names, references to standards, by prescriptive specifications and by performance specifications.
 - .1 Where more than one manufacturer's trade name is specified for a *Product*, supply one *Product* from list of *Products* specified.
 - .2 When a *Product* is specified by reference to a standard, select one *Product* from a manufacturer that meets or exceeds the requirements of the standard and manufacturer's written application directions.
 - .3 When a *Product* or system is specified by prescriptive or performance specifications, *Provide* one *Product* or system which meets or exceeds the requirements of the prescriptive or performance *Specifications* and manufacturer's written application directions.
 - .4 The onus is on the *Contractor* to prove compliance with governing published standards, prescriptive *Specifications* and with performance *Specifications*.
 - .5 Visual selection *Specification*:
 - .1 Where *Specifications* include the phrase "as selected by *Consultant* from manufacturer's full range" or similar phrase, select a *Product* that complies with requirements. The *Consultant* will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
 - .6 Visual matching *Specification*:
 - .1 Where *Specifications* require "match *Consultant's* sample", *Provide* a *Product* that complies with requirements and matches the *Consultant's* sample. The *Consultant's* decision will be final on whether a proposed *Product* matches the *Specification*.
- .3 Basis of design:

- .1 Where the *Contract Documents* list basis of design this indicates the *Product* or system that was used in the preparation of the design included in the *Contract Documents*, and which may be deemed as an example of an acceptable *Product*.
- .2 The basis of design establishes the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products from other manufacturers.
- .3 The inclusion of a *Product* or system in the basis of design does not preclude the use of other *Products* or systems in the *Work*, provided the proposed *Product* or system complies with the design and performance requirements contained in the *Contract Documents*, and that such *Products* or systems proposed for use in the *Work* that are not the named basis of design follow procedures for product substitutions specified under Section 01 25 00 – Product Substitution Procedures.
- .4 Where the *Contract Documents* list acceptable *Products* or acceptable manufacturers, select as applicable, one *Product* meeting performance of *Specifications* and manufacturer's written application directions.
- .5 Where the *Contract Documents* require design of a *Product* or system, and minimum material requirements are specified, the design of such *Product* or system shall employ materials specified within applicable Section. Where secondary materials or components are not specified, augment with materials meeting applicable code limitations, and incorporating compatibility criteria with adjacent work.
- .6 Defective *Products*, whenever identified prior to the completion of the *Work*, will be rejected, regardless of previous inspections or reviews. Inspection or review of the *Work* in progress by the *Consultant*, the *Owner*, or independent inspection and testing agencies does not relieve the *Contractor* of its responsibility for the quality of the *Products* or *Work*. The *Contractor* shall remove and replace defective *Products* at the *Contractor's* own expense and shall be responsible for any delays and expenses caused by rejection, which delays and expenses will not be considered or approved as changes in the *Work*.
- .7 Should any dispute arise as to the quality or fitness of the *Products*, the decision rests solely with the *Consultant* and shall be based upon the requirements and intent of the *Contract Documents*.
- .8 Unless otherwise indicated in the *Contract Documents*, maintain uniformity of manufacture and manufacturer for any particular or similar item or items throughout the *Work*.
- .9 *Products* exposed in the finished work shall be uniform in colour, texture, range, and quality, and be from one production run or batch, unless otherwise indicated in the *Contract Documents*.
- .10 The *Owner* retains right to select from choices available within specified *Products* for colours, patterns, finishes or other options normally made available. Submit full range of *Product* options in accordance with 01 33 00 – Submittal Procedures for such selection.
- .11 Permanent labels, trademarks, and nameplates on *Products* are not acceptable in prominent locations, except where required for operating instructions, or when located in the mechanical/electrical room, or as may be provided otherwise in the *Contract Documents*.
- .12 Quality control:
 - .1 Implement a system of quality control to ensure compliance with the *Contract Documents*.

- .2 Notify the *Consultant* of defects in the *Work* or departures from intent of the *Contract Documents* that may occur during construction. The *Consultant* will recommend appropriate corrective action in accordance with requirements of the *Contract*.

2.2 AVAILABILITY

- .1 While it was the intent of the *Contract Documents* and procedures, and the goal of the competitive procurement process that led to the formation of this *Contract*, to *Provide* unlimited competition to *Provide Products*, certain *Products* specified or indicated are accompanied by reference to brand names, proprietary names, trade marks, catalogue numbers, or catalogue designations or symbols, indicated as “acceptable products,” “acceptable materials,” or “acceptable manufacturers”. In such cases, the name of a distributor, *Supplier*, or a dealer is sometimes given to assist the *Contractor* in finding a source of supply.
- .2 The naming of a source of supply does not relieve the *Contractor* of the responsibility of its own source of supply. If unable to obtain the specified *Product*, the *Contractor* shall supply a substitute *Product* equal to, or superior to, the *Product* specified and in accordance with the procedures and requirements of Section 01 25 00 – Product Substitution Procedures, which substitution will not be considered or approved as a change in the *Work*. Should the *Contractor* be unable to obtain a substitute *Product* equal to, or superior to, the specified *Product*, and the *Owner* accepts an inferior *Product*, the *Contract Price* shall be adjusted accordingly in an amount determined by the *Consultant*, in consultation with the *Contractor*, and in accordance with Section 01 26 00 - Contract Modification and Requests for Interpretation
- .3 The use of *Product* brand names, proprietary names, trade marks, catalogue numbers, or catalogue designations or symbols does not preclude the *Contractor* from proposing substitutions for the named *Products*, provided such proposals are in accordance with Section 01 25 00 – Product Substitution Procedures.

2.3 INSERTS, ANCHORS, AND FASTENERS

- .1 Use only factory made, threaded or toggle type inserts as required for supports and anchors, properly sized for load to be carried.
- .2 Where inserts cannot be placed, use factory made expansion shields for light weights only.
- .3 Supply and locate inserts, holes, anchor bolts and sleeves during placement or fabrication of structural elements.
- .4 Fasteners stressed in withdrawal are not acceptable, except where otherwise indicated in the *Contract Documents*.
- .5 Metal fastenings shall be uniform to metals materials and components being anchored or of a metal which will not set up a galvanic action causing damage to the fastening or metal component under moist conditions.
- .6 Fastenings for prefinished materials shall be of concealed type unless otherwise indicated in the *Contract Documents*, and when exposed finish is required, of matching prefinishing materials.
- .7 Metal fastenings and accessories shall be same texture, colour and finish as material on which they occur, as selected by *Consultant*.
- .8 Power actuated fasteners:
 - .1 Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as

- determined by testing per ASTM E1190-11 conducted by a qualified independent testing agency.
- .2 Do not use power actuated fasteners which are stressed in withdrawal in finished work.
 - .3 Do not use power actuated fasteners within 100 mm (4") of the edge of concrete or masonry, unless otherwise accepted in writing by the *Consultant*.
 - .4 Do not use power actuated fasteners in post-tensioned concrete.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in the *Contract Documents*, install *Products* in accordance with manufacturer's printed installation or application instructions. Do not rely on labels or enclosures supplied with *Products*. Obtain printed instructions directly from manufacturers.
- .2 Notify the *Consultant* in writing, of conflicts between the *Contract Documents* and manufacturer's instructions.
- .3 Improper installation or erection of *Products*, due to failure in complying with these requirements, authorizes the *Consultant* to require removal and re-installation at no additional cost to the *Owner*.
- .4 The *Contractor* shall ensure that manufacturers' representatives have access to the *Work* at all times. The *Contractor* shall render assistance and facilities for such access in order that the manufacturers' representatives may properly perform their function.

3.2 OVERLOADING

- .1 Protect the existing building from loads which may cause permanent deformation.
- .2 Protect the *Work* from loads which may cause permanent deformation.

3.3 GALVANIC/DISSIMILAR METAL CORROSION

- .1 Insulate dissimilar metals from each other by suitable plastic strips, washers or sleeves to prevent galvanic corrosion where conductive liquid or electrolyte (rainwater or condensation) exists.

3.4 PENETRATIONS

- .1 Holes or voids created in assemblies or partitions for penetrating mechanical, electrical, or sprinkler service items, shall be of sufficient size to accommodate the penetrating item as well as additional required fill materials, such as sealants, firestopping and smoke sealants, insulation, and the like, without exceeding the maximum opening allowable by the manufacturer of the additional required fill material and design requirements appropriate for size of penetration.
 - .1 Finish penetrations in areas exposed to view to satisfaction of the *Consultant*.

3.5 WORKMANSHIP

- .1 General:
 - .1 Execute the *Work* using workers experienced and skilled in the respective duties for which they are employed.
 - .2 Do not employ an unfit person or anyone unskilled in their required duties.

- .3 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the *Consultant*, whose decision is final.
- .4 Upon request by the *Consultant*, submit proof, in the form of CCDC 11 - *Contractor's* Qualification Statement, of qualifications of *Subcontractors* to verify *Subcontractor's* qualifications and experience meet or exceed the requirements of the *Contract Documents*.
 - .1 If, upon review of the *Contractor's* Qualification Statement, it is found that the *Subcontractor* does not meet the qualification requirements specified in the *Contract Documents* pertaining to the parts of the *Work* for which the *Subcontractor* has been retained, the *Contractor* shall replace the unqualified *Subcontractor* with a qualified *Subcontractor*, satisfactory to the *Contractor* and the *Owner*, at no additional cost to the *Owner* and at no increase in the *Contract Time*.
- .5 Remove *Products* or materials that have been broken, chipped, cracked, discoloured, abraded, or damaged during construction period and *Provide* undamaged *Products* or materials meeting the requirements of the *Contract Documents*.
- .2 Coordination:
 - .1 Ensure cooperation of workers in layout of the *Work*. Maintain efficient and continuous supervision.
 - .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- .3 Backer plates:
 - .1 *Provide* backer plates to support and *Provide* anchorage base to carry loads from surface or recessed applied materials.
- .4 Concealment:
 - .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise in the *Contract Documents*.
 - .2 Before installation, inform the *Consultant* of any contradictory situation. Install as directed by the *Consultant*.
- .5 Cutting and remedial work:
 - .1 Perform cutting and remedial work required to make parts of the *Work* come together. Coordinate the *Work* to ensure this requirement is maintained. Obtain permission from the *Consultant* before commencing any cutting. Refer also to requirements of Section 01 73 29 – Cutting and Patching.
- .6 Location of fixtures:
 - .1 Consider location of fixtures, access panels, outlets and mechanical and electrical items indicated as approximate only. Locate fixtures, and the like approximately; architectural Drawings will relate these items to known dimensions, such as ceiling tile grid or wall locations and the like.
 - .2 Obtain the *Consultant's* acceptance for precise locations of fixtures, access panels, outlets, mechanical, and electrical items.

- .3 The *Consultant* reserves the right to relocate electrical outlets and mechanical fixtures at a later date, but prior to installation, without cost, provided that the relocation per outlet does not exceed 3050 mm (10') from the original location.
- .4 Inform the *Consultant* of conflicting installations. Install only as directed by the *Consultant*.
- .7 Fastenings:
 - .1 *Provide* metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise in the *Contract Documents*.
 - .2 Prevent electrolytic action and corrosion between dissimilar metals and materials.
- .8 Protection of work in progress:
 - .1 Take reasonable and necessary measures, including those required by *Authorities Having Jurisdiction*, to *Provide* protection.
 - .2 Adequately protect parts of the *Work* completed or in progress. Parts of the *Work* damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the *Consultant*, at no additional cost to the *Owner*.
 - .3 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member without written permission of the *Consultant*, unless specifically indicated. Refer also to Section 01 73 29 – Cutting and Patching.
 - .4 Adequately protect finished flooring from damage. Take special measures when moving heavy loads or equipment on them.
 - .5 Keep floors free of oils, grease or other materials likely to discolour them or affect bond of applied surfaces.
 - .6 Protect work of other *Subcontractors* from damage while doing subsequent work. The Contractor shall ensure that damaged work is made good by the appropriate *Subcontractors* at no additional cost to the *Owner*.
 - .7 Protect existing buildings, curbs, roads and lanes. If, during the *Work*, any buildings, curbs, roads or lanes are damaged, bear costs for repairs.
- .9 Existing utilities:
 - .1 When breaking into or connecting to existing services or utilities, execute the *Work* at times approved by the *Owner*, with a minimum of disturbance to *Owner's* ongoing operations, the *Work*, and traffic.
 - .2 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by *Authority Having Jurisdiction* and stake or otherwise record location of capped service.
- .10 Protection of mechanical and electrical *Products* or materials:
 - .1 Wrap in protective plastic and seal mechanical and electrical items of mechanical and electrical equipment prior to and during for shipment, storage at the *Place of the Work* and after installation.
 - .2 Remove protective coverings only to the extent required for installation of the items. Re-install protection immediately following installation.

- .3 Remove protective coverings in stages, as work areas are completed, or when directed by the *Consultant*.

.11 Operational requirements:

- .1 Operable *Products* shall be provided fully operational and ready for intended use.
- .2 Adjust operating hardware and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts for smooth squeak-free function, in accordance with manufacturer's instructions.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Objectives
- .4 1.4 Description of Work
- .5 1.5 Related Work Specified Elsewhere
- .6 1.6 Reference Standards
- .7 1.7 Definitions
- .8 1.8 LEED® Construction Coordinator
- .9 1.9 LEED® Pre-Construction Meeting
- .10 1.10 LEED® Orientation Meeting
- .11 1.11 Submittals
- .12 1.12 Recycled Content
- .13 1.13 Regional Content
- .14 1.14 FSC Certified Wood
- .15 1.15 Pre-Construction
- .16 1.16 Post-Construction

1.3 OBJECTIVES

- .1 To minimize the ecological footprint of the building by specifically selecting materials that conserve raw and non-renewable resources.
- .2 To minimize the amount of energy expended in the transportation of materials to the *Site* through intentional sourcing of regional materials.
- .3 To document for the purpose of LEED® Certification under the Canadian Green Building Councils LEED®-Canada NC – v4.1 Rating System, the Materials and Resources Credits.

1.4 DESCRIPTION OF WORK

- .1 The *Contractor* shall source and select all materials in Divisions 3 – 10, 31, 32 that meet the sustainability criteria detailed herein.
- .2 The *Contractor* shall submit documentation to the *Consultant* to certify that the materials selected by the *Contractor* and its *Subcontractors* meet the criteria prior to ordering of the *Products* or materials.
- .3 The *Contractor* shall provide the *Consultant* a final accounting of material cost (total *Subcontractor* cost excluding labour and equipment) for all *Products* and materials included in Divisions 2 through 10, 31 and 32 for LEED material credit calculations.

1.5 RELATED WORK SPECIFIED ELSEWHERE

- .1 01 35 20 - General LEED Requirements.
- .2 01 35 90 - Indoor Air Quality Management.

1.6 REFERENCE STANDARDS

- .1 CaGBC, "Materials & Resources Credits" Leadership in Energy and Environmental Design Reference Guide for New Construction & Major Renovations (LEED® Canada Reference Guide for Green Building Design and Construction v4.1)

1.7 DEFINITIONS

- .1 Recycled Content: is the percentage by weight of recycled material that is in a product or material brought onto the *Site*.
- .2 Post-Consumer Recycled Content: is the amount by weight of recycled material that is derived from previously used consumer products (e.g. aluminum and steel cans, glass and plastic bottles, asphalt from parking lots, gypsum from drywall, etc.)
- .3 Post-Industrial Recycled Content: is the amount by weight of recycled material that is derived from outside industrial sources (ie. In-house process recycling of production scrap is not included). Some examples are: sawmill dust used in MDF board, blast furnace slag used in mineral wool insulation, and coal fly ash used in concrete mixes.
- .4 In-House Process Recycled Content: is the trimmings, cutoffs, and scrap that are returned to the production process as a part of internal housekeeping. This material is not included as recycled content for LEED purposes.
- .5 Manufacturing Location: is the last point of processing or assembly (e.g. A sawmill that turns harvested trees into framing lumber which is then used on-*Site*).
- .6 Extraction Location: is the origin of material inputs that are transported to the Manufacturing Location (e.g. The location of the forests where the trees for the framing lumber were harvested from).
- .7 Chain-Of-Custody Certification: Certification for wood products that validates compliance with FSC guidelines from the forest where the product was harvested to the company the wood product is purchased from.

1.8 LEED® CONSTRUCTION COORDINATOR

- .1 Designate an individual to be responsible for all aspects of LEED® coordination during construction to oversee material selection and sourcing.
- .2 The *Contractor's* LEED® Construction Coordinator shall be responsible for:
 - .1 Coordinating with the *Subcontractors* to select *Products* and materials that meet the requirements specified herein.
 - .2 Providing *Product* and material documentation submittals as detailed herein prior to the ordering of the *Product* or material.
 - .3 Providing final material costs (excluding labour and equipment) for all *Products* and materials that are included as part of the *Work* covered by Divisions 2 through 10, 31 and 32.
 - .4 Reporting *Products* and materials selection progress to the *Consultant*.

- .5 The LEED® Construction Coordinator shall be regularly on-*Site* during construction.

1.9 LEED® PRE-CONSTRUCTION MEETING

- .1 Prior to commencement of the *Work*, the LEED® Construction Coordinator shall hold a pre-construction meeting with the *Consultant* to review the *Product* and material selection requirements. This meeting must include a review of:
- .1 *Product* and material selection objectives
 - .2 *Product* and material required documentation submittals
 - .3 *Product* and material itemized costs (excluding labour and equipment)

1.10 LEED® ORIENTATION MEETING

- .1 Prior to mobilization on-*Site*, the LEED® Construction Coordinator (in conjunction with the *Consultant*) shall hold an orientation meeting with the construction team to explain the material and *Product* selection criteria and documentation to the *Subcontractors*. This meeting must include a review of:
- .1 *Product* and material selection objectives
 - .2 *Product* and material documentation requirements
 - .3 *Product* and material itemized costs (excluding labour and equipment)
 - .4 The LEED® Construction Coordinator shall hold a Questions and Answers session to clarify the requirements and procedures for the *Subcontractors*.

1.11 SUBMITTALS

- .1 The *Contractor* shall submit the following schedules (which are included as Section 01 61 10.1 – LEED Product Requirements Schedules) applicable to the tendered scope of Work;
- .1 General Material Certification Letter – Schedule A: *Provide* the completed schedule and supporting documents from the manufacturer (e.g. fact sheet, letter) for all *Products* and materials covered by Divisions 2 through 14.
 - .2 Supplementary Cementing Materials Letter – Schedule B: *Provide* the completed schedule and concrete mix design information for all mixes OR equivalent Portland Cement Reduction Calculator (http://www.cagbc.org/cagbcdocs/LEED-Canada_NC-CS_2009-MRc4-Portland_Cement_Reduction_Calculator-v2-EN.XLS)
 - .3 FSC Wood Certification Letter – Schedule C: *Provide* the completed schedule, *Product* literature (where applicable), and invoices for all *Products* and materials that contain FSC certified wood.
 - .4 Material Cost Certification Letter – Schedule D: *Provide* the completed schedule itemizing costs (excluding labour and equipment) for *Products* and materials covered by Divisions 2 through 14.
 - .5 Concrete Material Cost Letter – Schedule E: *Provide* the completed schedule listing all concrete mix designs, amount of concrete by mix and cost of the concrete OR equivalent Portland Cement Reduction Calculator (http://www.cagbc.org/cagbcdocs/LEED-Canada_NC-CS_2009-MRc4-Portland_Cement_Reduction_Calculator-v2-EN.XLS)

1.12 RECYCLED CONTENT

- .1 Select *Products* and materials that have at least the minimum recycled content listed below:

MINIMUM RECYCLED CONTENT	
CATEGORY	MINIMUM RECYCLED CONTENT
Compost / Mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-place Concrete	6% post-industrial
CMU: Gray Block	20% post-industrial
Steel Reinforcing Bars	75% combined
Structural Steel Shapes	45% combined
Steel Joists	45% combined
Steel Deck	45% combined
Steel Fabrications	60% combined
Steel Studs	45% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined
Rigid Insulation	20% post-industrial
Batt Insulation	30% combined
Cellulose Insulation	90% combined
Rock Wool Insulation	75% post-industrial
Fireproofing	20% combined
Steel Doors and Frames	35% combined
Gypsum Wallboard	100% combined
Carpet	40% combined
Ceramic Tile Flooring	60% combined
Rubber Flooring and Base	60% combined
Acoustical Ceiling Tile	40% post-consumer
ACT Suspension Systems	90% post-consumer
Toilet Partitions	60% post-consumer

- .2 Any other *Products* and materials that are not listed but may contain recycled content shall be given reference.
- .3 The sum of the post-consumer recycled content plus $\frac{1}{2}$ of the post-industrial (or pre-consumer) recycled content must constitute at least 25%, by cost, of the total permanently installed materials (Divisions 2 through 10) in the *Project*. Mechanical, electrical and plumbing components and specialty items, such as elevators, shall be excluded.

1.13 REGIONAL CONTENT

- .1 Give preference to materials that are extracted and manufactured regionally.
- .2 To qualify as regional, *Products* and materials must meet the following criteria:
- .1 The distance from the final manufacturing location to the *Project Site* must be equal to or less than:
 - .1 800 km, if transported by truck, or;
 - .2 2400 km, if transported by rail or water.
 - .2 The distance from the point of extraction, harvest, recovery and processing to the final manufacturing site must be equal to or less than:

- .1 800 km, if transported by truck, or;
- .2 2400 km, if transported by rail or water.
- .3 If a fraction of a *Product* is extracted, harvested, recovered, processed and manufactured regionally, then only that percentage, by weight, is considered regional.
- .4 At least 30%, by cost, of the total permanently materials installed in the *Project* must be regional. Mechanical, electrical and plumbing components and specialty items, such as elevators, shall be excluded.

1.14 FSC CERTIFIED WOOD

- .1 Minimum 100% of permanently installed wood (by cost) must be FSC Certified.
- .2 Ensure that all *Suppliers*, retailers, manufacturers and wood materials to be ordered have COC documentation to support the FSC Certified Wood content claims (see Schedule C). Ensure that all parties who claim ownership of the wood must be COC certified. Documentation supporting this certification shall be provided to the *Consultant* prior to ordering of any materials or *Products*.
- .3 For all FSC Certified Wood, *provide* invoices and/or letters from retailers or manufacturers for each *Product* installed that clearly demonstrates supplied wood products meet FSC certification requirements. Documentation should include the vendor's COC number and identify certified *Products* on an item-by-item basis.

1.15 PRE-CONSTRUCTION

- .1 All *Product* and materials information (Schedules A, B and C) shall be provided to the *Consultant* at least 14 *Working Days* prior to ordering.
- .2 Concrete mix designs (Schedule B) shall be provided to the *Consultant* after approval of the designs, and prior to delivery of any concrete.

1.16 POST-CONSTRUCTION

- .1 All *Product* and material costs excluding labour and equipment (Schedule D) information shall be provided to the *Consultant* after all of the materials have been purchased, and prior to *Subcontractor's* demobilization.
- .2 Concrete supply documentation (Schedule E) shall be provided to the *Consultant* after all concrete has been delivered to *Site* and prior to the *Contractor's* demobilization.

PART 2 - PRODUCTS

Not Applicable.

PART 3- EXECUTION

Not Applicable.

END OF SECTION

SCHEDULE A – GENERAL MATERIAL CERTIFICATION LETTER

Material Supplier: _____

Date: _____

To: _____

Re: _____

For the purposes of LEED® documentation, I/We hereby certify that the following *Products*:

Product Name	Description

Contain:

_____ % Post-Consumer Recycled Content by (weight/volume)

_____ % Pre-Consumer Content by (weight/volume) from external sources

In accordance with the International Organization of Standards document. ISO 1402 – Environmental Labels and Declarations – Self-Declared Environmental Claims (Type II environmental labeling).

These *Products* were manufactured (or final processing or assembly) and extracted (or harvested, recovered, or processed) at the following locations:

Manufacturing Location	Extraction Location
City:	City:
Province/State:	Province/State:
Postal/Zip Code:	Postal/Zip Code:
Mode of Transport (circle one): Truck / Rail / Ship	Mode of Transport (circle one): Truck / Rail / Ship

Authorized Official:	Signature:
Organization:	Date:
Job Title:	Telephone No.:

SCHEDULE B – SUPPLEMENTARY CEMENTING MATERIALS LETTER

Concrete Supply: _____

Date: _____

To: _____

Re: _____

For the purposes of LEED® documentation, I/We hereby certify that the Supplementary Cementing Materials were used in the following concrete mixes for this *Project*:

Mix Number	Concrete design Strength @ 28 days (Mpa)	Air Entrained (Yes/No)	Portland Cement Used (kg/m3)	SCM Used (kg/m3)

Authorized Official:	Signature:
Organization:	Date:
Job Title:	Telephone No.:

SCHEDULE C – FSC CERTIFIED WOOD LETTER

Material Supplier: _____

Date: _____

To: _____

Re: _____

For the purposes of LEED® documentation, I/we hereby certify that the following *Products*:

Retailer/Manufacturer	Product	FSC Chain-of-Custody Certificate No.

Contain:

_____ % FSC Certified Wood

These wood *Products* meet the requirements for the Forest Stewardship Councils (FSC) Principals and Criteria and FSC Chain-of-Custody Standard (FSC-STD-40-004), and comply with the documentation requirements included within those standards.

Authorized Official:	Signature:
Organization:	Date:
Job Title:	Telephone No:

SCHEDULE D – MATERIAL COST CERTIFICATION LETTER

Material Supplier: _____

Date: _____

To: _____

Re: _____

For the purposes of LEED® documentation, I/we hereby provide the following material supply cost documentation for the *Products* we used in this *Project*. These costs do not include any labour or equipment:

Product	Manufacturer	Cost

Authorized Official:	Signature:
Organization:	Date:
Job Title:	Telephone No:

SCHEDULE E – CONCRETE MATERIAL COST LETTER

Concrete Supplier: _____

Date: _____

To: _____

Re: _____

For the purpose of LEED® documentation, I/we hereby certify the following mixes, quantities and costs for the *Project*:

Mix Number	Volume of Mix Used (cubic yards)	Concrete Supply Cost (\$)

Authorized Official:	Signature:
Organization:	Date:
Job Title:	Telephone No:

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Submittals
- .4 1.4 Preparation
- .5 1.5 Performance Requirements

1.3 SUBMITTALS

- .1 Submittal Items:
 - .1 Submit written request to the *Consultant* in advance of cutting, coring, and alteration that affects:
 - .1 Structural integrity of any element of *Work*.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 The *Owner* or work of *Other Contractors*.
 - .2 Include in the request:
 - .1 Identification of *Project*.
 - .2 Location and description of affected work.
 - .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 the *Owner* or work of *Other Contractors*.
 - .7 Written permission of affected *Other Contractor*.
 - .8 Date and time work will be performed.
 - .9 Non-destructive structural survey: Location of reinforcement in concrete structure confirmed by non-destructive, positive method other than X-ray.
- .3 Do not commence cutting, patching, or remedial work until request has been reviewed by the *Consultant*.

1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

- .2 After uncovering, inspect conditions affecting the performance of the *Work*.
- .3 Beginning of cutting and patching shall be taken to mean acceptance of the existing conditions by the *Contractor*.
- .4 *Provide* supports to assure the structural integrity of the surrounding elements as well as devices and methods to protect other portions of the *Work* from damage.
- .5 *Provide* protection from weather for areas that may be exposed by uncovering work.
- .6 Where uncovering of area exposes local deterioration, cracking, evidence of water infiltration, structural settlement, previous modifications, or other unexpected conditions, advise the *Consultant* immediately in writing and leave conditions exposed until receipt of the *Consultant's* written instructions. If area is exposed to the Exterior, *Provide* temporary protection from inclement weather.

1.5 PERFORMANCE REQUIREMENTS

- .1 Execute cutting, fitting, and patching to complete the *Work*. Under no circumstances will overcutting of corners of opening be accepted. Ensure corners of openings to be cut are predrilled or sawed.
- .2 Remove and replace defective and non-conforming work.
- .3 Remove samples of installed work for testing if directed by the *Consultant*.
- .4 *Shop Drawings* identifying precise locations and size of openings to be cored and cut are to be submitted for review by the *Consultant*. *Provide* non-destructive structural survey of structural concrete to be cored or cut, for the *Consultant's* review. Coring and cutting work locations shall be reviewed by the *Consultant* for acceptance before proceeding.
- .5 *Provide* openings in non-structural elements of the *Work* for penetrations of mechanical and electrical work.
- .6 Perform work by methods to avoid damage to other work, and which will *Provide* proper surfaces to receive patching and finishing.
- .7 Employ qualified installer with at least three years of relevant experience to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools shall not be used anywhere within existing buildings unless approved by the *Consultant*.
- .9 Restore work with new *Products* in accordance with requirements of the *Contract Documents*.
- .10 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and with suitable allowance for deflection, expansion, contraction, and firestopping.
- .11 Enclose pipes, ducts, conduit and wires passing through floors at areas where faucets occur in a 100 mm (4") high metal sleeve and make air and watertight with water resistant firestopping.
- .12 Completely seal voids of penetrations of fire rated wall, ceiling, and floor constructions with firestopping and smoke seals.
- .13 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection. Refinish entire assembly units.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Environmental Controls
- .4 1.4 Materials
- .5 1.5 Cleaning During Construction

1.3 ENVIRONMENTAL CONTROLS

- .1 Conduct cleaning and disposal operations to comply with all requirements of the *Authorities Having Jurisdiction* including antipollution laws.
- .2 Store volatile waste in covered metal containers and remove from the *Place of the Work* daily.
- .3 Prevent accumulation of waste which create hazardous conditions.
- .4 *Provide* adequate ventilation during use of volatile or noxious substances.

1.4 MATERIALS

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

1.5 CLEANING DURING CONSTRUCTION

- .1 Clean-up the *Place of the Work* daily. Maintain clean and clear egress routes at all times.
- .2 Maintain the *Place of the Work*, grounds and public properties free from accumulations of waste materials and rubbish.
- .3 *Provide* containers at the *Place of the Work* for collection of waste materials and rubbish. Remove waste materials and rubbish from the *Place of the Work* when containers become full.
- .4 Vacuum and clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until *Substantial Performance of the Work*.
- .5 Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- .6 Promptly as the *Work* proceeds, on a daily basis and upon completion of the *Contract*, clean up and remove rubbish, surplus materials and equipment.
- .7 Remove as the work of this Section progresses, corrosive and foreign materials which may set or become difficult to remove at time of final cleaning or which may damage members.
- .8 Wash exposed surfaces with a cleaning solution approved by the *Product* manufacturers.
- .9 Debris and waste shall not be permitted within cavities of the *Work*.

PART 2 - PRODUCTS

PART 3 - EXECUTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Definitions
- .5 1.5 Description of *Work*
- .6 1.6 Waste Reduction Plan
- .7 1.7 Documentation
- .8 1.8 Submittals
- .9 2.1 Equipment
- .10 3.1 Demolition And New Construction
- .11 3.2 Diversion Of Materials
- .12 3.3 Supplements

1.3 SUMMARY

- .1 All materials generated from the *Work* are to be managed in accordance with Ontario Regulation 347 “General – Waste Management Regulation R.R.O. 1990 (as amended) and Ontario Regulation 102/94 “Waste Audits and Waste Reduction *Work Plans*” and Ontario Regulation 103/94 “Industrial, Commercial and Institutional source Separation Programs” of the Ontario *Environmental Protection Act* (EPA).

1.4 DEFINITIONS

- .1 Waste Reduction Plan (WRP): Relates to the tracking and auditing of actual waste generated from the *Work*. The Plan consists of identified and unidentified construction waste materials that are to be salvaged, recycled and diverted from landfill and involves a series of ongoing activities to separate reusable and recyclable waste materials into material categories from other types of waste at point of generation. See sample appended to this section.
- .2 Record of Disposal and Recycled Materials (RDRM): Identifies and tracks, on a monthly basis, all waste materials and verifies quantities of all recycled materials and final disposal locations.
- .3 Waste Management Coordinator (WMC): Designated individual who is in attendance on-*Site* full or part-time. *Contractor* is to designate, or have designated, individuals from each *Subcontractor* to be responsible for waste management related to their trade and for coordinating activities with the WMC.

1.5 DESCRIPTION OF WORK

- .1 Salvage, recycle and divert from landfill a minimum of 95% of all construction waste generated from the *Work*. Identify significant generic types of products, work, or requirements that will achieve this goal. Develop a Waste Reduction Plan and participate in Materials Source Separation Program. *Provide* the documentation specified in this Section.

- .2 Comply with the requirements of the latest edition of the Ontario *Environmental Protection Act* and 3-R's Regulations related to source separation (recycling) programs and waste audits and waste reduction work plans on construction sites.
- .3 Take an active role in implementing environmentally sound business practices and producing goods and services that lessen burden on environment in production, use and final disposition. Support implementation of reduction, re-use and recycling strategies and use of environmentally sound products. Reduce or eliminate excessive packaging and promote use of environmental responsible packaging practices.
- .4 Enter into agreements with local recycling companies and haulers for all anticipated recycled materials.

1.6 WASTE REDUCTION PLAN

- .1 Within fourteen (14) Days after receipt of Notice to Proceed and prior to any waste removal from the project, develop and submit to the *Owner* for review a Waste Reduction Plan on sample appended to this section.
- .2 Waste Reduction Plan to Include:
 - .1 Types and estimated quantities of salvageable materials that are expected to be generated during demolition.
 - .2 Types and estimated quantities of recyclable materials expected to be generated during construction including but not limited to those listed below.
 - .3 Contracting with a deconstruction specialist to salvage all or most materials generated.
 - .4 Selective salvage as part of demolition contractor's work.
- .3 The methods to be used to recycle these materials. Methods shall include one or more of the following options:
 - .1 Requiring *Subcontractors* to take materials back for recycling at a permitted facility.
 - .2 Contracting with a full-service recycling service.
 - .3 Processing and reusing materials on-*Site*.

1.7 DOCUMENTATION

- .1 Final Waste Reduction Plan: Once the *Owner* has accepted the Waste Reduction Plan, submit, within 14 *Working Days*, a Final Waste Reduction Plan.
- .2 To each application for Progress Payment attach a record of the amount of material disposed (in tons) and the amount of each material recycled (in tons) using form appended to this section as Sample Record of disposal and Recycled Materials. For co- mingled materials, include weight tickets from the recycling facility and verification of the recycling rate for mixed loads at the facility.
- .3 Be responsible for providing such information whether directly involved in recycling the materials or not.

1.8 SUBMITTALS

- .1 Submit spreadsheet of Record of Disposal and Recycled Materials following sample form appended to this section as Sample Record of Disposal and Recycled Materials.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Supply all equipment as necessary to complete work.

PART 3 - EXECUTION

3.1 DEMOLITION AND NEW CONSTRUCTION

- .1 Recycle the items listed in Sample Record of Disposal and Recycled Materials appended to this Section (on or off-*Site*).
- .2 *Provide* on-*Site* facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- .3 *Provide* containers to deposit reusable and/or recyclable materials.
- .4 Locate containers in locations to facilitate deposit of materials without hindering daily operations.
- .5 Collect, handle, store on-*Site* and transport off-*Site*, salvaged materials in separate condition. Transport to approved and authorized recycling facility.
- .6 Use safety meetings, signage, and subcontractor agreements to communicate the goals of the Waste Reduction Plan.
- .7 Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- .8 Comply with Division 1 requirements for controlling dust and dirt, environmental protection, and noise control.

3.2 DIVERSION OF MATERIALS

- .1 Maximize the amount of materials that can be recycled, salvaged or reused. An emphasis shall be placed on, but shall not be limited to, wood, steel and metal, concrete, brick, gypsum board, etc. in accordance with Ontario Regulations 102/94 and 103/94 and as described herein.
- .2 Following the list on Sample Record of Disposal and Recycled Materials appended to this section, separate materials from general waste stream and stockpile in separate piles or containers to approval of *Consultant* and consistent with applicable fire regulation. Mark containers or stockpile areas. *Provide* instruction on disposal practices.

3.3 SUPPLEMENTS

- .1 The documents listed below, attached following END OF SECTION, form part of this Section:
- .2 Sample Construction Waste Reduction Plan.
- .3 Sample Record of Disposal and Recycled Materials.

END OF SECTION

SAMPLE CONSTRUCTION WASTE REDUCTION PLAN

Company	
Project Name	Project Size (m2)
Goals:	

1. Analysis of Expected Job-Site Waste:

Drywall – Wood – Paper - Concrete Debris – Cardboard - Asphalt Debris - Foam board – Plastic – Plywood – Gravel – Dirt - Trees, branches, and other organic products mixed with dirt - Metals, including rebar, brass, chrome, aluminum, copper, metal stud scrap, screws, nails.

2. Measurement

Rough quantities will be measured in tonnes where possible, and in cubic yards and pounds where necessary and converted to tones afterward. The recycling coordinator estimates a total of _____ tonnes of material will be produced though our activities on this job site, and the _____ % of these materials shall be recycled, reused, or salvaged.

3. Removal Methods

We have entered into an agreement with _____, a wasteless disposal service, to *Provide* recycling services for the duration of the project. The disposal bin is set up as the main recycling station. Drop boxes will be used for individual materials as space quantities allow.

Projected savings for all debris will be approximately \$ _____. All materials will be taken to _____ recycling depot located at _____. Mixed waste drop boxes will be separate by the disposal company off-site and recycled to the greatest extent possible. At their location, the disposal company _____ is currently recycling 90% - 100% of their intake.

4. Removal Costs and Revenues

The current costs and revenues in the *Region* for recycling construction waste materials are as follows:

Material	Cost or Revenue / 40 cubic yard bin
Asphalt and Concrete	_____ <\$75> _____ cost
Commingled Recyclables	_____ <\$100> _____ cost
Wood	_____ <\$100> _____ cost
Light scrap metal	_____ <\$100-120> _____ revenue
Cardboard	_____ <\$90-105> _____ revenue

5. Options for Disposal

To the greatest extent practicable, all reusable items will be salvaged. The demolition and deconstruction plans will address in detail the measures to be taken. Items to be reused include (but are not limited to):

Siding – Roof decking – Timber and beams – Windows – Doors and Hardware – Mechanical and Electrical equipment – Concrete (pulverize and use as base rock) – Landscaping and organic materials (such as mulch and compost). All salvageable materials will be donated to a local <charity> <organization>, or sold to a <used building supplier>. Any materials that cannot be retained or salvaged will be recycled.

Furnishings, equipment, doors and hardware, electrical, mechanical will be salvaged to the greatest extent possible. Asphalt and concrete will be ground as appropriate for reuse. Dirt and gravel will be trucked to reclamation or reuse sites as appropriate for the material. Any wood landscape waste to be chipped and mulched for reuse on site. All non-woody organic materials to be composted for reuse on site. Mixed dry-waste, including wood, drywall, metal, cardboard, plastic and Styrofoam will be recycled.

6. **Materials Handling Procedures**

An area will be designated for recycling and separation activities. The interior of the construction site office will have recycling containers for paper, glass, cardboard and aluminum. Drop boxes will be used adjacent to the new building as appropriate. Labels directing the separation of materials will be posted at the construction trailer and on each of the drop boxes. Construction debris will be continually picked up during the day and placed into the proper recycling or disposal bins.

The *Project* Manager will instruct each trade's supervisor and all workers as to proper waste management and recycling practice. This instruction will include hazardous wastes generated through chemical use and through demolition. We will incorporate waste reduction and recycling instructions into each trade's *Contract* requiring all trades to cooperate fully.

7. **Personnel**

The *Project* Manager will supervise the implementation of this plan in the field by the following individuals who will:

Assist with oversight and monitoring of the plan in the field. Organize and keep recycling area tidy.
Coordinate recycling bin pick-up and removal.
Receive waste production and recycling information from each Trade and vendor. Compile and report of all waste material information sheets.
Review waste management plan results.

The Construction Waste Management Reporting Sheet will be submitted to _____ at the trade meeting and on a biweekly basis, no later than 15 Days after month end. Each trade will be responsible for ensuring the accuracy of this information.

8. **Hazardous Wastes**

Hazardous wastes will be separated, labeled, stored and recycled or disposed of according to local regulations, worker safety regulations, and provincial and federal regulations under the direction of our safety Officer. Where practical, efforts will be made to reuse hazardous materials like paints, adhesives and other products.

SAMPLE RECORD OF DISPOSAL AND RECYCLED MATERIALS

Company	Contact Person	Phone:
		email:
Project Location	Waste Contractor	Report Start Date:
		Report End Date:

Material Type	Minimum Diversion %	Actual Diversion %	Material Destination	Weight
Acoustic Ceiling Tile	95			
Aluminum	95			
Asphalt	95			
Cardboard	95			
Concrete	100			
Copper	95			
Drywall	95			
Ductwork	100			
Fill-clean	100			
Fill – other	100			
Fluorescent lamps and ballasts	N/a			
General waste – office paper, pop cans, bottles	75			
Glass	95			
Land-clearing debris	100			
Plastic - general	75			
Plastic -packaging	95			
Steel	95			
Topsoil	100			
Trees	95			
Wood	95			

I, _____ declare this report is accurate to the best of my knowledge.
 Submitted on this _____ day of _____, 20_____.
 Signed: _____

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Protecting Installed Construction And Adjacent Property
- .4 1.4 Underground And Concealed Services
- .5 1.5 Waterproofing And Roofing
- .6 1.6 Making Good

1.3 PROTECTING INSTALLED CONSTRUCTION AND ADJACENT PROPERTY

- .1 Refer to GC 9.1 - Protection of Work and Property
- .2 Refer to individual specification Sections for Product-specific requirements pertaining to the protection of installed Products.
- .3 Adequately protect parts of the Work that are either completed or in-progress.
- .4 Unless specified otherwise, maintain protection until Substantial Performance of the Work.
- .5 Provide protective coverings at walls, projections, corners and jambs, sills and soffits of openings in and adjacent to traffic areas.
- .6 Remove protection and protective coverings upon expiry of specified duration.
- .7 Protect Products from frost during construction.
- .8 Remove snow and ice from the uncompleted roof and from any floors.
- .9 As soon as the Work is sufficiently advanced, and in order to prevent delay, enclose the building with tarpaulins, plastic sheeting or glazing and temporary doors, with locks to doors as required.
- .10 Provide protection for completed and partially completed finishes and equipment during performance of the Work.
- .11 Protect pre-finished Products, including windows, louvers, finish hardware and doors from damage by mortar, paint, wallboard compounds and other construction materials and operations.
- .12 Protect new and existing trees and vegetation designated to remain from construction damage. Provide snow fencing or other protection where directed by Consultant.
 - .1 Conform to City of Vaughan Tree Protection Policy and Specifications for Construction Near Trees.

1.4 UNDERGROUND AND CONCEALED SERVICES

- .1 Protect pipes, ducts, cables, conduits, wires and other services against damage arising from the performance of the Work.

- .2 Take necessary precautions to locate the underground and concealed services and to protect them from damage.

1.5 WATERPROOFING AND ROOFING

- .1 Restrict traffic to waterproofed and roofed surfaces and restrict material storage on these surfaces.
- .2 When traffic or material storage is unavoidable, follow recommendations for protection of surfaces from manufacturer of roofing or waterproofing material.
- .3 Keep waterproofed and roofed surfaces free of debris.
- .4 Following completion of the roof system, adequately ventilate the Work to prevent moisture build up under the new roof membrane. Coordinate ventilation requirements with roof installer's recommendations.

1.6 MAKING GOOD

- .1 Make Good means to restore new or existing work after being damaged, cut, patched or rejected by the Consultant. Use materials identical to the original materials, with visible surfaces matching the appearance of the original surfaces in all details, and with no apparent junctions between new and original surfaces.
- .2 Make Good defective and damaged portions of the Work.
- .3 Make Good damage to property adjacent to the Place of the Work.
- .4 Make Good damage to the Work resulting from lack of adequate heating protection.
- .5 Make Good damaged services in accordance with the authority having jurisdiction.

PART 2 - PRODUCTS

None is this Section.

PART 3- EXECUTION

None is this Section.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents* including Sections of Division 01.
- .2 No less than two percent (2%) of the *Contract Price* shall be assigned as the cost for the preparation and delivery of the *Project* record documents *to the Consultant*. This value shall be indicated on the schedule of values in accordance with Sections 01 29 73 - Schedule of Values and 01 33 00 – Submittal Procedures.
- .3 The review to determine *Substantial Performance of the Work* will not take place until the documents and products described in this Section have been received by the *Consultant*.
- .4 The procedures for completing the *Contract* and acceptance by the *Owner* shall be in accordance with the methods described in OAA/OGCA Document 100 (July 1, 2018, and reissued January 8, 2019) and any additional requirements described in this Section.
- .5 The closeout procedures will be reviewed at the *Contract* start-up meeting to ensure that parties understand their responsibilities. Refer to Section 01 31 19 – *Project* Meetings for procedures and requirements for *Contract* start-up meeting.
- .6 Within 28 *Days* of commencement of the *Work*, submit to the *Consultant* a list of closeout submittals required by the *Contract Documents*.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Cleaning Prior to *Substantial Performance of the Work*
- .4 1.4 Final Cleaning
- .5 1.5 *Project* Record Documents
- .6 1.6 Spare Parts and Maintenance Materials
- .7 1.7 Systems Demonstration
- .8 1.8 Substantial Performance and Takeover Procedures
- .9 1.9 Warranty Period

1.3 CLEANING PRIOR TO SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 Immediately prior to the *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved, remove surplus *Products* and construction machinery and equipment not required for the performance of the remaining *Work* and clean as described under subsection 1.4 - Final Cleaning to the greatest extent practicable given work remaining to be completed. Cleaning shall be to a sufficient extent to permit the *Consultant's* review to be performed properly and reasonably.

1.4 FINAL CLEANING

- .1 Environmental controls:
 - .1 Conduct cleaning and disposal operations to comply with all requirements of the *Authorities Having Jurisdiction* including anti-pollution laws.

- .2 Store volatile wastes in covered metal containers and remove from *Place of the Work* daily.
- .3 Prevent accumulation of wastes which create hazardous conditions.
- .4 *Provide* adequate ventilation during use of volatile or noxious substances.
- .2 Materials:
 - .1 Use only cleaning materials recommended by manufacturer of surface to be cleaned and as recommended by cleaning material manufacturer.
- .3 Final cleaning:
 - .1 Remove waste *Products* and debris other than that caused by the *Owner* and leave the *Work* clean and suitable for occupancy by the *Owner*.
 - .2 When the *Contract* is completed, remove surplus *Products*, tools, construction machinery and equipment.
 - .3 Clean glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, prefinished surfaces, and fixtures.
 - .4 Remove stains, spots, marks and dirt from decorative parts of the *Work*, electrical and mechanical fixtures, furniture fittings, walls, and floors.
 - .5 Vacuum clean and remove dust from building interiors, behind grilles, louvres, and screens. Vacuum clean interior of electrical equipment.
 - .6 Clean floor finishes to recommendations of manufacturer.
 - .7 Remove non-permanent labels.
 - .8 Remove dirt and residue from surfaces.
 - .9 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.
 - .10 At completion of the *Work*, remove protective coatings, clean surfaces and remove excess compounds and sealant materials. Make good defective, scratched or damaged work, at the *Contractor's* expense.
 - .11 Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.
 - .12 Remove seal wrap on mechanical and electrical *Products* and materials and clean as required.
 - .13 Clean and/or replace lamps, light fixtures, lenses, and grilles.
 - .14 Remove protective covering and labels from lamps, hardware, and specialty items.
 - .15 Under the direction of the *Consultant*, aim adjustable luminaires.

1.5 PROJECT RECORD DOCUMENTS

- .1 Collect reviewed submittals, and assemble required closeout submittals executed by *Subcontractors*, *Suppliers*, and manufacturers. Prior to submitting closeout submittals to the *Consultant*, undertake the following:
 - .1 Review maintenance manual contents (operating, maintenance instructions, *As-Built Drawings*, materials) for completeness.

- .2 Review supply and completeness of spare parts required by *Contract Documents* and manufacturers.
 - .3 Review submittals in relation to *Contract Price*, *Change Orders*, *Change Directives*, holdbacks and other adjustments to the *Contract Price*.
 - .4 Review inspection and testing reports to verify conformance to intent of *Contract Documents* and that changes, repairs or replacements have been completed.
 - .5 Submit a final statement of accounting giving total adjusted *Contract Price*, previous payments, and monies remaining at time of application for completion of the *Contract*. The *Consultant* will issue a final *Change Order* reflecting approved adjustments to *Contract Price* not previously made.
- .2 Operation and Maintenance Manuals:
- .1 Submit operation and maintenance manuals, as outlined in Section 01 78 23, consisting of the following general components:
 - .1 Operation and maintenance.
 - .2 *Shop Drawings*.
 - .3 Warranties.
 - .4 *Project* data.
- .3 Submit Operation and Maintenance Manuals as follows:
- .1 15 Days prior to applying for the review to determine *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* digital versions ("PDF" files) of operation and maintenance manuals. Files shall be original PDF files, not scanned, and shall be searchable.
 - .2 Submit using digital storage medium or transfer process acceptable to the *Consultant* and the *Owner*.
 - .3 If revisions to the Operation and Maintenance Manuals are required, comments will be provided by the *Consultant* team for re-submission prior to undertaking the review to determine *Substantial Performance of the Work*.
 - .4 Manuals are to be re-submitted to the *Consultant* for review once any required revisions have been made.
 - .5 Manuals shall contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules, and all other operation and maintenance information as required by the *Contract Documents*, including all warranties.
 - .6 Final Hard Copies, (Three Copies) shall be printed and submitted to the *Owner*. The *Contractor* shall organize the data in the form of an instructional manual in binders of commercial quality, with hard covers, 8-1/2" x 11" in size, with a maximum ring size of 2". The following shall be followed:
 - .1 On the cover, identify each binder with the typed or printed title "Operation and Maintenance Manuals," listing also the title of the *Project*, and identifying the subject matter of the contents.
 - .2 Arrange the contents into applicable categories of work, parallel to the Sections of the *Specifications*.

- .3 When multiple binders are used, correlate data into consistent related groupings.
 - .4 *Provide* tabbed fly-leaf for each separate *Product* and system, with typed description of *Product* and major component parts of equipment.
 - .5 If drawings are included, *Provide* with reinforced punched binder tab, bind in with text, folding drawings of a larger size to size of text pages.
 - .6 For each *Product* or system, list names, addresses, and telephone numbers of *Subcontractors* and *Suppliers*, including a local source of supplies and replacement parts.
 - .7 *Product* Data: mark each sheet to clearly identify specific *Products* and component parts, as well as data applicable to the installation, and delete inapplicable information.
- .4 *As-Built Documents:*
- .1 Prior to the commencement of the *Work*, the *Consultant* will *Provide* the *Contractor* with a set of *Contract Drawings* for the purpose of recording changes in the *Work*, as well as the actual locations of concealed services.
 - .2 Accurately and neatly record deviations from the *Contract Documents* caused by conditions at the *Place of the Work* and changes in the *Work* as the *Work* progresses.
 - .3 Record information by means of red felt-tip marker.
 - .4 Record, without being limited to, the following:
 - .1 Field changes of dimensions/details.
 - .2 Changes by *Change Orders*, *Change Directives*, and *Supplemental Instructions*.
 - .3 Locations of interior mechanical and electrical equipment and distribution.
 - .4 Specification as-builts: Record as-built *Products*, including manufacturer, manufacturer's model or system number.
 - .5 Identify each document as "As-Built Copy." Maintain in good condition in the *Site* office and make available for review by the *Consultant* and the *Owner* upon request.
 - .6 In the *Specifications*, legibly mark each item to record actual construction, including manufacturers, trade names, and catalogue number for each *Product* actually installed, particularly optional items and substitute items.
 - .7 The *Contractor* shall ensure that mechanical and electrical records are kept by the respective *Subcontractors* (who shall receive an extra copy each of the mechanical and electrical *Drawings* and *Specifications* for this purpose from the *Contractor*), and are delivered to the *Contractor* who shall transfer the information to the *As-Built Drawings*.
 - .8 The *Contractor* shall *Provide* *As-Built Site* survey once foundations are completed to ensure building is situated as required. Drawings must be submitted in PDF and CAD Format. The *Contractor* shall *Provide* *As-Built Site* survey upon the completion of the *Project* in PDF and CAD format.
 - .9 On completion of the construction work, and 15 *Days* prior to applying for the review to determine *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* the complete *As-Built Documents*.
- .5 *Shop Drawings* and Inspection Reports:

- .1 15 Days prior to applying for the review to determine *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* digital versions ("PDF" files) of all reviewed *Shop Drawings* including an inventory of the *Shop Drawings* submitted.
- .1 Engineered *Shop Drawings* shall include copies of the certificate of insurance, the engineer's field review reports, and the engineer's letters of general conformity that were provided as part of the engineered submittal in accordance with Section 01 33 00 – Submittal Procedures appended to the pertinent engineered *Shop Drawing* in the *Shop Drawing* manual.
- .2 15 Days prior to applying for review to determine *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* digital versions ("PDF" files) of all inspection and testing reports bound together in one volume and arranged in chronological sequence.
- .6 Warranties:
 - .1 Submit copies of bonds, guarantees, warranties and extended warranties together in one report binder, complete with an indexed summary list of warranties and expiration dates. Warranties to be in accordance with Section 01 78 36 - Warranties.
- .7 *Project* data: shall include the following information supplemented by additional required data specified elsewhere in the *Contract Documents*:
 - .1 Maintenance instructions for finished surfaces and materials.
 - .2 Copy of hardware and paint schedules.
 - .3 Names, addresses and phone numbers of *Subcontractors* and *Suppliers*, as applicable.
 - .4 Additional material used in the *Work* listed under various Sections showing name of manufacturer and source of supply.
 - .5 Report recording demonstration and instruction provided to *Owner* for operation and maintenance of building systems as described in this Section.
 - .6 Key construction photos.
 - .7 Permits and forms:
 - .1 Workplace Safety & Insurance Board certificate of clearance.
 - .2 Certificates of approval of the *Work* by local building department (if available).
 - .3 Electrical authority certificate of inspection.
- .8 Posted operating instructions
 - .1 Prepare operating instructions in English for posting near equipment and systems. Posted instructions to be glass covered, framed and mounted.
 - .2 Posted instructions to consist of simplified, consolidated equipment, control and power diagrams graphically representing the entire system, including concise instructions on how to start and stop systems, what settings and conditions are to be observed by the operators, and what control adjustments are to be made or maintained by the operator.
 - .3 Posted instructions must include control diagrams with added specific operating instructions, controls, interlocks, and the like.

- .4 Posted instructions must include:
 - .1 HVAC controls for each system;
 - .2 One line schematic diagrams of water supply;
 - .3 One line isometric diagrams of sanitary drainage;
 - .4 One line diagrams of steam distribution, hot and cold water systems, including risers, valves, control devices, etc.

1.6 SPARE PARTS AND MAINTENANCE MATERIALS

- .1 At the time of submission of the *Project* record documents, or earlier if acceptable to the *Consultant* and the *Owner*, the *Contractor* shall submit to the *Owner* maintenance equipment for the various items, pieces of equipment, systems, or accessories required by the *Contract Documents*.
- .2 At the time of submission of the *Project* record Documents, or earlier if acceptable to the *Consultant* and the *Owner*, the *Contractor* shall submit to the *Owner* extra materials for the various items, pieces of equipment, systems, or accessories required by the *Contract Documents*.
- .3 Spare parts, maintenance materials, and extra materials provided shall be new, not damaged or defective, and of same quality, manufacture, and manufacturer as of the *Products* provided in the *Work*. If requested, the *Contractor* shall furnish evidence as to the type, source, and quality of the *Products* provided.
- .4 Defective *Products* will be rejected, regardless of previous inspections. The *Contractor* shall replace such *Products* at its own cost, and such replacement shall not be considered or approved as a change in the *Work*.
- .5 Store spare parts and maintenance materials in a manner to prevent damage or deterioration.
- .6 Provide a typed inventory list of maintenance materials prior to *Substantial Performance of the Work* application. List all items, complete with quantities, and storage locations.
- .7 Establish a master list identifying maintenance materials and maintain a log of when materials are turned over to *Owner* and signing authority for acceptance of materials on behalf of *Owner*.

1.7 SYSTEMS DEMONSTRATION

- .1 Refer also to requirements of Divisions 21, 22, and 23 and Divisions 26, and 28 with respect to commissioning for control systems, mechanical and electrical systems.
- .2 Perform system demonstration and commissioning work no later than 10 *Working Days* prior to submitting request for the *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved.
- .3 Submit required certificates of approval or acceptance from *Authorities Having Jurisdiction*.
- .4 Meet with other subconsultants; structural, mechanical, electrical, to coordinate demonstration, instruction, commissioning and completion.
- .5 Review condition of equipment such as lighting, elevators and heating system, which has been used in the course of the *Work* to ensure turning over at completion in "as new condition" with warranties dated and certified from time specified.

- .6 When partial occupancy of the uncompleted *Project* is required by the *Owner*, coordinate the *Owner's* uses, requirements, access, etc., with the *Contractor's* requirements to complete the *Work*.
- .7 Preparation:
 - .1 Submit to both the *Owner* and the *Consultant*, a schedule of time and date for demonstration of each item of equipment and each system at least 15 *Days* prior to designated dates.
 - .2 Ensure that the services, apparatuses, and equipment are installed and complete, have been inspected, tested and adjusted, and are all in perfect operating condition.
 - .3 Verify the conditions for demonstration and instructions comply with the *Owner's* and manufacturer's requirements and that designated personnel is present.
- .8 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment to the *Owner*.
 - .2 Instruct the *Owner's* personnel in operation, adjustment and maintenance of equipment and systems, using operation and maintenance data provided as the basis for instructions. Arrange and coordinate instruction of the *Owner's* staff in care, maintenance and operation of building systems and finishes.
 - .3 The *Contractor* shall ensure that the *Contractor*, the manufacturer's representatives, and responsible personnel from *Subcontractors* whose work is being demonstrated are present at these demonstrations.
 - .4 Instruct the *Owner* on use of software required for operation and maintenance of building systems and *Provide* a toll-free telephone number or website address for further assistance to the *Owner*.
 - .5 Prepare and insert additional data in the operation and maintenance data manuals when the need for additional data becomes apparent during demonstration or instruction and/ or when requested by the *Owner*.
- .9 Demonstration and instruction Report:
 - .1 Submit a written reports within five *Working Days* after completion of demonstration, recording that demonstration and instructions have been satisfactorily completed. Report shall include time and date of each demonstration, instruction, and commissioning activity, complete with a list of persons present.
- .10 Correct deficiencies and defects identified during demonstration, instruction, or commissioning.
- .11 Attend 'end-of-work' testing and break-in or start-up demonstration.

1.8 SUBSTANTIAL PERFORMANCE AND TAKEOVER PROCEDURES

- .1 A minimum of 60 *Working Days* prior to the anticipated Substantial Performance date, the *Contractor* (in writing) shall *Provide* a notice letter to the *Owner* of the anticipated Substantial Performance date.
- .2 The *Contractor* shall affirm the *Substantial Performance of the Work* date and *Provide* the *Owner* and the *Consultant* with a notice letter confirming the date, a minimum of 20 *Working Days* prior to the Substantial Performance date.

.3 Deficiency review:

- .1 The *Contractor* shall conduct an inspection of the *Work* to identify deficiencies and defects, which shall be repaired as required. When the *Contractor* considers that the *Work* is substantially performed, the *Contractor* shall prepare and submit to the *Consultant* a comprehensive list of items to be completed or corrected and apply for a review by the *Consultant* to establish *Substantial Performance of the Work*. Failure to include an item on the list does not relieve the responsibility of the *Contractor* to complete the *Contract*.
- .2 One week prior to the anticipated *Substantial Performance of the Work* date, the *Consultant*, the *Owner* and the *Contractor* will complete a deficiency walk through to confirm items noted in subsection 1.8.3.1 The *Consultant* will *Provide* the *Contractor* a deficiency list with Value of Deficiency work to be complete.
- .3 The *Contractor* shall be responsible for ensuring that items shown and described in the *Contract Documents* are complete. Any deficiency reviews to approve the certificate of *Substantial Performance of the Work* will be immediately cancelled if it becomes obvious to the *Consultant* that extensive deficiencies are outstanding.
- .4 No later than 10 *Working Days* after the receipt of the *Contractor's* application, the *Consultant* and the *Contractor* will review the *Work* to identify any defect or deficiencies. If necessary, the *Consultant* will tabulate a list of deficiencies to be issued to the *Contractor* for correction of same.
- .5 The *Contractor* shall submit to the *Owner* and the *Consultant* a written Substantial Performance Application complete with all required documents. The application for Substantial Performance shall follow OAA/OGCA Take-Over-Procedures.
- .6 Neither the *Consultant's* review to determine if *Substantial Performance of the Work* has been achieved, nor acceptance of the *Work*, will take place until receipt, by the *Consultant*, of acceptable copies of the closeout submittals required herein and by the *Contract Documents*.

.4 Certification of Substantial Performance of the Work:

- .1 When the *Consultant* considers that the deficiencies and defects have been completed and that it appears that the requirements of the *Contract Documents* (as may have been amended during the *Work*) have been substantially performed, the *Consultant* will issue a certificate of *Substantial Performance of the Work* to the *Contractor*, stating the date of *Substantial Performance of the Work*.
- .2 The *Contractor* must obtain the *Owner's* approval of the Certificate of Substantial Performance prior to publication.
- .3 The certificate of *Substantial Performance of the Work* shall be prepared and issued in accordance with the *Construction Act* and GC 5.4 of the *Contract*.

.5 Final Inspection for completion of the *Contract*:

- .1 Deficiencies and defects shall be made good before the *Contractor* submits a written request for final review of the *Work* and before the *Contract* is considered complete.
- .2 When the *Contractor* is satisfied that the *Work* is complete, and after the *Contractor* has reviewed the *Work* to verify its completion in accordance with the requirements of the *Contract Documents*, the *Contractor* shall submit a written request for a final review by the *Consultant*, who in turn will notify the *Owner*.

- .3 If there are any deficiencies identified by the *Consultant* as a result of the review of the *Work*, they shall be listed by the *Consultant* and submitted to the *Contractor*. This list shall be recognized as the final deficiency list for purposes of acceptance of the *Work* under the *Contract*.
- .4 Such deficiencies shall be corrected by the *Contractor* by a date mutually agreed upon between *Consultant* and the *Contractor*, unless a specific date is required by *Contract*, and a further review by the *Consultant* shall be called for by the *Contractor* following its own review to take place within 7 *Working Days* from date of request.
- .5 The *Contractor* shall thereafter submit invoice for final payment.
- .6 Money shall be withheld for deficiency work and will be released only when all deficiencies have been completed. No partial payment will be recognized until all work is completed.
- .6 Refer to GC 5 of the *Contract* for additional requirements relating to application for Certificates of Substantial and Total Performance of the Work.

1.9 WARRANTY PERIOD

- .1 The warranty period shall commence in accordance with Article A-15 of the Agreement between the *Owner* and the *Contractor*.
- .2 The *Contractor* shall *Provide* on-going review and attendance to building call-back, maintenance, and repair problems during the warranty periods.
- .3 At the beginning of the 2nd last month of the warranty period, the *Owner*, *Contractor* and the *Consultant*, along with key *Subcontractors* as designated by the *Contractor*, shall carry out a complete review of building and its systems to determine which deficiencies are to be rectified under the warranty. The *Contractor* shall be responsible for timely written notification to the *Owner* and the *Consultant* prior to such end of warranty period inspection and any delay in such notification shall extend such warranty period until proper notification is received by the *Owner* and the *Consultant*.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Related Documents
- .4 1.4 Summary
- .5 1.5 Definitions
- .6 1.6 Closeout Submittals
- .7 2.1 Requirements For Operation, And Maintenance Manuals
- .8 2.2 Operation Data
- .9 2.3 Product Maintenance Data
- .10 2.4 Systems And Equipment Maintenance Data
- .11 3.1 Manual Preparation

1.3 RELATED DOCUMENTS

- .1 The *Contract Documents*, including but not limited to, the *Drawings* and Individual *Specification* Sections and the *Contractor's* Submission Schedule, apply to this Section.

1.4 SUMMARY

- .1 This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - .1 Operation and maintenance manual for systems, subsystems, and equipment.
 - .2 *Product* maintenance data.
 - .3 Systems and equipment maintenance data.
- .2 Related Sections:
 - .1 Section 01 33 00 – Submittal Procedures
 - .2 Section 01 77 00 – Contract Closeout Procedures and Submittals
 - .3 Section 01 91 00 –Commissioning Requirements

1.5 DEFINITIONS

- .1 System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- .2 Subsystem: A portion of a system with characteristics similar to a system.

1.6 CLOSEOUT SUBMITTALS

- .1 Required Manuals: see Section 01 77 00 – Contract Closeout Procedures and Submittals for additional requirements.
- .2 Format: Submit operations and maintenance manuals in the following format:
 1. *Provide* 3 hard copies.
 2. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to the *Owner*.
 - .1 Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - .2 Enable inserted reviewer comments on draft submittals.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

- .1 Organization: Organize the manual into separate sections based on the table of contents of the *Project* manual, for each system and subsystem, and a separate section for each piece of equipment not part of a system. The manual must contain the following materials, in the order listed:
 - .1 Title page.
 - .2 Table of contents.
 - .3 Manual contents:
 - .1 Operation data.
 - .2 *Product* maintenance data.
 - .3 Systems and equipment data
- .2 Title Page: Include the following information:
 - .1 Subject matter included in manual.
 - .2 Name and address of the *Project*.
 - .3 Name and address of the *Owner*.
 - .4 Date of submittal.
 - .5 Name and contact information for the *Contractor*.
 - .6 Name and contact information for *Consultant*.
 - .7 Name and contact information for commissioning agent.
 - .8 Names and contact information for major consultants to the *Consultant* that designed the systems contained in the manuals.
 - .9 Cross-reference to related systems in other operation and maintenance manuals.

- .3 Table of Contents: List each product included in manual, identified by *Product* name, indexed to the content of the volume, and cross-referenced to *Specification* Section number in *Project* Manual.
 - .1 If operation or maintenance documentation requires more than one media volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- .4 Manual Contents: Organize into sets of manageable size. Arrange contents by CSI Section number and then by system, subsystem, and equipment.
- .5 Manuals, Electronic Copy: Submit electronic (PDF) copy of the manual, to the *Consultant*, concurrent with Action Submittal.

2.2 OPERATION DATA

- .1 Content: In addition to the requirements in this Section, include operation data required in individual *Specification* Section and the following information:
 - .1 System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated in the *Contract Documents*.
 - .2 Operating standards.
 - .3 Operating procedures.
 - .4 Operating logs.
 - .5 Wiring diagrams.
 - .6 Control diagrams.
 - .7 Piped system diagrams.
 - .8 Precautions against improper use.
 - .9 License requirements including inspection and renewal dates.
- .2 Descriptions: Include the following:
 - .1 *Product* name and model number. Use designations for *Products* indicated on the *Contract Documents*.
 - .2 Manufacturer's name.
 - .3 Equipment identification with serial number of each component.
 - .4 Equipment function.
 - .5 Operating characteristics.
 - .6 Limiting conditions.
 - .7 Performance curves.
 - .8 Engineering data and tests.
 - .9 Complete nomenclature and number of replacement parts.

- .3 Operating Procedures: Include the following, as applicable:
 - .1 Startup procedures.
 - .2 Equipment or system break-in procedures.
 - .3 Routine and normal operating instructions.
 - .4 Regulation and control procedures.
 - .5 Instructions on stopping.
 - .6 Normal shutdown instructions.
 - .7 Seasonal and weekend operating instructions.
 - .8 Required sequences for electric or electronic systems.
 - .9 Special operating instructions and procedures.
- .4 Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- .5 Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE DATA

- .1 Content: Organize data into a separate section, within the Operation and Maintenance Manual, for each *Product*, material, and finish. Include source information, *Product* information, maintenance procedures, repair materials and sources, and warranties, as described below in subsection 2.3.6.
- .2 Source Information: List each *Product* included in the Section identified by *Product* name and arranged to match manual's table of contents. For each *Product*, list name, address, and telephone number of installer or *Supplier* and maintenance service agent, and cross-reference *Specification* Section number and title in *Project* Manual and drawing or schedule designation or identifier where applicable.
- .3 Product Information: Include the following, as applicable:
 - .1 *Product* name and model number.
 - .2 Manufacturer's name.
 - .3 Color, pattern, and texture.
 - .4 Material and chemical composition.
 - .5 Reordering information for specially manufactured *Products*.
- .4 Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - .1 Inspection procedures.
 - .2 Types of cleaning agents to be used and methods of cleaning.
 - .3 List of cleaning agents and methods of cleaning detrimental to the *Product*.
 - .4 Schedule for routine cleaning and maintenance.

- .5 Repair instructions.
- .5 Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- .6 Warranties and Guarantees: Include copies of warranties and guarantees lists of circumstances and conditions that would affect validity of warranties.
 - .1 Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE DATA

- .1 Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty information in subsection 2.4.7, as described below.
- .2 Source Information: List each system, subsystem, and piece of equipment included in a separate section within the Operation and Maintenance (O & M) Manual identified by *Product* name and arranged to match manual's table of contents. For each *Product*, list name, address, and telephone number of installer or *Supplier* and maintenance service agent, and cross-reference *Specification* Section number and title in *Project* Manual and drawing or schedule designation or identifier where applicable.
- .3 Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - .1 Standard maintenance instructions and bulletins.
 - .2 Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - .3 Identification and nomenclature of parts and components.
 - .4 List of items recommended to be stocked as spare parts.
- .4 Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - .1 Test and inspection instructions.
 - .2 Troubleshooting guide.
 - .3 Precautions against improper maintenance.
 - .4 Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - .5 Aligning, adjusting, and checking instructions.
 - .6 Demonstration and training video recording, if available.
- .5 Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - .1 Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - .2 Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

- .6 Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- .7 Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties.
 - .1 Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- .1 Operation and Maintenance Documentation shall be provided for review, concurrent, with Action Submittal specified in individual *Specification* Section.
 - .1 Correct or modify the manual to comply with the Consultant's and commissioning authority's comments. Submit copies of each corrected manual within 15 *Working Days* of receipt of the *Consultant's* and commissioning authority's comments and prior to commencing demonstration and training.
- .2 Product Maintenance Data: Assemble a complete set of maintenance data, in a separate section, within the O & M Manual, indicating care and maintenance of each *Product*, material, and finish incorporated into the *Work*.
- .3 Operation and Maintenance Data: Assemble a complete set of operation and maintenance data, in a separate section, within the O & M Manual, indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - .1 Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - .2 Prepare a separate section within the O & M Manual, for each system and subsystem, in the form of an instructional manual for use by the *Owner's* operating personnel.
- .4 Manufacturers' Data: Where manual contain manufacturers' standard printed data; include only sheets pertinent to *Product* or component installed. Mark each sheet to identify each *Product* or component incorporated into the *Work*. If data include more than one item in a tabular format, identify each item using appropriate references from the *Contract Documents*. Identify data applicable to the *Work* and delete references to information not applicable.
 - .1 Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- .5 Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in *As-Built Drawings* to ensure correct illustration of completed installation.
 - .1 Do not use original *Project* record documents as part of operation and maintenance manuals.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General requirements
- .2 1.2 Section Includes
- .3 1.3 Warranties
- .4 1.4 Extended Warranties

1.3 WARRANTIES

- .1 Refer to Article A-15 of the Agreement between *Owner* and *Contractor* and GC 12.3.6 of the General Conditions of the *Contract* for the Warranty Periods provisions, and as follows:
 - .1 Warranties shall commence on the date specified in Article A-15 of the Agreement between *Owner* and *Contractor*.
 - .2 Submit warranties for applicable items, signed by the applicable company responsible for each warranty.
 - .3 Submit warranties on form approved by the *Owner* including, but not limited to, the following information:
 - .1 Name and address of *Project*.
 - .2 Warranty commencement date.
 - .3 Duration of warranty.
 - .4 Clear indication of what is being warranted and what remedial action will be taken under warranty.
 - .5 Authorized signature and seal of company providing each warranty.
- .2 The *Owner* shall be named in manufacturer's *Product* warranties. Submit on relevant *Product* manufacturer's standard warranty or guarantee form.
- .3 The *Owner* will give prompt notice in writing to the *Consultant* of any defects noted during the warranty periods(s) and the *Consultant* will notify the *Contractor* promptly requesting him to remedy such defects.
- .4 A minimum of 30 *Working Days* prior to the expiration of the Warranty Period stipulated in Article A-15 of the Agreement between *Owner* and *Contractor*, the *Owner*, the *Consultant* and the *Contractor* shall conduct an inspection of the *Work*. The *Contractor* shall promptly remedy any defects due to faulty materials or workmanship.
- .5 The use of permanent heating system for temporary heat shall not affect requirement that all warranties start on the date specified in Article A-15 of the Agreement between *Owner* and *Contractor*.

- .6 Prior to application for *Substantial Performance of the Work*, the *Contractor* shall formally assign to the *Owner* all extended warranties given by *Subcontractors* for their *Work* on the *Project* and such *Subcontractors* shall be formally advised of the assignment.

1.4 EXTENDED WARRANTIES

- .1 Extended warranties shall be in accordance with the *Contract* and as follows:
- .1 Where specifically identified in the *Contract Documents*, extended warranties shall be furnished by individual manufacturer for particular *Product* / system / assembly or by *Subcontractor* for a particular *Product* / system / assembly / section of the *Specifications*.
 - .2 Extended warranties must include for proper performance of the portion of the *Work* as defined by the scope of the applicable *Specification* Section to the extent that the design and *Contract Documents* permit such performance.
 - .3 Extended warranties shall be provided by *Subcontractor* unless warranty is specified to be provided by *Product* manufacturer. The *Contractor* shall be fully responsible for submitting extended warranties to the *Owner*.
 - .4 The *Owner* shall promptly give the warrantor notice in writing of observed defects and deficiencies which occur during the warranty period.
 - .5 Extended warranties shall commence on the date specified in Article A-15 of the Agreement between *Owner* and *Contractor*.
 - .6 Extended warranties specified shall be in addition to, and run concurrent with, other warranties required by the *Contract Documents*. Manufacturer's disclaimers and limitations on *Product* warranty will not relieve the *Contractor* of its obligations under the requirements of the *Contract Documents*.
 - .7 Submit extended warranty on warrantor's standard form specifically endorsed by the warrantor to the *Owner* and shall include the following information:
 - .1 Name and address of *Project*.
 - .2 Warranty commencement date.
 - .3 Warranty period.
 - .4 Specific warranty terms as required in applicable portion of the *Contract Documents*.
 - .5 Name and title of authorized signing officer and seal of warrantor.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Related Documents
- .4 1.4 Summary
- .5 1.5 Closeout Submittals
- .6 2.1 As-Built Drawings
- .7 2.2 As-Built Specifications
- .8 2.3 As-Built Schedule
- .9 2.4 Record Product Data
- .10 2.5 Miscellaneous Record Submittals
- .11 3.1 Recording And Maintenance

1.3 RELATED DOCUMENTS

The Contract Documents, including but not limited to, the *Drawings* and Individual *Specification* Sections, apply to this Section.

1.4 SUMMARY

This Section includes administrative and procedural requirements for As-built documents, including the following:

- .1 *As-Built Drawings*
- .2 *As-built Specifications*
- .3 *As-built Schedule*
- .4 *Record Product Data*
- .5 *Miscellaneous record submittals*

Related Sections:

- .6 Section 01 32 00 – Construction Progress Documentation - Schedule
- .7 Section 01 33 00 – Submittal Procedure
- .8 Section 01 77 00 – Contract Closeout Procedures and Submittals
- .9 Section 01 78 23 – Operation and Maintenance Manuals

Administrative and procedural requirements for *Contract* turnover documents, including, but not limited to the following, as provided in individual *Specifications* Sections.

- .10 Sustainable Documents

.11 Commissioning Documents

.12 Hazardous Waste Documents

1.5 CLOSEOUT SUBMITTALS

Required Documents: Section 01 77 00 – Contract Closeout Procedures and Submittals, describes administrative requirements for submission, number and type of copies required for *Contract* closeout requirements.

PART 2 - PRODUCTS

2.1 AS-BUILT DRAWINGS

As-Built Drawings: Maintain one set of marked-up paper copies of the *Contract Drawings* and *Shop Drawings on-Site*. Review *As-built Drawings* and *Shop Drawings* monthly with the *Owner*, for approval.

- .1 Preparation: Daily mark *As-Built Drawings* to show the actual installation where installation varies from that shown originally. Collect from individual or entity who obtained record data, whether individual or entity is installer, *Subcontractor*, or similar entity, information for preparation of corresponding marked-up *As-Built Drawings*.
 - .1 Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - .2 Accurately record information in an acceptable drawing technique.
 - .3 Record data as soon as possible after obtaining it.
 - .4 Record and check the markup before enclosing concealed installations.
- .2 Content: Types of items requiring marking include, but are not limited to, the following:
 - .1 Dimensional changes to *Drawings*.
 - .2 Revisions to details shown on *Drawings*.
 - .3 Depths of foundations below first floor.
 - .4 Locations and depths of underground utilities.
 - .5 Revisions to routing of piping and conduits.
 - .6 Revisions to electrical circuitry.
 - .7 Actual equipment locations.
 - .8 Duct size and routing.
 - .9 Locations of concealed internal utilities.
 - .10 Changes made by *Change Order*.
 - .11 Changes made following the *Owner's* written orders.
 - .12 Details not shown in the original *Contract Drawings*.
 - .13 Field records for variable and concealed conditions.
 - .14 Record information on the *Work* that is shown only schematically.

- .3 Mark the *Contract Drawings* and *Shop Drawings* completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up as-built prints.
- .4 Mark as-built sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the *Work* at same location.
- .5 Mark important additional information that was either shown schematically or omitted from original *Drawings*.
- .6 Note Construction *Change Directive* numbers, alternate numbers, *Change Order* numbers, and similar identification, where applicable.

2.2 AS-BUILT SPECIFICATIONS

Preparation: Mark *Specifications* to indicate the actual *Product* installation where installation varies from that indicated in *Specifications*, addenda, and *Contract* modifications.

- .7 Give particular attention to information on concealed *Products* and installations that cannot be readily identified and recorded later.
- .8 Mark copy with the proprietary name and model number of *Products*, materials, and equipment furnished, including substitutions and *Product* options selected.
- .9 Record the name of manufacturer, *Supplier*, installer, and other information necessary to provide a record of selections made.
- .10 For each principal *Product*, indicate whether record *Product* Data has been submitted in operation and maintenance manuals instead of submitted as record *Product* Data.
- .11 Note related *Change Orders*, record *Product* Data, and turnover drawings where applicable.

2.3 AS-BUILT SCHEDULE

Final Schedule: Submit to the *Owner* a final schedule update. The as-built Schedule shall reflect the exact manner in which the *Project* was actually constructed including actual start and finish dates, activities, sequences and logic.

- .12 The *Contractor* shall certify the final schedule update as a true reflection of the way the *Project* was actually constructed.

2.4 RECORD PRODUCT DATA

Preparation: Mark *Product* Data to indicate the actual *Product* installation where installation varies substantially from that indicated in *Product* Data submittal.

- .13 Give particular attention to information on concealed *Products* and installations that cannot be readily identified and recorded later.
- .14 Include significant changes in the *Product* delivered to the *Project Site* and changes in manufacturer's written instructions for installation.
- .15 Note related *Change Orders*, as-built *Specifications*, and *As-Built Drawings* where applicable.

2.5 MISCELLANEOUS RECORD SUBMITTALS

Assemble miscellaneous records required by individual *Specification* Sections for miscellaneous record keeping and submittal in connection with actual performance of the *Work*. Bind or file miscellaneous records and identify each, ready for continued use and reference.

Format: Submit miscellaneous record submittals.

- .16 Include miscellaneous record submittals directory organized by *Specification* Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

Maintain Change Log: Maintain and submit written change log to the *Owner*, monthly for review indicating items incorporated in *Contract* turnover documents concurrent with progress of the *Work*, including modifications, concealed conditions, field changes, *Product* selections, and other notations incorporated.

Recording: Maintain one copy of each submittal during the construction period for *Contract* turnover document purposes. Post changes and modifications to *Contract* turnover documents as they occur; do not wait until the end of the *Project*.

Maintenance of Turnover Documents and Samples: Store turnover documents and Samples in the field office apart from the *Contract Documents* used for construction. *Contract* turnover documents are not to be used for construction purposes. Maintain turnover documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. *Provide* access to *Contract* turnover documents for the *Owner's* reference during normal working hours during performance of *Contract*.

END OF SECTION

2.1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.

3.1. APPLICABLE STANDARDS

- .1 Applicable Standards are listed below:
 - .1 2015 ASHRAE Handbook – HVAC Applications Chapter 43 HVAC Commissioning
 - .2 ASHRAE Guideline 1.1 – 2007 – The HVAC&R Technical Requirements for the Commissioning Process
 - .3 ASHRAE Guideline 0 – 2013 – The Commissioning Process
 - .4 ASHRAE 202 – 2013 – Commissioning Process for Buildings and Systems
 - .5 ASHRAE Guideline 4-2008 – Preparation of O&M Documentation
 - .6 ATSM E2813 – Standard Practice for Building Enclosure Commissioning
 - .7 ATSM E2947 – Standard Guide for Building Enclosure Commissioning
 - .8 CSA Z320-11 Building Commissioning Standard & Check Sheets
 - .9 CSA C282-15 – Emergency Power Supply for Buildings
 - .10 NIBS Guideline 3-2012 – Building Enclosure Commissioning Process

3.2. DESCRIPTION

- .2 Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. The commissioning process begins in the design phase and continues through construction, acceptance and the warranty period. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, functional testing and training.
- .3 Commissioning during the construction phase is intended to achieve the following specific objectives according to the *Contract Documents*:
 - .1 Verify that applicable equipment and systems, and envelope assemblies are installed according to the manufacturer's recommendations and industry best practices, and that they receive adequate operational checkout by installing contractors.
 - .2 Verify and document proper performance of equipment and systems.
 - .3 Verify that O&M documentation left on site is complete.
 - .4 Verify that the *Owner's* operating personnel are adequately trained.
- .4 The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to *Provide* a finished and fully functioning product.

3.3. ABBREVIATIONS

- .5 The following are common abbreviations used in the Commissioning *Specifications*:

CxA	Commissioning Authority	FT	Functional performance test
-----	-------------------------	----	-----------------------------

CC	Controls <i>Subcontractor</i>	GC	General <i>Contractor</i>
PM	<i>Project Manager</i>	MC	Mechanical <i>Subcontractor</i>
Cx	Commissioning	PFT	Pre-functional test
EC	Electrical <i>Subcontractor</i>	Subs	Subcontractors to the General <i>Contractor</i>
FM	Facility Management	TAB	Test and Balance <i>Subcontractor</i>

3.4. COORDINATION

- .6 Commissioning Team. The commissioning team consists of the representatives from the *Owner*, the Facility Management (FM) Staff, Commissioning Authority (CxA), the *Project Manager* (PM), the General *Contractor* (GC), the *Consultant* (Architect, Design Engineers), the Mechanical *Subcontractor* (MC), the Electrical *Subcontractor* (EC), the Testing and Balancing (TAB) *Subcontractor*, the Controls *Subcontractor* (CC), Specialty Subcontractors and any other installing subcontractors or suppliers of equipment.
- .7 Management. The CxA is hired by the *Owner* and follows the rules of an Independent Commissioning Authority. The CxA directs and coordinates the commissioning activities and reports to the *Owner* or the *Project Manager* (PM). All members work together to fulfill their contracted responsibilities and meet the objectives of the *Contract Documents*.
- .8 Scheduling. The CxA will work with the PM and GC according to established protocols to schedule the commissioning activities. The CxA will *Provide* sufficient notice to the PM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. The CxA will work with the GC to *Provide* the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan provides a format for this schedule. As construction progresses more detailed schedules are developed by the GC and the CxA. The Commissioning Plan also provides a format for detailed schedules.

3.5. COMMISSIONING PROCESS

- .9 Commissioning Plan. The CxA develops a commissioning plan which provides guidance in the execution of the commissioning process. The Commissioning Plan details the commissioning process; activities, deliverables in a logical, sequential order, and details roles and responsibilities of parties involved in Cx. Following the commissioning scoping meeting, the CxA will update the plan which is then considered the “final” plan, though it will continue to evolve and expand as the project progresses. The *Specifications* will take precedence over the Commissioning Plan.
- .10 Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
 - .1 Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
 - .2 Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 - .3 Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures and shop drawings.
 - .4 Mock-up tests are executed by subs on required envelope assemblies.
 - .5 The CxA oversees startup plans and startup documentation formats prepared by the Subs. The CxA provides the Subs with pre-functional test sheets to be completed during the startup process.

- .6 In general, the checkout and performance verification proceeds from simple to complex; from component level, to equipment, to systems, and finally intersystem levels with pre-functional test sheets being completed before functional testing.
- .7 The Subs, under their own direction, execute and document the pre-functional test sheets and perform startup and initial checkout. The CxA documents that the test sheets and startup were completed according to the approved plans. This may include the CxA witnessing start-up of selected equipment.
- .8 The Subs complete all testing required prior to functional testing by the CxA including pre-functional, start-ups, duct leakage, pipe pressure testing, balancing, controls verification and any other test as required by the specifications.
- .9 The CxA develops specific equipment and system functional performance test procedures with the assistance of Subs as required. The Subs review the test procedures once prepared.
- .10 The procedures are executed by the Subs, under the direction of, and documented by the CxA.
- .11 Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.
- .12 The CxA reviews the O&M documentation and training plan for completeness.
- .13 The CxA provides final Commissioning Documentation.
- .14 Commissioning is completed before Substantial Completion.
- .15 Deferred/ Seasonal testing is conducted, as specified or required.
- .16 Warranty review is conducted to review facility operation

3.6. RELATED WORK

- .11 Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the *Work* of this section.

01 91 00	Commissioning Requirements	Describes the commissioning process, responsibilities common to all parties, responsibilities of the <i>Consultant</i> , CxA, GC and Suppliers, focusing on the CxA. The unique <i>Subcontractor</i> responsibilities are included in Divisions 7, 8, 22, 23, 25 and 26.
01 91 19	Building Envelope Commissioning	Describes the Cx responsibilities of the GC and appropriate Subs, and the mock-up assembly testing, pre-functional and building envelope testing responsibilities. Points to 01 91 00 and provides specific mock-up, pre-functional and building envelope testing requirements for Divisions 7 & 8 components/ assemblies for use on this project.
22 08 00	Plumbing System Commissioning	Describes the Cx responsibilities of the Fire Suppression, Plumbing, Mechanical, TAB and Controls Subcontractors and the pre-functional testing and startup responsibilities of each. Points to 01 91 00 for functional testing requirements and provides the pre-functional and the specific functional testing requirements for Division 22, 23 and 25 equipment, for use on this project.
23 08 00	HVAC System Commissioning	
25 08 00	Integrated Automation Commissioning	
26 08 00	Electrical <i>Work</i> Commissioning	Describes the Cx responsibilities of the Electrical, <i>Contractor</i> and the pre-functional testing and startup responsibilities.

		Provides the pre-functional and the specific functional testing requirements for Division 26 equipment, for use on this project. Points to Section 01 91 00.
--	--	--

.12 The following sections detail general requirements which apply to the *Work* of section 01 91 00, and by extension the specification sections detailed in the table above

- .1 01 31 13 - Coordination
- .2 01 32 00 – Construction Progress Documentation - Schedule
- .3 01 33 00 – Submittal Procedures
- .4 01 45 00 – Quality Control
- .5 01 77 00 – *Project* Closeout
- .6 Division 7, 8, 22, 23, 25 and 26 Specification Sections as relevant to testing procedures, acceptance criteria, submittal requirements, training etc. as related to the commissioning process and commissioned equipment/ systems shall apply to the Works of this section 01 91 00, and by extension the specifications detailed in the table above.

3.7. DEFINITIONS

.13 The following are definitions for terms used in the commissioning *Specifications*

- .1 Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the *Contract Documents*.
- .2 Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. The basis of design is the technical response to the design intent.
- .3 Building Envelope Testing - Performance testing of installed building envelope systems, components and materials including water leakage, air leakage, water penetration, joint adhesion, thermal imaging etc.
- .4 Commissioning Authority (CxA) – The CxA works independent of the design and constructions teams. The CxA directs and coordinates the day-to-day commissioning activities. The CxA does not take an oversight role like the PM. The CxA is part of the *Project Manager* (PM) team or shall report directly to the PM.
- .5 Commissioning Plan - an overall plan that details the commissioning process; activities and deliverables, outlines general roles and responsibilities the commissioning team, and details coordination planning for the commissioning process.
- .6 *Contract Documents* - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts etc.).
- .7 *Consultant* – the prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical, electrical, structural etc. designers/engineers.
- .8 *Contract* – the undertaking by the parties to perform their respective duties, responsibilities and obligations and prescribed in the *Contract Documents* and represents the entire agreement between the parties.
- .9 Control system - the central building energy management control system.
- .10 Data-logging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data-loggers separate from the control system.

- .11 Deferred Functional Tests – FT's that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
- .12 Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the *Contract Documents* (that is, does not perform properly or is not compliant with the design intent).
- .13 Design Intent (*Owner's Project Requirements*) - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
- .14 Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.
- .15 Drawings – the graphic and pictorial portions of the *Contract Document*, showing the design, location and dimensions of the work, generally including plans, elevations, sections, details and diagrams
- .16 Factory Testing - testing of equipment on-site or at the factory by factory personnel with an *Owner's* representative present.
- .17 Functional Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB *Contractor's* primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing subcontractor or vendor. FTs are performed after pre-functional test sheets and startup are complete.
- .18 General *Contractor* (GC) – the prime contractor for this project. Generally, refers to all the GC's subcontractors as well.
- .19 Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- .20 Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data-loggers or the trending capabilities of control systems.
- .21 Non-Compliance - see Deficiency.
- .22 Mock Up - A full sized physical assemblies of a structure (for purposes of this document, building envelope components/ assemblies) that are constructed on-site for study, demonstration and testing. A mock-up is a prototype used to demonstrate aesthetic effects, and to display functionality of a system which enables testing of a design including interfaces between dissimilar materials.
- .23 Non-Conformance - see Deficiency.
- .24 Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

- .25 *Owner-Contracted Tests* - tests paid for by the *Owner* outside the GC's contract and for which the CxA does not oversee. These tests will not be repeated during functional tests if properly documented.
- .26 *Phased Commissioning* - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.
- .27 *Pre-functional Tests (PFT's)* - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CxA to the Sub. Pre-functional test sheets are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels satisfactory, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). Pre-functional refers to before functional testing and are to be completed by the installing subcontractor. Pre-functional test sheets augment and are combined with the manufacturer's start-up checklist. The CxA may choose to witness pre-functional tests for large/critical pieces of equipment.
- .28 *Project Manager (PM)* - the *Owner's* representative in the day-to-day activities
- .29 *Sampling*. - functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Section 01 91 00, Part 3.10.10.8 for details.
- .30 *Seasonal Performance Tests* - FT's that are deferred until the system(s) will experience conditions closer to their design conditions.
- .31 *Shop Drawings* – drawings, diagrams, illustrations, schedules, performance charts, brochures, product data, and other data which the General *Contractor* provides to illustrate details of portions of the *Work*.
- .32 *Simulated Condition* - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- .33 *Simulated Signal* - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
- .34 *Specifications* - the construction specifications of the *Contract Documents*.
- .35 *Startup* - the initial starting or activating of dynamic equipment, including executing pre-functional test sheets.
- .36 *Subs* – the Subcontractors to the General *Contractor*; a person or identity having direct contract with the General *Contractor* to perform a part or parts of the *Work*.
- .37 *Test Procedures* - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.
- .38 *Test Requirements* - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the *Contract Documents*
- .39 *Trending* - monitoring using the building control system.
- .40 *Vendor* - supplier of equipment.
- .41 *Warranty Period* - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the *Contract Documents* and accepted submittals.

3.8. SYSTEMS TO BE COMMISSIONED

- .14 Systems to be commissioned may include, but may not limited, to the following:
 - .1 Mechanical. including HVAC & R equipment and controls
 - .2 Plumbing, including domestic hot water systems, pumps and controls
 - .3 Electrical, including service, distribution, lighting and controls including daylighting controls
 - .4 Building Automation System
 - .5 Building Envelope

2.2 PRODUCTS

3.9. TEST EQUIPMENT

- .15 All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division *Subcontractor* for the equipment being tested. For example, the HVAC *Subcontractor* of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls systems except for equipment specific to and used by TAB in their commissioning responsibilities.
- .16 Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these *Contract Documents* shall be included in the base bid price to the *Subcontractor* and left on site, except for stand-alone datalogging equipment that may be used by the CxA.
- .17 Data-logging equipment and software required to test equipment will be provided by the CxA but shall not become the property of the *Owner*.
- .18 All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the *Specifications*. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to accuracy of 0.28deg.C (0.5deg.F) and a resolution of $\pm 0.056\text{deg.C}$ (0.1deg.F). Pressure sensors shall have an accuracy of $\pm 2.0\%$ of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

2.3 EXECUTION

3.10. GENERAL COMMISSIONING RESPONSIBILITIES

- .19 The general responsibilities of various parties in the commissioning process are provided in the following sections. Additional responsibilities of the GC and appropriate Subs are in Division 7-8, Mechanical and TAB Contractors are in Division 22 and 23, Controls *Subcontractor* are in Division 25 and those of the Electrical *Subcontractor* in Division 26.
- .20 All members of the commissioning team shall attend the commissioning scoping meeting and additional meetings, as necessary.

3.11. CONSULTANT (ARCHITECT/ ENGINEERS) COMMISSIONING RESPONSIBILITIES

- .21 Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.

- .22 *Provide* any design narrative and sequences documentation requested by the CxA. The Designers shall assist (along with the Contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
- .23 Attend commissioning scoping meetings and other selected commissioning team meetings.
- .24 Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
- .25 Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review the O&M manuals.
- .26 From the *Subcontractor's* red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the chilled and hot water, condenser water, domestic water, steam and condensate systems; supply, return and exhaust air systems and emergency power system.
- .27 *Provide* a presentation at one of the training sessions for the *Owner's* personnel.
- .28 Witness testing of selected pieces of equipment and systems.
- .29 Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

3.12. COMMISSIONING AUTHORITY RESPONSIBILITIES

- .30 The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General *Contractor* and the *Consultant*. The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe and document performance that systems are functioning in accordance with the documented design intent and in accordance with the *Contract Documents*. The Contractors will *Provide* all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CxA.
- .31 Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
- .32 Coordinate the commissioning work and, with the GC ensure that commissioning activities are being scheduled into the master schedule.
- .33 Develop and issue the Commissioning Plan.
- .34 Plan and conduct a commissioning scoping meeting and other commissioning meetings.
- .35 Before startup, review the current control sequences and interlocks and work with Contractors and Consultants until sufficient clarity has been obtained, in writing, to be able to write detailed functional testing procedures.
- .36 Review *Subcontractor* submittals applicable to systems being commissioned. Request and review additional information required to perform commissioning tasks, including O&M materials, subcontractor start-up and checkout procedures.
- .37 Prepare pre-functional tests and test sheets.
- .38 Perform site visits, as necessary, to observe component and system installations, start-ups, to inspect envelope assemblies etc. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

- .39 Review HVAC piping test and flushing reports and ductwork testing reports. Notify the owner and/or the PM of any deficiencies in results or procedures.
- .40 Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observation and spot checking.
- .41 Approve systems start-up by reviewing start-up reports and by selected site observation.
- .42 Review testing reports of the control system
- .43 Review air and water balancing by reviewing reports and spot checking during functional testing.
- .44 Witness/ review contractor electrical testing (ex. generator, ATS, lighting control). Notify the owner and/or the PM of any deficiencies in results or procedures.
- .45 Witness performance testing of building envelope components/ assemblies executed by others. Review completed test sheets.
- .46 With necessary assistance and review from installing Contractors, write the functional performance test procedures for equipment and system. This may include energy management control system trending, stand-alone data-logger monitoring, or manual functional testing.
- .47 Analyze any functional performance trend logs and monitoring data to verify performance.
- .48 Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved. Perform actual functional testing with contractors on equipment to be commissioned.
- .49 Maintain a master deficiency and resolution log and a separate testing record.
- .50 Review the preparation of the O&M manuals.
- .51 Verify the training program for the *Owner's* operating personnel.
- .52 *Provide* a Final Commissioning Report and Commissioning Record.
- .53 Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
- .54 Return to site prior to the end of the 1 year warranty period and review with facility staff the current building operation and identify any problems or concerns. *Provide* a report with recommendations and identify areas that may come under warranty or under the original construction contract.

3.13. PROJECT MANAGER COMMISSIONING RESPONSIBILITIES

- .55 Facilitate the coordination of the commissioning work by the CxA and ensure that commissioning activities are being scheduled into the master schedule.
- .56 Review the final Commissioning Plan.
- .57 Attend a commissioning scoping meeting and other commissioning team meetings.
- .58 Perform the normal review of *Subcontractor* submittals.
- .59 Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
- .60 Observe and witness mock-ups (if required), pre-functional test sheets, startup and functional testing and building envelope testing, at their discretion.
- .61 Review commissioning progress and deficiency reports.
- .62 Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
- .63 Review commissioning test results.
- .64 Coordinate the training of owner personnel.

- .65 Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Final Commissioning Program.
- .66 Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

3.14. GENERAL CONTRACTOR COMMISSIONING REQUIREMENTS

- .67 Facilitate the coordination of the commissioning work by the CxA, and coordinate with the Subs to ensure support throughout commissioning. Ensure that commissioning activities are being scheduled into the master schedule.
- .68 Review the final Commissioning Plan.
- .69 Attend a commissioning scoping meeting and other commissioning team meetings.
- .70 Include the cost of commissioning in the total contract price.
- .71 Perform the normal review of *Subcontractor* submittals.
- .72 In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
- .73 Ensure that all Subs execute their commissioning responsibilities according to the *Contract Documents* and schedule.
- .74 Observe mock-ups, pre-functional test sheets, startup and functional testing, specialty system testing and building envelope performance testing at their discretion.
- .75 Review commissioning progress and deficiency reports.
- .76 Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
- .77 Sign-off on individual commissioning tests as completed and passing.
- .78 *Provide*, coordinate and schedule all required training of owner personnel. See 3.14 of this specification 01 91 00 for more information.
- .79 Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.
- .80 Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CxA, according to the specifications.
- .81 Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

3.15. EQUIPMENT SUPPLIER COMMISSIONING RESPONSIBILITIES

- .82 *Provide* all requested submittal data, including detailed start-up procedures and specific responsibilities of the *Owner* to keep warranties in force.
- .83 Assist in equipment testing per agreements with Subs, which may include factory tests and the development of associated reports.
- .84 Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to *Contract Documents* in the base bid price to the *Subcontractor*, except for stand-alone data-logging equipment that may be used by the CxA.
- .85 Through the Contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.

- .86 *Provide* information requested by CxA regarding equipment sequence of operation and testing procedures.
- .87 Review test procedures for equipment installed by factory representatives.

3.16. MEETINGS

- .88 The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to create the Commissioning Plan to its “final” version, which will also be distributed to all parties.
- .89 Miscellaneous Meetings. Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CxA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.17. REPORTING

- .90 The CxA will *Provide* regular updates to the PM and/or the owner, depending on the management structure, with increasing frequency as construction and commissioning progresses.
- .91 The CxA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes.
- .92 Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- .93 A final commissioning summary report developed by the CxA will be provided to the PM and/or the owner, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. Pre-functional test sheets and functional tests will be appended to the summary report and combined with the executed Commissioning Program to form the Commissioning Record.

3.18. SUBMITTALS

- .94 Contractors will *Provide* the CxA standard submittals required to facilitate the commissioning work. This process will be integrated into the normal submittal process and protocol of the construction team. At a minimum, the submittals will include equipment, system, building envelope and controls related shop drawings, the manufacturer’s printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings, and details of owner contracted tests. In addition, the installation and checkout materials that are shipped inside the equipment and the field checkout forms to be used by the factory or field technicians shall be submitted to the CxA. All documentation requested by the CxA will be included by the Subs in their O&M manual contributions.
- .95 The CxA will review submittals related to the commissioned equipment for use in the development of functional test procedures.
- .96 The CxA may request additional design narrative from the *Consultant* and Controls *Subcontractor*, depending on the completeness of the design intent documentation and sequences provided with the *Specifications*.
- .97 These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the GC, though the CxA will review them.

3.19. MOCK-UP, START-UP, PRE-FUNCTIONAL TEST SHEETS AND INITIAL CHECKOUT

- .98 The following procedures apply to the appropriate mechanical and electrical equipment and building envelope components to be commissioned. Some systems that are not comprised so much of actual dynamic machinery (e.g. electrical system power quality) may have very simplified PFTs and startup.
- .1 Mock-Up Tests. As required, mock-up tests are developed and executed by others (subs). The mock-up tests including the testing of a prototype or replica of the building envelope components/ assemblies to verify performance prior to full scale construction.
 - .2 Start-up and Initial Checkout Plan. The CxA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for pre-functional test sheets and startup are identified in the commissioning scoping meeting and in the checklist forms. The parties responsible for executing functioning performance testing are detailed in specific commissioning specification sections (refer to Section 01 91 00 subsection 1.6 of this document for details).
 - .3 Pre-functional Tests. PFTs are generally provided by the CxA to the GC. The GC determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution. Pre-functional tests are a critical commissioning piece in order to ensure functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
 - .4 The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CxA's test sheets with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include test sheets and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:
 - .1 The CxA's pre-functional test sheets.
 - .2 The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - .3 The manufacturer's normally used field checkout sheets.
 - .5 The subcontractor submits the full startup plan to the CxA for review.
 - .6 The CxA reviews the procedures and the format for documenting them, noting any procedures that need to be added.
 - .7 The full start-up procedures and the approval form may be provided to the PM for review depending on management protocol.
- .99 Sensor and Actuator Calibration:

- .1 All field-installed temperature, relative humidity, CO/CO₂, and pressure sensors/gauges, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if accepted by the *Owner* in advance. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
 - .2 All procedures used shall be fully documented on the pre-functional test sheets or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
- .100 Sensor Calibration Methods:
- .1 All Sensors Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure.
 - .2 Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or Building Automation System (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
 - .3 Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or BAS) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.
- .101 Tolerances, Standard Applications
- .1 The following tolerances shall apply unless superseded in the contract documents.

SENSOR	REQ TOLERANCE [+/-]
Cooling coil, chilled and condenser water temps	0.22°C (0.4°F)
AHU wet bulb or dew point	1.11°C (2.0°F)
Hot water coil and boiler water temp	0.83°C (1.5°F)
Outside air, space air, duct air temps	0.22°C (0.4°F)
Watt hour, voltage & amperage	1% of design
Pressures, air, water and gas	3% of design
Flow rates, air	10% of design

SENSOR	REQ TOLERANCE [+/-]
Flow rates, water Relative humidity	4% of design 4% of design
Combustion flue temps	2.78°C (5.0°F)
Oxygen or CO ₂ monitor	0.1 % pts
CO monitor	0.01 % pts
Natural gas and oil flow rate	1% of design
Steam flow rate	3% of design
Barometric pressure	338.639 Pa (0.1 in. of Hg)

.102 Valve and Damper Stroke Setup and Check:

- .1 EMS Readout For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- .2 Closure for heating coil valves (NO): Set heating setpoint 11.11°C (20°F) above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 11.11°C (20°F) below room temperature. Observe the valve close. Restore to normal.
- .3 Closure for cooling coil valves (NC): Set cooling setpoint 11.11°C (20°F) above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 11.11°C (20°F) below room temperature. Observe valve open. Restore to normal.

.103 Execution of Pre-functional Test Sheets and Startup:

- .1 Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the PM, GC and CxA. The performance of the pre-functional test sheets, startup and checkout are directed and executed by the Sub or vendor. When checking off pre-functional test sheets, signatures may be required of other Subs for verification of completion of their work.
- .2 The CxA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as accepted by the PM).
- .3 For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CxA shall observe a sampling of the pre-functional and start-up procedures.
- .4 The Subs and vendors shall execute startup and *Provide* the CxA with a signed and dated copy of the completed start-up and pre-functional tests and test sheets.
- .5 Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

.104 Deficiencies, Non-Conformance and Approval in Test Sheets and Startup:

- .1 The Subs shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of test completion.
- .2 The CxA reviews the report and submits either a non-compliance report or an approval form to the Sub or PM. The CxA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CxA will involve the PM and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the test sheets and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CxA recommends approval of the execution of the test sheets and startup of each system to the PM using a standard form.

3.20. FUNCTIONAL TESTING

- .105 This sub-section applies to all commissioning functional testing for all divisions.
- .106 Systems to be Commissioned: The list of equipment to be commissioned is detailed in specific commissioning specification sections (refer to Section 01 91 00 subsection 1.8 of this document for details).
- .107 Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and *Contract Documents*. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
- .108 In general, each system should be operated through all modes of operation (where applicable). Verifying each sequence in the sequences of operation is required, as well as verifying correct response to failure scenarios.
- .109 Development of Test Procedures: Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in specific commissioning specification sections (refer to Section 01 91 00 subsection 1.6 of this document for details), the CxA shall develop specific test procedures and forms to verify and document proper operation of each piece or M&E equipment and system including controls. Each Sub or vendor responsible to execute a test, shall *Provide* limited assistance to the CxA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxA shall *Provide* a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CxA may submit the tests to the *Consultant* for review, if requested.
- .110 Building Envelope Test procedures: Test development for the building envelope components/assemblies shall be joint responsibility of the appropriate sub or installing contractor and CxA. The test forms shall be executed on site by the appropriate parties as per contract. Building envelope tests developed/ executed by others may be witnessed by the CxA as appropriate, and completed test forms shall be provided to the CxA and commissioning team. The CxA shall *Provide* sign off on for these systems once the tests have been proven satisfactory, and all deficiencies have been resolved.
- .111 The CxA shall review owner-contracted, factory testing or required owner acceptance tests which the CxA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.
- .112 The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.
- .113 The test procedure forms developed by the CxA for M&E shall include (but not be limited to) the following information:
 - .1 System and equipment or component name(s)
 - .2 Equipment location and ID number
 - .3 Date
 - .4 *Project* name
 - .5 Participating parties
 - .6 A copy of the specification section describing the test requirements
 - .7 A copy of the specific sequence of operations or other specified parameters being verified

- .8 Required pre-test field measurements (filled-up pre-functional tests)
- .9 Instructions for setting up the test.
- .10 Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
- .11 Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
- .12 A section for comments
- .13 Signatures and date block for the CxA and all participating parties.
- .114 Test Methods:
 - .1 Test Execution: Functional performance testing may be achieved by manual testing (persons manipulate the equipment or simulate conditions and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities. The CxA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the PM. This may require a change order and adjustment in charge to the *Owner*. The CxA will determine which method is most appropriate for tests that do not have a method specified.
 - .2 Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 - .3 Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
 - .4 Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
 - .5 Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout setpoint to be 2°F above the current outside air temperature.
 - .6 Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during pre-functional testing.
 - .7 Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall *Provide* all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

- .8 Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution. Sampling strategies will be determined at the discretion of the CxA with approval by the PM.
- .9 If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA will stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

.115 Coordination and Scheduling:

- .1 The Subs shall *Provide* sufficient notice to the CxA regarding their schedule for mock-up testing, completion of pre-functional test sheets, startup of all equipment and systems, and building envelope testing. The CxA will schedule functional tests through the PM, GC and affected Subs. The CxA shall direct, witness and document the functional testing of mechanical and electrical equipment and systems. The Subs shall execute the tests.
- .2 In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CxA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
- .3 Test Equipment: Refer to Section 01 91 00, Part 2 for test equipment requirements. Equipment required for building envelope commissioning tests will be provided by the party executing the applicable test.
- .4 Problem Solving: The CxA will recommend solutions to problems found, however it is the responsibility of the *Consultant*, subs, and the GC to solve, correct and retest problems.

3.21. DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- .116 Documentation: The CxA shall witness and document the results of functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the PM and Subs for review. The CxA will include the filled out forms in the Commissioning Record.

.117 Non-Conformance:

- .1 All deficiencies or non-conformance issues shall be noted and reported to the PM on a standard non-compliance form.
- .2 Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
- .3 Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues.
- .4 Any deficiencies identified during mock-up testing shall be rectified prior to proceeding with construction of that component

- .5 As tests progress and a deficiency is identified, the CxA discusses the issue with the executing subcontractor.
 - .1 When there is no dispute on the deficiency and the Sub accepts responsibility to correct, the following course of action occurs:
 - .2 The CxA documents the deficiency in deficiency tracking log and issues to the *Project Team*. The Sub corrects the issue and signs off on the deficiency tracking log indicating the issue has been resolved
 - .3 The CxA reschedules the test and the test is repeated. If the test is successful, the CxA closes the item.
- .6 If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - .1 The deficiency shall be documented on the deficiency tracking log with the Sub's response and a copy given to the PM and to the Sub representative assumed to be responsible.
 - .2 Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the *Consultant*. Final acceptance authority is with the *Project Manager*.
 - .3 The CxA documents the resolution process.
 - .4 Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs off on the deficiency tracking log and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved, at which time the CxA closes the item.
- .7 Cost of Retesting:
 - .1 The cost for the Sub to retest a Pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
 - .2 For a deficiency identified, not related to any Pre-functional checklist or start-up fault, the following shall apply: The CxA will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CxA's time for a second retest will be charged to the GC, who may choose to recover costs from the responsible Sub.
 - .3 The time for the CxA to direct any retesting required because a specific Pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the GC, who may choose to recover costs from the party responsible for executing the faulty Pre-functional test.
 - .4 Refer to the sampling section of Section 01 91 00, Part 3.10 for requirements for testing and retesting identical equipment.
- .8 The GC shall respond in writing to the CxA and PM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
- .9 The CxA retains the original deficiency tracking log until the end of the project.
- .10 Any required retesting by any subcontractor shall not be considered a justified reason for a claim of delay or for a time extension by the GC.
- .118 Approval:

- .1 The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA and by the PM, if necessary. The CxA recommends acceptance of each test to the PM using a standard form. The PM gives final approval on each test using the same form, providing a signed copy to the CxA and the GC.

3.22. OPERATION AND MAINTENANCE MANUALS

- .119 The specific content and format requirements for the standard O&M manuals are detailed in Mechanical & Electrical *Specifications* by the Consultants. ASHRAE Guideline 4-2008 is the recommended format.
- .120 The CxA shall review the O&M manuals, documentation and as-builts for systems that were commissioned and to verify compliance with the *Specifications*. The CxA will communicate deficiencies in the manuals to the PM or *Consultant*. Upon a successful review of the corrections, the CxA recommends acceptance of these sections of the O&M manuals to the PM or *Consultant*. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the *Consultant's* review of the O&M manuals according to the *Consultant's* contract.

3.23. TRAINING OF OWNER PERSONNEL

- .121 The GC shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed for commissioned equipment.
- .122 The PM shall interview the FM staff and lead engineer to determine the special needs and areas where training will be most valuable. The *Owner* and PM with input from the CxA as required shall decide how rigorous the training should be for each piece of commissioned equipment. The PM shall coordinate with the GC to ensure the results are communicated to the Subs and vendors who have training responsibilities.
- .123 In addition to these general requirements, the detailed training requirements of *Owner* personnel by Subs and vendors is detailed in specific commissioning specification sections (refer to Section 01 91 00 subsection 1.6 of this document for details).
- .124 Each Sub and vendor responsible for training will submit a written training plan to the Cx Team for review and approval prior to training. The plan will cover the following elements:
 - .1 Equipment (included in training)
 - .2 Intended audience
 - .3 Location of training
 - .4 Objectives
 - .5 Subjects covered (description, duration of discussion, special methods, etc.)
 - .6 Duration of training on each subject
 - .7 Instructor for each subject
 - .8 Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - .9 Instructor and qualifications
- .125 For the primary HVAC equipment, the Controls *Subcontractor* shall *Provide* a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

- .126 The M&E *Consultant* shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall include a review of all systems using the simplified system schematics including chilled water systems, heating systems, air distribution system, control system strategies, electrical distribution, etc.
- .127 The GC develops an overall training schedule with the PM with input from the *Owner* and FM staff. The CxA shall oversee implementation of the training plan. The *Owner* and FM staff shall advise the PM and CxA if training was satisfactorily completed.

3.24. DEFERRED TESTING

- .128 All necessary testing shall be completed for all required equipment/ systems. This includes, but is not limited to, projects that are occupied or operational before all equipment has been installed, or projects that reach substantial completion during peak heating or cooling months. Deferred and/or seasonal testing will be directed and documented by the CxA. The *Contractor/ Subs* shall be involved in any required deferred and/ or seasonal testing including aiding in the execution of tests and conducting required deficiency corrections. Testing shall be completed including deficiency resolution even if activities occur after the project is completed.
- .129 Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of test sheets and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.
- .130 Seasonal Testing During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.25. WRITTEN WORK PRODUCTS

- .131 The commissioning process generates a number of written work products described in various parts of the *Specifications*. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

PRODUCT		DEVELOPED BY
1	Final Commissioning Plan	CxA
2	Commissioning Meeting Minutes	CxA
3	Commissioning Schedule	GC with CxA and PM
4	Equipment Documentation Submittals	Subs
5	Mock-Up Test Reports	Subs
6	Sequence Clarifications	Subs and <i>Consultant</i> (as needed)
7	Pre-functional Test Sheets	CxA
8	Filled out Pre-Functional Test Sheets	Subs
9	Start-up and Initial Checkout Plan	Subs and CxA
10	Start-up and Initial Checkout/ Reports	Subs
11	Final TAB Report	TAB Subcontractors
12	Commissioning Issues Log (deficiencies)	CxA
13	Functional Test Forms	CxA

14	Filled Out Functional Test Forms	CxA
15	Building Envelope Test Forms	Subs and CxA
16	Filled Out Building Envelope Test Forms	Subs and CxA
17	O&M Manuals	Subs
18	Overall Training Plan	GC and PM
19	Specific Training Agendas	Subs
20	Final Commissioning Report and Record	CxA

APPENDIX A – COMMISSIONING ROLES AND RESPONSIBILITIES MATRIX

No.	ACTIVITY	COMMISSIONING TEAM					
		Owner/ PM	Consultant	CxA	GC	Subs/ Vendors	FM Staff
Commissioning Activities During Design							
1	Cx Review of Design Docs, Drawings and Specs	Review	Review	Provide			
2	Establish Cx Specs	Review	Review	Provide	Review	Review	
3	Include Cx Specs in Construction Documents		Provide				
4	Establish Cx Plan	Approve	Review	Provide	Assist	Assist	Review
Commissioning Activities During Construction & Performance Verification							
5	Contractor Shop Drawings	Review	Review	Review	Assist	Provide	
6	Develop Cx Schedule & Integrate with Master Schedule	Review		Assist	Provide	Assist	
7	Conduct Cx Meetings			Provide			
8	Maintain list of systems and their Cx status (CPM)	Review		Provide	Assist	Assist	
9	Maintain list of Cx issues, status, resolution (IOC Report)	Review	Review	Provide	Review	Assist	Review
10	Conduct Cx focused site visits			Provide	Assist	Assist	
11	Conduct Building Envelope Mock-ups, Submit Reports	Review	Review	Review	Assist	Provide	
12	Establish Start-Up Procedures for Systems			Review	Review	Provide	
13	Establish Equipment Specific Pre-Functional Test Sheets	Review	Review	Provide	Review	Assist	Review
14	Establish System Specific Functional Test Sheets (M, E, BAS)	Review	Review	Provide	Review	Assist	Review
15	Establish Building Envelope Checks and Tests	Review	Review	Provide/ Review	Assist	Provide	
16	Perform Construction QC testing & inspections				Provide	Provide	
17	Verify readiness for startup & Cx checking				Assist	Provide	
18	Complete Start-ups and Cx Pre-functional test sheets	Review		Review		Provide	
19	Provide Controls Verification Report	Review	Review	Review		Provide	
20	Provide Balancing Report	Review	Approve	Review		Provide	
21	Schedule & Coordinate execution of Cx testing			Assist	Provide	Assist	
22	Operate & demonstrate system equipment during Cx					Provide	
23	Complete Cx Functional Test Sheet (M, E, BAS)	Review		Provide	Assist	Assist	
24	Complete Building Envelope Testing	Review		Provide/ Review	Provide	Provide	

No.	ACTIVITY	COMMISSIONING TEAM					
		Owner/ PM	Consultant	CxA	GC	Subs/ Vendors	FM Staff
Commissioning Activities During Design							
25	Witness Functional Testing as appropriate	Provide		Provide	Provide	Provide	Provide
26	Resolve Issues Identified During Commissioning	Approve	Assist	Approve	Provide	Provide	
27	Establish O&M manual	Review	Approve	Review	Provide	Provide	Review
Commissioning Activities During Training							
28	Establish training curriculum; Schedule & Agenda	Approve		Review	Provide	Provide	Review
29	Deliver training program	Review		Review	Assist	Provide	
30	Participate as Trainee						Provide
31	Verify training has been delivered	Provide		Provide	Provide		Provide
32	Administer trainee attendance, records				Provide	Assist	
Commissioning Activities During Post Occupancy							
33	Provide Final Cx Record and Documentation	Approve		Provide	Review		
34	Establish schedule for post occupancy cx activities	Review		Provide	Assist		
35	Complete Seasonal/ Deferred Cx Testing (as required)	Review		Provide			
36	Witness Seasonal/ Deferred Cx Testing as appropriate	Review		Provide	Provide	Provide	Provide
37	Conduct a post-occupancy (10 month warranty) review	Assist		Provide			Assist

Legend:		
Provide - Responsible for Delivery	Approve - Authorize Document	Blank - NA
Assist - Provide Support	Review - Review & Provide Comment	

END OF SECTION

2.1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.

3.1. APPLICABLE STANDARDS

- .1 Applicable Standards are listed below:
 - .1 2015 ASHRAE Handbook – HVAC Applications Chapter 43 HVAC Commissioning
 - .2 ASHRAE Guideline 1.1 – 2007 – The HVAC&R Technical Requirements for the Commissioning Process
 - .3 ASHRAE Guideline 0 – 2013 – The Commissioning Process
 - .4 ASHRAE 202 – 2013 – Commissioning Process for Buildings and Systems
 - .5 ASHRAE Guideline 4-2008 – Preparation of O&M Documentation
 - .6 ATSM E2813 – Standard Practice for Building Enclosure Commissioning
 - .7 ATSM E2947 – Standard Guide for Building Enclosure Commissioning
 - .8 CSA Z320-11 Building Commissioning Standard & Check Sheets
 - .9 CSA C282-15 – Emergency Power Supply for Buildings
 - .10 NIBS Guideline 3-2012 – Building Enclosure Commissioning Process

3.2. GENERAL

- .2 The purpose of this section is to specify building envelope commissioning responsibilities as required by Divisions 7 & 8.
- .3 1.2.2. Commissioning requires the participation of Divisions 7 & 8 to ensure that exterior building envelope components and assemblies including system-to-system interfaces are tested in compliance with relevant standards and meet or exceed the performance requirements stipulated *Contract Documents*. The general commissioning requirements and coordination are detailed in Section 01 91 00. The Building Envelope Subcontractors shall be familiar with all applicable parts of Section 01 91 00 and the commissioning plan issued by the CxA and shall execute all commissioning responsibilities assigned to them in the *Contract Documents* including and building envelope testing requirements in Divisions 7 & 8 including those of the specifications listed in Section 1.5 of this 01 91 19.

3.3. SYSTEMS TO BE COMMISSIONED

- .4 Systems to be commissioned as part of this contract include, but may not be limited to the following:
 - .1 Building Envelope
 - .1 Air/vapour barrier
 - .2 Curtain walls
 - .3 Roofing
 - .4 Thermal insulation

3.4. COMMISSIONING TEAM

- .5 The Commissioning Team shall consist of representatives of the following as appropriate:
 - .1 Owner and the Owner's FM Staff

- .2 *Consultant*
- .3 Commissioning Authority (CxA)
- .4 General *Contractor* (GC)
- .5 Subcontractors (Mechanical, Electrical, Controls, TAB, Building Envelope)
- .6 Specialized third-party for verification

3.5. RELATED WORKS

- .7 The following specification sections detail building envelope testing requirements which shall apply to the *Work* of this section 01 91 19:
 - .1 01 45 00 – Quality Control
 - .2 07 13 26 – Sheet Waterproofing
 - .3 07 21 00 – Thermal Insulation
 - .4 07 26 13 – Above-Grade Vapour Barrier
 - .5 07 26 16 – Below Grade Vapour Barrier
 - .6 07 27 00 – Air Barrier Systems
 - .7 07 52 16 – Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
 - .8 07 92 00 – Joint Sealants
 - .9 08 11 13 – Steel Doors and Frames
 - .10 08 35 13 – Four-Fold Metal Doors
 - .11 08 36 13 – Sectional Overhead Metal Doors A
 - .12 08 41 00 – Aluminum Framed Glazing Systems
 - .13 08 80 00 – Glass and Glazing

2.2 PRODUCTS

Not Used.

2.3 EXECUTION

3.6. COMMISSIONING AUTHORITY RESPONSIBILITIES

- .6 The Commissioning Authority shall:
 - .1 Plan, organize and implement the commissioning process as specified herein;
 - .2 Prepare the commissioning plan, ensure its distribution for review and comment;
 - .3 Revise the commissioning plan as required during construction;
 - .4 Chair commissioning meetings, and prepare and distribute minutes to all commissioning team members, whether or not they attended the meeting;
 - .5 In conjunction with the GC, coordinate commissioning activities;
 - .6 Assist GC/Subs, as required, in development of building envelope performance test procedures/ review forms prior to execution;
 - .7 Monitor system verification checks, and ensure the results are documented as the checks are done;

- .8 Direct the GC and applicable *Subcontractor's* to conduct building envelope commissioning testing on building enclosure elements/ assemblies as required to ensure that all required performance tests are carried out for verification purposes;
- .9 Witness building envelope performance tests and track results;
- .10 Perform additional building envelope testing and spot checks and track results;
- .11 Prepare and submit a commissioning report which documents all checks and tests done throughout the commissioning process, and the results obtained from each;
- .12 Ensure all required O&M manuals, instructions and demonstrations are provided to the *Owner's* designated facility operating staff.

3.7. CONSULTANT RESPONSIBILITIES

- .7 The *Consultant* commissioning responsibilities are outlined below:
 - .1 Review the commissioning plan, proposed test procedures, and participate (as appropriate) in on-site commissioning meetings.
 - .2 At their discretion during the acceptance phase of the commissioning process, be on site to review commissioning documentation, to witness building envelope commissioning tests, and to analyze the installation and its performance

3.8. OWNER RESPONSIBILITIES

- .8 The *Owner* shall have the following commissioning responsibilities
 - .1 Ensure the availability of facility operations staff for all scheduled instructions and demonstration sessions (training).
 - .2 At their discretion, witness commissioning performance tests.

3.9. SUBCONTRACTOR RESPONSIBILITIES

- .9 All required testing per the specifications, unless other specified, shall be subcontracted by the GC (through various Building Envelope Subcontractors and Testing Agencies). Testing shall be conducted by an agency, fully accredited by the appropriate governing body for each of the components of systems to be tested or evaluated for compliance with the requirements of the *Contract Documents*.
- .10 The commissioning responsibilities applicable to the GC's Building Envelope Subcontractors are as follows:
 - .1 Documentation of all testing and inspection reports on building envelope shall be provided and forwarded to the CxA. Written documentation must contain recorded test values of all tests performed per the individual product specification.
 - .2 *Provide* schedule of field quality and control tests and inspections required by the *Contract Documents* to the CxA.
 - .3 Perform tests using qualified personnel. *Provide* jobsite and building envelope assembly/ component access. *Provide* necessary instruments and equipment to conduct testing including mock-ups and building envelope performance testing.
 - .4 Include the cost of commissioning in the contract price.
 - .5 In each purchase order or subcontract written, include requirements for submittal data.
 - .6 Attend a building envelope commissioning scoping meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.
 - .7 Contractors shall *Provide* normal cut sheets and shop drawing submittals to the CxA of commissioned equipment. *Provide* additional requested documentation, to the CxA for

- development of mock-up test procedures, pre-functional and building envelope performance testing procedures.
- .8 Typically, this will include detailed manufacturer installation and initial checkout, full details of any owner-contracted tests, laboratory testing reports (if any), and full warranty information including all responsibilities of the *Owner* to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority.
 - .9 The Commissioning Authority may request further documentation necessary for the commissioning process. This data request may be made prior to normal submittals.
 - .10 Contractors shall assist (along with the design engineers) in clarifying the function or performance of commissioned equipment in areas where the specifications, or component documentation is not sufficient for writing detailed testing procedures.
 - .11 Prepare mock-up test procedures (if required) as specified in the *Contract Documents/ Project Specifications*. Subs shall ensure test procedures support feasibility, safety and envelope material/ component protection.
 - .12 *Provide* skilled technicians to execute any required mock-up testing following approved procedures. Tests may be witnessed by the *Owner* or other parties as appropriate. Submit completed mock-up tests reports to the CxA, PM, GC.
 - .13 Develop an initial checkout plan using manufacturer's procedures and the pre-functional test sheets from the CxA. Submit manufacturer's detailed procedures and other requested equipment documentation to CxA for review.
 - .14 During the checkout process, execute and document the building envelope related portions of the pre-functional test sheets provided by the CxA for commissioned building envelope components.
 - .15 With assistance from the CxA, as required, prepare the specific building envelope performance test procedures specified in the *Contract Documents* and as required by Divisions 7 & 8. Subs shall ensure test procedures to ensure feasibility, safety and envelope material/ component protection.
 - .16 *Provide* skilled technicians to execute starting of equipment and to execute the building envelope performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving where performance does not meet the design requirements and contract documents.
 - .17 Perform building envelope performance testing, using approved test forms, under the direction/ witnessing of the CxA for specified equipment in sub-section 1.3 of this section (Section 01 91 19) and as required by the *Contract Documents* and divisions 7 & 8 (as applicable). Assist the CxA in interpreting the monitoring data, as necessary.
 - .18 Correct deficiencies (differences between specified and observed performance) as interpreted by the CxA, PM, GC and *Consultant* and retest the equipment.
 - .19 Cost associated with re-testing caused by failure of the exterior building envelope tests during mock-ups or construction phase performance testing shall be the responsibility of the GC and applicable *Subcontractor's*. These costs also include fees and reimbursable expenses for the *Owner's* consultant and CxA to witness the re-tests.
 - .20 During construction, maintain as-built red-line drawings for all drawings. Update after completion of commissioning (excluding deferred testing). Prepare red-line as-built drawings for all drawings.
 - .21 Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

- .22 *Provide* any operational and maintenance data for the building enclosure systems, subsystems and components to the Commissioning Agent.
- .23 Execute deferred performance testing, if required, witnessed by the CxA, according to the specifications.
- .24 Correct deficiencies and make necessary adjustments to as-built drawings for applicable issues identified in any deferred testing.

3.10. SUBMITTALS

- .11 Section 7 & 8 Contractors shall *Provide* submittal documentation relative to building envelope commissioning to the CxA as requested by the CxA. These submittals may be in addition to those specified in Section 01 91 00 Part 3.8.
 - .1 Qualifications Data: For fabricators, installers, and testing agencies, submit to the Commissioning Agent for review all qualifications required in Divisions 7 & 8 for review.
 - .2 Preconstruction Mock-Up Test Reports: all preconstruction air and water leakage performance test results, including all failed tests, recording the noted deficiency and the required repair, and *Provide* a copy of all remediation processes and QC/QA processes that will be put in place to address the deficiency on future work product
 - .3 Source Quality Control Reports: retain a copy for field review by the Commissioning Agent and include in the closeout submittal a copy of all manufacturer QA/QC reports submitted for products supplied for the project
 - .4 Field Quality Control Reports: *Provide* a copy of the test reports for all field water and air penetration and other appropriate building exterior enclosure tests completed

3.11. MOCK-UP TESTS

- .12 The appropriate GC's Subcontractors shall follow the mock-up and initial checkout procedures listed in the Responsibilities list in this section 3.4 and this section 3.6. Mock-ups shall follow *Contract Documents*/ specifications as; Refer to 01 45 00 – Quality Control and Division 7 and 8 specifications related to the building envelope mock-ups. The GC or applicable *Subcontractor(s)* are required to complete component/ mock-ups for various assemblies to ensure building envelope components are fully functional, meeting the design objectives of the *Contract Documents*. The commissioning procedures and building envelope testing do not relieve or lessen this responsibility or shift that responsibility partially to the Commissioning Authority or *Owner*.
- .13 Coordinate installation of exterior envelope and materials for which mock-up are required in individual specifications, along with supporting material. Coordinate construction of full-size mock-ups according to approved shop drawings. Mock-up of the exterior envelope shall be erected separately from the building but on project site, consisting of multiple products, assemblies, and sub-assemblies as required.
- .14 Parts of the work not conforming to acceptable mock-ups and quality control shall be rejected. All deficiencies shall be resolved prior to full scale construction of the exterior building envelope structure.

3.12. PRE-FUNCTIONAL TEST SHEETS

- .15 Pre-functional test sheets contain items for the GC and appropriate *Subcontractor's* to perform. On each checklist, a column is provided that is to be completed by the GC assigning responsibility for that line item to a trade. Those executing the test sheets are only responsible to perform items that apply to the specific application at hand. These test sheets do not take the place of the manufacturer's recommended checkout procedures or report. Some checklist procedures may be redundant in relation to checkout procedures that will be documented on typical laboratory testing checkout sheets. Double documenting may be required in those cases.

- .16 Refer to Section 01 91 00 for additional requirements regarding mock-up, pre-functional test sheets, startup and initial checkout.

3.13. BUILDING ENVELOPE PERFORMANCE TESTING

- .17 The appropriate Subcontractors shall follow the building envelope performance testing procedures listed in the Responsibilities list in this Section 01 91 00, Part 3.11, this section 3.8 as applicable, and the testing requirements outlined in the specifications listed in Section 1.1 Related Works of this 01 91 19. Building envelope testing shall be in accordance with the requirements of Divisions 7 & 8. Subcontractors applicable to building envelope work have the responsibility and is required to complete all required building envelope testing to ensure compliance with the design performance requirements and the *Contract Documents*.
- .18 Building envelope performance testing is intended to begin upon completion of an assembly or enclosure system. Building envelope testing may proceed prior to completion of the entire building enclosure system at the discretion of the CxA and PM. Beginning testing before full completion, does not relieve the *Subcontractor* from fully completing the system, including all Pre Functional test sheets as soon as possible.
- .19 Equipment or tools required to execute any building envelope testing shall be provided by the party executing the test.
- .20 Building envelope testing shall comply with the *Contract Documents* and include for all envelope testing as required by Divisions 7 & 8 as applicable. The following building envelope performance test procedures are recommended:
 - .1 Air Barrier:
 - .1 Detection Liquid Air Testing per ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes
 - .1 Testing shall be completed on 2-3 locations
 - .2 Curtain Wall & Windows:
 - .1 Air Infiltration Testing per ATSM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
 - .1 Testing shall be completed on 2-3 locations
 - .2 Water Penetration Testing per ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
 - .1 Testing shall be completed on 2-3 locations.
 - .3 Various Wall Assemblies
 - .1 Dynamic Water Penetration Testing in accordance with AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain walls and Doors Using Dynamic Pressure
 - .1 Used at junctions between window and wall types
 - .2 Sealant Pull Test per ASTM C1193 – Standard Guide for Use of Joint Sealants
 - .1 Any cuts made shall be repaired by the installer
 - .3 Pull Adhesion Test for project substrates in accordance with ASTM D4541-09e1 - Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers
 - .4 Roofing
 - .1 Infrared Roof Survey per ASTM C1153 - Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging and Capacitance
 - .1 Testing to be completed once the building is enclosed and conditioned.

- .21 The GC/ Subs shall coordinate testing with the required Testing Agency and inform the Cx Team including the CxA in advance of testing.
- .22 The GC/ Subs shall *Provide* powered scaffold, lifts, hose, water, electric supply, communication system and manpower to perform tests.
- .23 Subs/ Testing agency shall perform all required envelope testing. Test results shall be submitted to the Cx Team and CxA for review. The CxA may witness select tests and perform spot checks as required.
- .24 GC will work with the Test Agency and CxA to determine necessity for additional/ revised test methods and for field chamber tests based upon evaluation of initial test results. The CxA will interpret marginal results and adjust the test procedures as appropriate.
- .25 GC/ *Subcontractor* to perform out-of-sequence work as required facilitating system tests
- .26 Refer to Specification 01 91 00 for more information in addition to this 01 91 19

3.14. DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- .27 Refer to Specification 01 91 00 Part 3.12 for more information in addition to this 01 91 19.

3.15. TRAINING OF OWNER PERSONNEL

- .28 Refer to Specification 01 91 00 Part 3.14 for requirements for training, as required/ applicable to building envelope components/ assemblies

3.16. DEFERRED TESTING

- .29 Refer to Section 01 91 00, Part 3.15 for requirements of deferred testing.

3.17. WRITTEN WORK PRODUCTS

- .30 Written work products for building envelope commissioning will consist of the mock-up test reports, pre-functional test sheets and building envelope test sheets. Refer to Section 01 91 00 Part 3.16.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Related *Work*
- .4 1.4 References
- .5 1.5 Samples
- .6 2.1 Materials
- .7 2.2 Source Quality Control
- .8 3.1 Installation
- .9 3.2 Maintenance

1.3 RELATED WORK

- .1 Section 31 05 17 - Aggregates
- .2 Section 31 23 13 – Site Grading

1.4 REFERENCES

- .1 ASTM D4791-89, Test Method for Flat or Elongated Particles in Coarse Aggregate.
- .2 OPSS 1001.

1.5 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Allow continual sampling by the *Consultant* during production.
- .3 *Provide* the *Consultant* with access to source and processed material for sampling.
- .4 Install sampling facilities at discharge end of production conveyor to allow the *Consultant* to obtain representative samples of items being produced. Stop conveyor belt when requested by the *Consultant* to permit full cross section sampling.

PART 2 - PRODUCTS

2.1 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 Clear stone for mud mat and along bottom of silt control fencing: 50 mm clear stone in accordance with OPSS 1001.

- .3 Geotextile for siltation control fence shall be Class I non-woven geotextile fabric in accordance with OPSS 1860.

2.2 SOURCE QUALITY CONTROL

- .1 Inform the *Consultant* of proposed source of aggregates and *Provide* access for sampling at least four weeks prior to commencing production.
- .2 If, in the 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 the *Consultant* four weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection by the *Consultant* if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Mud Mat Installation
 - .1 Place clear stone to the dimensions indicated on the *Contract Drawings* to a depth of 300 mm.
 - .2 Remove and replace top layers of clear stone when they become laden with mud and the mud mat becomes ineffective in removing mud from equipment exiting the *Site*.
 - .3 The mud mat installation does not alleviate the *Contractor's* responsibility to clean mud from adjacent roadways as a result of the construction.
- .2 Silt Control Fence
 - .1 Install silt control fence along construction *Site* perimeter including tee bars, geotextile filter fabric, clear stone along the upstream side of the fence in the instance the ground is frozen.

3.2 MAINTENANCE

- .1 Maintain the mud mat and replace clear stone during the construction period as required to maintain the function of the mud mat.
- .2 Maintain silt control fencing for the duration of the construction and replace as required until the *Site* is stabilized as determined by the *Consultant*.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Related *Work*
- .4 1.4 References
- .5 2.1 Materials
- .6 3.1 Grade Preparation & Sub-Base Course
- .7 3.2 Granular Base
- .8 3.3 Concrete
- .9 3.4 Tolerances
- .10 3.5 Expansion and Contraction Joints
- .11 3.6 Curing
- .12 3.7 Linseed Oil Treatment
- .13 3.8 Backfill
- .14 3.9 Defective Concrete
- .15 3.10 Field Quality Control

1.3 RELATED WORK

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling
- .2 Section 32 11 23 - Granular Base
- .3 Section 32 11 19 - Granular Sub-Base
- .4 Section 32 12 16 - Asphalt Paving

1.4 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.2-M89, Boiled Linseed Oil
 - .2 CAN/CGSB-3.3-M89, Kerosene
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM D698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)

- .4 Ontario Provincial Standard Specification (OPSS) 353.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Concrete mixes and material shall conform to OPSS 1301, 1302, 1303, 1305, 1306, 1308, 1315, and 1350. Concrete for curb and toe wall construction shall have a minimum compressive strength of 30 MPa after 28 *Days*.
- .2 Granular Base and Sub-Base: in accordance to Section 32 11 23 and 32 11 19, respectively.
- .3 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to *Provide* water soluble soap.
- .4 Fill material: in accordance to Section 31 23 10 – Excavating, Trenching, Backfilling.
- .5 Boiled linseed oil: in accordance to CAN/CGSB-1.2.
- .6 Kerosene: in accordance to CAN/CGSB-3.3.

PART 3 - EXECUTION

3.1 GRADE PREPARATION & SUB-BASE COURSE

- .1 Grading: in accordance to Section 31 23 13 – Site Grading.
- .2 Place sub-base course of OPSS Granular 'B', Type I in maximum 150 mm loose lifts and compact to a minimum of 100% of SPMDD.

3.2 GRANULAR BASE

- .1 Obtain the *Consultant's* approval of subbase before placing granular base.
- .2 Place compacted OPSS Granular 'A' to depth, lines and widths as indicated.
- .3 Compact granular base to a minimum of 100% of SPMDD.

3.3 CONCRETE

- .1 Obtain the *Consultant's* approval of granular base.
- .2 Do concrete curb construction in accordance with OPSS 353.
- .3 *Provide* 1.0m. wide depressions in curb where specified on the *Drawings* as required to allow surface drainage to be conveyed to adjacent bio-swale areas.

3.4 TOLERANCES

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5 EXPANSION AND CONTRACTION JOINTS

- .1 Joints are to be constructed in accordance with OPSS 353.07.06.

3.6 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1 to exposed finished surfaces for at least one *Day* after placing, or by sealing moisture in by curing compound approved by the *Consultant*.

- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film. In accordance with manufacturer's requirements.
- .4 Concrete curing is to be in accordance with OPSS 904.

3.7 LINSEED OIL TREATMENT

- .1 After concrete has cured for specified curing time and when surface of concrete is dry, apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks, and gutters.

3.8 BACKFILL

- .1 Allow concrete to cure for seven *Days* prior to backfilling.
- .2 Backfill to designated elevations with material approved by the *Consultant*. Compact and shape to required contours as indicated by the *Consultant*.

3.9 DEFECTIVE CONCRETE

- .1 Concrete is defective when:
 - .1 Containing excessive honeycombing or embedded debris.
 - .2 Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
 - .3 Average 28-Day strength of any three consecutive strength tests is less than specified minimum 28-Day strength.
 - .4 Any 28-Day strength test result is more than 3.5 MPa below the specified minimum 28-Day strength.
- .2 Repair of defective concrete work:
 - .1 Repair defective areas while concrete is still plastic, otherwise wait until curing is completed. Use repair methods approved by the *Consultant*.
 - .2 Grind off high surface variations where required by the *Consultant*.
- .3 Remove and replace defective concrete where required by the *Consultant*:
 - .1 Remove between joints by sawing through concrete across full width.
 - .2 Replace with new concrete to this Section as required by the *Consultant*.
 - .3 Construct contraction joint between sawn face of existing concrete and face of new concrete.
 - .4 Install tie bars between old and new concrete as required by the *Consultant*.

3.10 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the *Consultant* in accordance with CAN/CSA-A23.1.
- .2 The *Consultant* may take additional test cylinders during cold weather concreting. Cure cylinders on *Site* under same conditions as concrete which they represent.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

1.2 SECTION INCLUDES

- .1 1.1 General requirements
- .2 1.2 Section Includes
- .3 1.3 Description
- .4 1.4 Reference Standards
- .5 1.5 Approved Products
- .6 1.6 Delivery, Material Handling and Storage
- .7 1.7 Engineering Design and Certification
- .8 1.8 Submittals
- .9 2.1 Definitions
- .10 2.2 Products
- .11 3.1 Design Standard
- .12 3.2 Soil
- .13 3.3 Design Geometry
- .14 3.4 State of Stress
- .15 3.5 Inclination of Failure Surface
- .16 3.6 Settlement Control
- .17 3.7 Global Stability
- .18 3.8 Inspection
- .19 3.9 Construction Tolerances
- .20 3.10 Site Preparation
- .21 3.11 Installing Drainage System
- .22 3.12 Leveling Base or Spread Footing Placement
- .23 3.13 Installation of Modular Concrete Retaining Wall Units
- .24 3.14 Drainage Soil
- .25 3.15 Retained Soil
- .26 3.16 Finishing Wall

1.3 DESCRIPTION

- .1 The work covered by this section includes the furnishing of all labor, materials, equipment and incidentals for the design, inspection and construction of a modular concrete retaining wall including the drainage system as shown on the Construction Drawings and as described by the *Contract Specifications*. The work included in this section consists of, but is not limited, to the following:
 - .1 Design, inspection and certification by a registered professional engineer.

- .2 Excavation and foundation soil preparation.
- .3 Furnishing and placement of the leveling base.
- .4 Furnishing and placement of the drainage system.
- .5 Furnishing and placement of geotextiles.
- .6 Furnishing and placement of segmental retaining wall facing units.
- .7 Furnishing and compaction of drainage and retained soils.

1.4 REFERENCE STANDARDS

- .1 Engineering Design
 - .1 NCMA Design Manual for Segmental Retaining Walls, Second Edition.
 - .2 NCMA TEK 2-4 - *Specifications* for Segmental Retaining Wall Units.
 - .3 NCMA SRWU-2 - Determination of Shear Strength between Segmental Concrete Units.
- .2 Segmental Retaining Wall Units
 - .1 ASTM C 140 - Sampling and Testing Concrete Masonry Units
 - .2 ASTM C 1262 - Evaluating the Freeze - Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.
 - .3 ASTM C 33 - Specification for Concrete Aggregates
 - .4 ASTM C 90 - Standard Specification for Load-Bearing Concrete Masonry Units
 - .5 ASTM C 150- Specification for Portland Cement
 - .6 ASTM C 595 - Specification for Blended Hydraulic Cements.
- .3 Geotextile Filter
 - .1 ASTM D 4751 - Standard Test Method for Apparent Opening Size
- .4 Soils
 - .1 ASTM D 698 - Moisture Density Relationship for Soils, Standard Method
 - .2 ASTM D 422 - Gradation of Soils
 - .3 ASTM D 424 - Atterberg Limits of Soils
 - .4 ASTM D G51 - Soil pH
- .5 Drainage Pipe
 - .1 ASTM D 3034 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe
 - .2 ASTM D 1248 - Specification for Corrugated Plastic Pipe

1.5 APPROVED PRODUCTS

- .1 Siena Stone® 925mm Unit Segmental Retaining Wall System as supplied by Unilock

- .2 Color: Natural.
- .3 Or equivalent

1.6 DELIVERY, MATERIAL HANDLING AND STORAGE

- .1 The installing contractor shall check all materials delivered to the site to ensure that the correct materials have been received and are in good condition.
- .2 The *Contractor* shall store and handle all materials in accordance with Unilock's recommendations and in a manner to prevent deterioration or damage due to moisture, temperature changes, contaminants, breaking, chipping or other causes.

1.7 ENGINEERING DESIGN AND CERTIFICATION

- .1 The term Engineer shall refer to the individuals or firms who have been retained by the *Contractor* to *Provide* design and inspection services for the retaining wall. The Design Engineer may be a different individual or firm from the Inspecting Engineer as Unilock may *Provide* this service. The Engineer(s) must be qualified in the area of segmental retaining wall design and construction and must be licensed to practice engineering in the Province that the wall is to be constructed.
- .2 The Engineer(s) will perform the following tasks:
 - .1 Produce sealed construction drawings and detailed design calculations, completed in accordance with the design requirements outlined in Part 3 of these specifications.
 - .2 Review the site soil and geometric conditions to ensure the designed wall is compatible with the site prior to construction.
 - .3 Inspect the site conditions, materials incorporated into the retaining wall, and the construction practices used during the construction.
 - .4 *Provide* the *Contractor* with a letter after completion, certifying the design meets the requirements of this specification, the design was compatible with the site and the wall was constructed according to design.

1.8 SUBMITTALS

- .1 The *Contractor* shall submit the following information for approval thirty (30) days prior to the construction of the segmental retaining wall.
 - .1 Design Submittal – *Provide* sets of stamped construction drawings and detailed design calculations, completed and sealed by the Engineer in accordance with the design requirements outlined in Part 3 of this specification.
 - .2 Materials Submittal – Manufacturer's certifications, stating that the SRW units and imported aggregates and soils meet the requirements of this specification and the Engineer's design.
 - .3 Installer Qualifications - The *Contractor* must be able to demonstrate that their field construction supervisor has the necessary experience for the project by providing documentation showing that they have successfully completed projects of similar scope and size.

PART 2 PRODUCTS

2.1 DEFINITIONS

- .1 Modular concrete retaining wall units are dry-cast solid concrete units that form the external fascia of a modular unit retaining wall system.

- .2 Coping units are the last course of concrete units used to finish the top of the wall.
- .3 Retained soil is an in-situ soil or a specified soil that is placed behind the wall drainage material.
- .4 Foundation soil is the in-situ soil beneath the wall structure.
- .5 Drainage aggregate is a free draining soil with natural soil filtering capabilities, or a free draining soil encapsulated in a suitable geotextile, or a combination of free draining soil and perforated pipe all wrapped in a geotextile, placed directly behind the modular concrete units.
- .6 Drainage pipe is a perforated polyethylene pipe used to carry water, collected at the base of the retaining wall, to outlets in order to prevent pore water pressures from building up behind the wall facing modules.
- .7 Non-woven geotextiles are permeable synthetic fabrics formed from a random arrangement of fibers in a planar structure. They allow the passage of water from one soil medium to another while preventing the migration of fine particles that might clog a drainage medium.
- .8 All values stated in metric units shall be considered as accurate. Values in parenthesis stated in imperial units are the nominal equivalents.

2.2 PRODUCTS

- .1 Concrete Segmental Retaining Wall Units
 - .1 The concrete wall modules shall be 185 x 1000 x 925 (7.25 x 39 x 36) (925mm Unit) with a maximum tolerance of plus or minus 3 mm (1/8 in.) for each dimension.
 - .2 The retaining wall modules shall be solid units and have a minimum weight of 450kg (1102 lbs.) and 366kg (895 lbs.) per unit.
 - .3 The concrete wall modules shall have an integral shear key connection that shall be offset to permit a minimum wall batter of 1H: 8V.
 - .4 The concrete wall modules shall have a minimum 28-day compressive strength of 35 MPa (5000 psi) as tested in accordance with ASTM C 140. The concrete shall have a maximum moisture absorption rate of 5 percent to ensure adequate freeze-thaw protection.
- .2 Retained Soil
 - .1 The retained soil shall be on site soils unless specified otherwise in the Construction *Specifications* or as directed by the *Owner* or *Owner's* Representative. If imported fill is required, it shall be examined and approved by the Engineer.
- .3 Foundation Soil
 - .1 The foundation soil shall be the native undisturbed on site soils. The foundation soil shall be examined and approval by the Engineer prior to the placement of the base material.
- .4 Leveling Base Material
 - .1 The footing material shall be non-frost susceptible, well graded compacted crushed stone (GW-Unified Soil Classification System), or a concrete leveling base, or as shown on the Construction Drawings.
- .5 Drainage Soil

- .1 The drainage soil shall be a free draining angular granular material of uniform particle size smaller than 25 mm (1 in.) separated from the retained soil by a geotextile filter. The drainage soil shall be installed directly behind the SRW units.
- .6 Drainage Pipe
 - .1 The drainage pipe shall be perforated corrugated HDPE or PVC pipe, with a minimum diameter of 100 mm (4 inches), protected by a geotextile filter to prevent the migration of soil particles into the pipe, or as specified on the construction drawings.
- .7 Geotextile Filter
 - .1 The non-woven geotextile shall be installed as specified on the construction drawings. Although selection of the appropriate geotextile specifications is site soil specific, a commonly used geotextile for filtration will have an Apparent Opening Size ranging between 0.149 and 0.210 mm (U.S. Sieve Sizes 100 to 70) and a minimum unit weight of 135 grams per square meter (4.0 oz /square yard). The coefficient of permeability will typically range between 0.1 and 0.3 cm/second.

PART 3 EXECUTION

3.1 DESIGN STANDARD

- .1 The Design Engineer is responsible for providing a design that shall consider the external stability, internal stability, and local stability of the SRW System. It is the responsibility of the Certifying Engineer or *Site* Geotechnical Engineer to determine if further design considerations must be implemented to ensure adequate global/overall slope stability, and/or, if the foundation soils will require special treatment to control total and differential settlement. The design life of the structure shall be 75 years unless otherwise specified in the construction drawings.
- .2 The segmental retaining wall shall be designed in accordance with recommendations of the NCMA Design Manual for Segmental Retaining Walls, Second Edition. The following is a summary of the minimum factors of safety for the various modes of failure evaluated in the proposed design.

External Stability

Base Sliding	1.5
Overturning	1.5
Bearing Capacity	2.0
Global Stability	1.3

Internal Stability

Shear Capacity	1.5
----------------	-----

3.2 SOIL

- .1 Design parameters: To be specified by the Engineer.

3.3 DESIGN GEOMETRY

- .1 The length, height, and overall elevations of the retaining wall must comply with the requirements of the proposed elevation detail, station information and site grading plan.
- .2 The structures' design height, H, shall be measured from the top of the leveling pad to the top of the wall where ground surface intercepts the wall facing.

- .3 Slopes above and below all sections of the segmental retaining wall are detailed in the site grading plan.
- .4 The minimum wall embedment shall be the greater of:
 - .1 The height of a SRW unit,
 - .2 150 mm (0.5 ft) or,
 - .3 The minimum embedment required because of the slope below the wall:

Slope Below Wall

Minimum Embedment

Level	H/10
3 : 1 (18.4 deg)	H/10
2 : 1 (26.5 deg)	H/7

- .5 The following surcharges shall be applied to the top of each design cross section based on the following proposed uses above the wall.

Use Above Wall

Minimum Surcharge

No Traffic	0 kPa (0 lb/sq. ft)
Light Traffic	4.8 kPa (100 lb/sq. ft)
Heavy Traffic	12.0 kPa (250 lb/sq. ft)

3.4 STATE OF STRESS

- .1 The lateral earth pressure to be resisted by the self weight of the retaining wall shall be calculated using the Coulomb coefficient of earth pressure, K_a , times the vertical stress at the base of the wall. The coefficient of active earth pressure, K_a , shall be used from the top to the bottom of the wall. The coefficient of active earth pressure, K_a , shall be assumed independent of all external loads except sloping fills. For sloping fills, the coefficient of active earth pressure, K_a , appropriate for the sloping condition, using Coulomb earth pressure shall be used in the analysis.

3.5 INCLINATION OF FAILURE SURFACE

- .1 A Coulomb failure surface passing through the base of the wall behind the facing units up to the ground surface at or above the top of wall shall be assumed in design of walls.

3.6 SETTLEMENT CONTROL

- .1 It is the responsibility of the Certifying Engineer or *Site* Geotechnical Engineer to determine if the foundation soils will require special treatment to control total and differential settlement.

3.7 GLOBAL STABILITY

- .1 It is the responsibility of the Geotechnical Engineer to determine if further design considerations must be implemented to ensure adequate global/overall slope stability.

3.8 INSPECTION

- .1 The Engineer is responsible for verifying that the contractor meets all the requirements of the specification. This includes the use of approved materials and their proper installation.
- .2 The *Contractor's* field construction supervisor shall have demonstrated experience and be qualified to direct all work related to the retaining wall construction.

3.9 CONSTRUCTION TOLERANCES

- .1 The following tolerances are the maximum allowable deviation from the planned construction,

Vertical Control: +/- 1.25 inches over a 10 ft distance, +/- 3 inches total
Horizontal Control: +/- 1.25 inches over a 10 ft distance, +/- 3 inches total
Rotation: +/- 2 degrees from planned wall batter
Bulging: 1.0 inch over a 10 ft distance

3.10 SITE PREPARATION

- .1 The foundation soil shall be excavated or filled as required to the grades and dimensions shown on the Construction Drawings or as directed by the *Owner* or *Owner's Representative*.
- .2 The foundation soil shall be proof rolled and examined by the Engineer to ensure that it meets the minimum strength requirements according to the design assumptions. If unacceptable foundation soil is encountered, the contractor shall excavate the affected areas and replace with suitable quality material under the direction of the Engineer.
- .3 In cut situations, the native soil shall be excavated to the lines and grades shown on the Construction Drawings and removed from the site or stockpiled for reuse as retained soil.

3.11 INSTALLING DRAINAGE SYSTEM

- .1 The approved non-woven geotextile shall be set against the back of the first retaining wall unit, over the prepared foundation, and extend towards the back of the excavation, up the excavation face and back over the top of the drainage material to the retaining wall, or as shown in the Construction Drawings.
- .2 The drainage pipe shall be placed behind the leveling base, or lower course of facing units as shown in the Construction Drawings or as directed by the Engineer. The pipe shall be laid at a minimum gradient of 2% to ensure adequate drainage to free outlets.
- .3 T - Sections and outlet pipes shall be installed on the drainage pipe at 15 m (50 ft.) centers or as shown on the Construction Drawings.
- .4 The remaining length of geotextile shall be pulled taut and pinned over the face of the retained soil. Geotextile overlaps shall be a minimum of 300 mm (1 ft.) and shall be shingled down the face of the excavation in order to prevent the infiltration of retained soil into the drainage layer.

3.12 LEVELING BASE OR SPREAD FOOTING PLACEMENT

- .1 The leveling base material shall be crushed stone compacted to 98% Standard Proctor Density, or vibrated concrete along the grades and dimensions shown on the Construction Drawings or as directed by the Engineer. The minimum thickness of the leveling base shall be 185 mm (7.25 inches)

3.13 INSTALLATION OF MODULAR CONCRETE RETAINING WALL UNITS

- .1 The bottom row of retaining wall modules shall be placed on the prepared leveling base as shown on the Construction Drawings. Care shall be taken to ensure that the wall modules are aligned properly, leveled from side to side and front to back and are in complete contact with the base material.
- .2 The wall modules above the bottom course shall be placed such that the tongue and groove arrangement provides the design batter (i.e. setback) of the wall face. Successive courses shall

be placed to create a running bond pattern with the edge of all units being approximately aligned with the middle of the unit in the course below it.

- .3 The wall modules shall be swept clean before placing additional levels to ensure that no dirt, concrete or other foreign materials become lodged between successive lifts of the wall modules.
- .4 A maximum of 3 courses of wall units can be placed above the level of the drainage material at any time.
- .5 The contractor shall check the level of wall modules with each lift to ensure that no gaps are formed between successive lifts.
- .6 Care shall be taken to ensure that the wall are not broken or damaged during handling and placement.

3.14 DRAINAGE SOIL

- .1 The drainage soil will be placed behind the retaining wall modules with a minimum width of 300mm (1 ft.) and separated from other soils using the approved non-woven geotextile.
- .2 Drainage soil shall be placed behind the wall facing in maximum lifts of 6 inches and compacted to a minimum density of 95% Standard Proctor.
- .3 No heavy compaction equipment shall be allowed within 1 meter (3 ft.) of the back of the wall fascia.

3.15 RETAINED SOIL

- .1 Retained soils shall be placed and compacted behind the drainage material in maximum lift thickness of 150 mm (6 inches). The retained soils shall be undisturbed native material or engineered fill compacted to a minimum density of 95% Standard Proctor.
- .2 No heavy compaction equipment shall be allowed within 1 m (3 ft.) of the back of the wall modules.

3.16 FINISHING WALL

- .1 Items 3.12 to 3.15 shall be repeated until the grades indicated on the Construction Drawings are achieved.
- .2 Coping units shall be secured to the top of the wall with two 10mm (3/8 inch) beads of the approved flexible concrete adhesive positioned 50mm (2 inches) in front and behind the tongue of the last course of retaining wall units.
- .3 Finish grading above the wall to direct surface run off water away from the segmental retaining wall. Use a soil with a low permeability to restrict the rate of water infiltration into the retaining wall structure.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Also included in this section are clauses for the following items:
 - Architectural Quality Concrete
 - Concrete Forming and Accessories
 - Concrete Reinforcing
 - Concrete Toppings
 - Defective Concrete
 - Finishing of Formed Surfaces
 - Finishing Treatment of Slab Surfaces (Screeding and Trowelling)
 - Polished Concrete Finish
 - Sealing and Curing
 - Slabs-on-Grade
 - Vapour Retarder Membrane for Slabs-on-Grade
- .2 Make a thorough examination of the drawings, site, specification and geotechnical report, to determine the intent, extent, materials and conditions of interfacing with other work and to be fully cognizant of the requirements.
- .3 Assume full responsibility for the design, for the adequacy and for the safety of all formwork and falsework.
- .4 The Contractor shall ensure that no asbestos containing materials are used in connection with the work of this section.

1.2 REFERENCE STANDARDS

- .1 Comply with The Building Code Act, as amended, the 2012 Ontario Building Code (OBC) as amended and Regulations and by-laws of other authorities having jurisdiction, including latest amendments thereto; all hereafter referred to as Building Code.
- .2 All codes, standard specifications and by-laws referred to in this Specification shall be current editions including all latest revisions, addenda and supplements, unless otherwise noted in the Building Code.
- .3 Conform to the following CSA Standards:
 - .1 A23.1.....Concrete Materials and Methods of Concrete Construction.
 - .2 A23.2.....Test Methods and Standard Practices for Concrete.
 - .3 A23.3.....Design of Concrete Structures.
 - .4 A3000.....Cementitious Materials Compendium.

- .5 G30.18 Carbon Steel Bars for Concrete Reinforcement.
- .6 S269.1 Falsework and Formwork.
- .7 W186 Welding of Reinforcing Bars in Concrete Construction.
- .4 Conform to the following ASTM Standards:
 - .1 C94/C94M Standard Specification for Ready-Mixed Concrete.
 - .2 C309 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
 - .3 C661 Standard Test Method for Indention Hardness of Elastomeric-Type Sealants by Means of a Durometer.
 - .4 C1116/C1116M Standard Specification for Fiber Reinforced Concrete.
 - .5 D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .6 E1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - .7 E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- .5 Conform to:
 - .1 ACI 214R Guide to Evaluation of Strength Test Results of Concrete.

.2 ACI 303R.....Guide to Cast-in-Place
Architectural Concrete Practice.

- .6 Conform to SP-66, ACI Detailing Manual - 2004 and the RSIC Reinforcing Steel Manual of Standard Practice.
- .7 In the event of conflict between reference standards, codes, drawings and specifications, the Contractor shall request clarification by the Consultant. The Consultant's decision as to which requirements govern shall be final and binding. Generally the more stringent provision shall govern. No extras to the contract will be approved due to such clarification.
- .8 Conform to the Occupational Health and Safety Act, R.S.O. 1990, c. O.1, last amendment.

1.3 SHOP DRAWINGS

- .1 Provide shop drawings (placing drawings and bar lists) showing dimensions and complete information necessary for fabrication and placing reinforcing steel and accessories.
- .2 Submit shop drawings in accordance with directions.
- .3 Allow ten (10) working days for the review of shop drawings and supply as many copies for review and distribution as directed. Shop drawings shall be checked in detail by the General Contractor before submission. Drawings which fail to meet this requirement shall be returned marked NOT REVIEWED.
- .4 Review of the Shop Drawings is for general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for confirming, correlating all quantities and dimensions, and is not relieved of the responsibility for compliance with the intent of the drawings and specifications.
- .5 Only shop drawings bearing the review stamps, signed and dated shall be kept at site.

1.4 SOURCE QUALITY ASSURANCE

- .1 Concrete supplied to this project shall meet the "Performance Based Specification" for concrete supply as adopted by the Ready Mix Concrete Association of Ontario.

.2 SUBMITTALS

Brand names, and when requested, manufacturer's data sheets, detail drawings or diagrams of all items which are proposed for use in the concrete mix, or which are to be cast in or attached to the concrete structure or will affect the concrete structure in any way, are to be submitted for review.

These shall include but not be limited to:

- .1 A schedule of "Standardized mix designs" which indicates compliance with the Construction Documents. Schedule to include but not be limited to:
 - .1 Concrete mix for each exposure class and strength to be utilized in the project.
 - .2 Water/cementitious materials ratio (w/cm).
 - .3 Air entrainment %, if applicable.
 - .4 Include "Pump Mixes" if proposed for use.
 - .5 Brand name and dosage of synthetic fibres.
 - .6 Brand names of all admixtures to be incorporated into the mixes.
 - .2 Brand names and, if requested, manufacturers' data sheet of proposed curing compound.
 - .3 If requested, provide a certified copy of a mill test report of the reinforcing supplied, and samples of reinforcing bars to be used on this project for testing by the appointed Inspection and Testing Company before delivery to the site.
 - .4 If requested, for unidentified reinforcing steel or reinforcing steel from non- Canadian mills, submit test data from an approved testing company verifying that each size and grade of reinforcing steel meets the Specification requirements. Pay for cost of such testing.
 - .5 Shop drawings of elevators, showing complete details of proposed connections to the structure, including pockets, inserts and loadings.
 - .6 Shop drawings of exterior walls panels showing complete details of proposed connections to the structure, including pockets, inserts and loadings.
 - .7 Shop drawings of steel and precast concrete stairs showing complete details of connections to the structure including pockets, inserts and loadings. Shop drawings to be stamped by a Licensed Professional Engineer.
 - .8 Cement finishing of floors shall be by a specialist sub-contractor thoroughly experienced in this type of work and a member in good standing with the Concrete Floor Contractors Association of Ontario (CFCAO). Submit references when requested.
- .3 Refer to **Coloured Surfaced Hardened Finishes** later in this section.
 - .4 MATCH SAMPLE OF ARCHITECTURAL QUALITY CONCRETE.

- .1 Provide a sample of "Architectural Concrete" including reveals, to the Architect's approval. Repeat at no cost to the owner until approval has been given.
- .2 All "Architectural Quality" concrete throughout the project shall match or exceed the quality level of the approved "Match" sample as to surface, cone tie pattern and other features as directed.
- .3 Refer also to **Architectural Quality Concrete** later in this section.
- .5 Refer also to **Polished Concrete Finish** later in this section.
- .6 Pre-Construction meetings as specified in this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Formwork
 - .1 Formwork lumber: Plywood and wood formwork materials are to conform to CSA A23.1.
 - .2 Plywood: Form plywood shall be exterior grade. Plywood shall be resin coated one side (in contact with concrete). Use sound undamaged plywood with clean true edges. Make-up or patching strips between panels shall be kept to a minimum.
 - .3 Falsework Materials: To conform to CSA S269.1. Materials shall bear grade marks or be accompanied with certificates, test reports or other proof of conformity.
 - .4 Formwork Release Agent: Shall be a proprietary material which will not stain the concrete or impair the natural bonding or color characteristics of coating intended for use on the concrete.
 - .5 Form Ties: Removable or "snap off" metal ties, fixed or adjustable lengths, free of devices leaving holes larger than 25 mm [1"] diameter in the concrete surface.
 - .6 Exposed Surfaces
 - .1 Form materials for concrete surfaces which require smooth and uniform surfaces for applied finishes or other purposes, shall consist of square edged smooth panels of plywood, metal or plastic. The panels shall be square and made in a true plane, clean, free of holes, surface markings and defects.
 - .2 Refer also to **Architectural Quality Concrete** later in this section.

.7 Circular (Tubular) Column Forms

- .1 Internally treated with release material.

Acceptable Types:

SONOTUBEby Sonoco
POLI-PERMAFORMby Atlas Construction Specialties
Other types subject to submission and acceptance.

- .2 Where required by the Architectural drawings and finish schedules provide lined forms so that no spiral line is visible in the finished concrete surface.

.2 REINFORCING AND ACCESSORIES

.1 Reinforcing Bars:

- .1 Shall be new deformed "Hi-Bond" bars conforming with CSA G30.18M with a minimum yield stress of 400 MPa [58 ksi]. All bars to have Typical Identification Patterns and standard identification requirements.
- .2 Epoxy coating is to conform to the specified standard, applicator is to be certified by RSIC.

.2 Welded Wire Mesh: Unless otherwise approved shall be supplied in flat sheets only.

.3 Chairs, bolsters, bar supports, side wall spacers and bar spacers:

- .1 Provide quantity for strength and support of the construction conditions, so that there is no possibility of displacement or deformation of the reinforcement during construction.
- .2 Use plastic chairs and/or sidewall spacers for all concrete.

Acceptable Types as supplied by:

Drummond & Reeves
Acrow Richmond
Superior Concrete

.4 Tie Wires: Annealed wire 1.29 mm [0.05"] diameter (No.16 U.S. Standard Gauge), or heavier or an approved proprietary system.

.5 Provide all necessary support bars and spacers in accordance with recommendations of the RSIC Manual.

.3 Ready Mix Concrete:

- .1 Unless otherwise specified, concrete shall be premixed, quality controlled conforming to CSA A23.1 with minimum 28 day compressive strengths as noted on the drawings.
- .2 Cement shall be Portland Cement of Canadian manufacture conforming to CSA A3000, Type GU (10).
- .3 Supplementary Cementing Materials shall conform to the requirements of CSA A3000.
- .4 Aggregates shall be clean, uncoated sand and coarse aggregates from approved sources conforming to CSA A23.1. Nominal size of coarse aggregate shall not exceed 20 mm [3/4"] unless otherwise stated on the structural drawings or specifications.
- .5 Water shall be potable from a municipal supply.
- .6 Chemical Admixtures, where permitted shall conform to the requirements of CSA A23.1.

- .1 Provide an approved water-reducing agent in all concrete.
Acceptable Types:

EUCON WRby Euclid
WRDA 82by Grace
PLASTOCRETE 161.....by Sika
MASTERSET R 100by BASF
MASTERPOZZOLITH 210by BASF

- .2 High Range Water Reducing Admixture (Super P)
Acceptable Types:

EUCON 37by Euclid
WRDA 20.....by Grace
SIKAMENT 686by Sika
MASTERRHEOBUILD 1000by BASF
MASTERGLENIUM 51.....by BASF

- .3 Mid-Range Water Reducing Additive where approved for use:
Acceptable Types:

MASTERPOLYHEED 1020.....by BASF
EUCON MRby Euclid
DARACEM 55.....by Grace
SIKAMENT 500by Sika

- .4 Air-Entraining Agent:
Acceptable Types:

EUCON AIR MAC6by Euclid
DARAX AEA EDby Grace
SIKA AIRby SIKA
MASTERAIRby BASF

- .7 Calcium chloride or chloride based admixtures **shall not** be used.
- .8 Salt or other chemicals shall not be added to reduce the freezing point of concrete.
- .9 All admixtures shall be used in strict accordance with the manufacturers' instructions.
- .10 SYNTHETIC FIBRE REINFORCING

- .1 Synthetic Fibre Reinforcing to control plastic shrinkage cracking: 100% virgin polypropylene fibres specifically manufactured for concrete reinforcement and containing no reprocessed materials. Fibres to be added at the concrete batching plant at the rate of 0.9 kg/m³ [1.52 lb/yd³] of concrete for defibrillated fibres and 0.6 kg/m³ [1.01 lb/yd³] for monofilament fibres, unless otherwise noted, in strict accordance with manufacturer's instructions.

Acceptable Types:

PSI FIBRESTRAND 150by Euclid
SIKAFIBER PPF-50 mmby SIKA Canada Inc.
MICROFIBREby Grace
MASTERFIBERby BASF

- .2 Macro Synthetic Fibre Reinforcing where approved for use as a replacement for Welded Wire Mesh or as specified on the drawings. Add at the batching plant at the rate as specified (min 1.8 kg/m³ [3.03 lb/yd³] of concrete) in strict accordance with the manufacturer's instructions.

Acceptable Products:

TUF-STRAND SF by Euclid

- .11 Typical Concrete Mixes: See schedule on drawings.

- .4 CONSTRUCTION GROUTS: Non-shrink grout unless otherwise noted shall be a premixed non-metallic, non-shrink grout.

Acceptable Types:

EUCO NS OR DRY PACK GROUTby Euclid
M-BED STANDARD.....by Sika
MASTERFLOW 555.....by BASF

CG-86.....by W.R. Meadows
CPD NON-SHRINK GROUTby CPD

- .5 CURING, SEALING AND/OR CURING/SEALING COMPOUND where approved for use shall conform to ASTM C309.

- .1 Acceptable Types:

MASTERKURE CC 300 XS.....by BASF
FLORSEAL WB 25.....by Sika
SUPER DIAMOND CLEAR 350by Euclid
CS-309-30.....by W.R. Meadows
ACRYLIC CURE & SEAL 30%by CPD
Compounds must be compatible with applied finishes.

- .2 Compound used for Coloured Surface Hardened Finishes shall be:

.1 SUPERDIAMOND (CLEAR) 350 FOR SURFLEX...by Euclid
.2 FLORSEAL WB25 (CLEAR) FOR COLORPLETE...by Sika
.3 MASTERKURE CC 300 XSby BASF

- .3 Compounds applied at the rates as recommended by the manufacturers.

- .6 SURFACE HARDENER: Unless otherwise noted shall be a non-metallic dry shake hardener.

Acceptable types:

MASTERTOP 110ABRby BASF
SURFLEX TRby Euclid
DIAMAG 7.....by Sika
CPD FLOOR HARDENER PRE-MIXby CPD

- .1 Colour to be plain or natural.

- .2 Coloured Surface Hardener acceptable types:

SURFLEX FRENCH GREYby Euclid
COLORPLETE FRENCH GREYby Sika

- .7 PRE-MOULDED JOINT FILLERS: Provide bituminous impregnated fibreboard conforming to ASTM D1751.

Acceptable types:

FIBRE EXPANSION JOINT FILLERby W.R. Meadows
CPD ASPHALT FIBRE EXPANSION JOINT FILLERby CPD

- .8 JOINT FILLER FOR "SAW-CUT" CONTROL JOINTS: Two component self-leveling sealant, minimum Shore A Durometer hardness of 80 at 20°C [68°F] as conforming to ASTM C661.

Acceptable types:

MASTERSEAL CR 190..... by BASF
EUCO QWIKJOINT UVR by Euclid
LOAD FLEX POLYUREA..... by Sika
REZI-WELD FLEX by W.R.Meadows
CIPADAM E-13 by CPD

.9 VAPOUR RETARDER MEMBRANE FOR SLAB-ON-GRADE

.1 Provide a vapour retarder membrane cover over the prepared base material below slabs-on-grade where noted on the drawings.

.2 Membrane shall have the following properties:

.1 Performance as tested after conditioning (ASTM E1745)

.2 Strength minimum CLASS B (ASTM E1745)

.3 Minimum thickness 0.25 mm [0.01"]

.3 Lap joints minimum 150 mm [6"] and tape with material as recommended by membrane manufacturer.

.4 Acceptable membrane types as manufactured by:

FLORPRUFE 120..... by Grace
STEGO WRAP by Stego Industries
PERMINATOR by W.R.Meadows
MOISTOP ULTRA by Fortifiber Building
Systems

.10 Other materials or products which are not listed herein shall comply with the latest CSA, ASTM, CGSB, or ACI Standards appropriate to those materials. Refer to **Source Quality Assurance** in **PART 1** of this section.

PART 3 – EXECUTION

3.1 WORK BY THIS SECTION AS SUPPLIED BY OTHERS

.1 Install anchors and other items to be cast into the concrete as supplied by others.

3.2 FORMWORK

.1 Formwork design, materials, and erection shall conform with CSA A23.1 including all falsework and ties.

.2 Column and wall footings and caps shall have plywood side forms. The placement of footings directly against neat cut excavations may be approved subject to review and acceptance by the Structural Consultant. Approval to

proceed must be given in writing by the Structural Consultant before any concrete is placed.

3.3 REINFORCING FABRICATION AND PLACEMENT

- .1 Conform to CSA A23.1.

3.4 CONCRETE

- .1 Mixing, Transportation and placement to conform to CSA A23.1.
- .2 Maximum time between adding mix water and complete discharge of concrete into forms shall be 120 minutes. Exemptions to this time frame shall only be permitted with approval by the Structural Consultant when previously approved chemical additives are used.
- .3 Approved synthetic fibres to be added to the concrete for slabs where noted on drawings. Refer elsewhere in this section for dosage rates and superplasticizers.

3.5 COLD WEATHER CONDITIONS

- .1 When the air temperature is at or below 5°C [41°F] or when there is a probability of its falling to that limit within 24 hours of placing (as forecast by the nearest weather office).

Conform to the requirements of CSA A23.1 including, but not limited to the following:

- .1 Job Preparation.
- .2 Concrete Temperature.
- .3 Concrete Placing.
- .4 Protection Requirements and Methods:
 - .1 Heated Enclosures.
 - .2 Protective Covers and Insulation.
- .5 Cooling after protection.
- .6 Cold-Weather Curing.
- .2 All materials and equipment needed for adequate protection and curing shall be on hand and ready for use before concrete placement has started.

3.6 HOT WEATHER PROTECTION REQUIREMENTS

- .1 Conform to the requirements of CSA A23.1.

3.7 FINISHING TREATMENT OF SLAB SURFACES (SCREEDING AND TROWELLING)

- .1 Screeding, Bull Floating, Darbying, Trowelling.
 - .1 Conform with the requirements of Clause 7.6 of CSA A23.1 and as modified hereinafter.
 - .2 Bring tops of floors to even level or sloping surfaces as shown on the drawings.
 - .3 Slabs shall be finished only when bleed water on the slab surface has evaporated.
 - .4 Machine trowel all floor slabs, except as required by the drawings and/or specifications to Class A Conventional (Smooth) classification.
 - .5 Surfaces of exterior exposed steps and platforms shall be finished with a wood float and given a "fine broom" finish to the Consultant's satisfaction. (Class A Conventional (Smooth) classification). Refer also to Architect's "Finish Schedule".
 - .6 Unless otherwise shown or specified, roof slabs shall be finished for waterproofing with a Steel Trowel Finish. (Class A Conventional (Smooth) Classification).
 - .7 Floors to receive separate finishes shall be screeded to proper elevation, and wood float finished. (Class A Conventional (Smooth) Classification).
 - .8 Class A Conventional (Smooth) Classification shall be as defined in CSA A23.1 Table 21 and shall be determined by F-number method as defined in Clause 7.6.1.1 unless otherwise directed.
 - .9 Finished surfaces not conforming to the specified tolerances shall be deemed as **Defective Concrete**. See later in this section.
- .2 **Slab-On-Grade** (Refer Also To **Polished Concrete Finish** Later In This Section)
 - .1 VAPOUR RETARDER MEMBRANE FOR SLABS-ON-GRADE
 - .1 For areas specified to receive on under slab membrane:
 - .1 Ensure that the prepared subgrade is approved by the Geotechnical Consultant.
 - .2 Level, tamp and/or roll the subgrade as required.
 - .3 Install the membrane in accordance with manufacturer's instructions and to ASTM E1643.
 - .4 Unroll membrane with the longest dimension parallel to the direction of the concrete pour.

- .5 Lap membrane over footings and seal to foundation walls, columns and column caps etc., and overlap joints 150 mm [6"].
- .6 Seal all penetrations (including pipes) and seal as per manufacturer's directions.
- .7 Repair damaged areas with membrane patches overlapping damaged areas by 150 mm [6"] and taping all four sides.

.2 READY MIX CONCRETE

- .1 Refer to drawings and also to **Materials** in this section.
- .2 Synthetic Fibres: Refer to READY MIX CONCRETE earlier in this section.
- .3 Superplasticizer
 - .1 Where shown on the drawings and specifications as slabs to have superplasticizer added to the mix, the approved superplasticizing agent can be added at the site or at the plant subject to the appropriate mix design being submitted for review and approval issued by the consultant. NO WATER IS TO BE ADDED AT SITE.
 - .2 As an alternative, the specified Mid-Range Water Reducing additive, added at the batching plant, may be approved for use. Subject to the appropriate mix design being submitted for review and approval issued by the Consultant.
- .4 Quantities and procedure for admixtures shall be determined and supervised with the assistance of the manufacturer's technical staff.

.3 Execution

- .1 Refer to **Field Quality Control** later in this section.
- .2 Obtain Geotechnical Consultant's approval of the granular fill before placing the concrete slabs-on-grade.
- .4 Provide screeds set to an engineer's level for leveling the surface of floor slabs-on-grade.
- .5 Provide keys or dowels at construction joints as detailed on the drawings.
- .6 Control Joints

- .1 Where shown on plans or on Typical Details, provide saw-cut control joints as indicated.
- .2 Control joints in slabs-on-grade shall be cut using power driven abrasive or diamond tipped blades.
- .3 Cutting shall begin as soon as the concrete surface has hardened sufficiently to resist raveling as the cut is made and before shrinkage cracks form in concrete. Generally, saw-cutting of slabs-on-grade shall be done within the first 24 hours after the slabs are placed. Alternatively, use the Soff-Cut method immediately after finishing the slab.
- .4 The depth of control joints shall be one-third (1/3) of the thickness of the slab, with a minimum of 40 mm [1.5"] unless otherwise noted.
- .5 Clear saw-cuts of all debris and ensure sides are clean and dry before proceeding.
- .6 Mix saw-cut joint filler according to manufacturer's instructions.
- .7 Pour filler into joints, flush with adjacent surfaces.

.3 Surface Hardened Finishes

- .1 For slabs designated to be surface hardened, apply the specified surface hardener in strict accordance with the manufacturer's instructions at a rate of 5.0 kg/m² [1.00 lb/ft²].

.4 Coloured Surface Hardened Finishes

- .1 Pre-Construction Meeting:
 - .1 Prior to start of work arrange for a project meeting of all parties associated with the placement of Coloured Surface Hardened Concrete. Presided by the Architect, the meeting shall include Floor Finishing Contractor, General Contractor's Representative, Owner's Representative, a Representative of the Backfilling and Compaction Contractor, Testing Company's Representative, Concrete Supplier's Representative, Surface Hardener Supplier's Representative, the Geotechnical Consultant's Representative and a Representative of the Structural Consultant.
 - .2 The meeting shall review Specifications for Work included under this section and determine a complete understanding of requirements and responsibilities relative to Work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, project staffing, restrictions on areas of pours, and other matters affecting the construction so as to permit compliance with the intent of this section.

- .2 For slabs shown on the drawings and/or specification to be "Colour Surface Hardened."
 - .1 Note: No water is to be added to the concrete on site. Superplasticizer additive is approved for use.
 - .2 Apply specified surface hardener at the rate of 6 kg/m² [1.25 lb/ft²].
 - .3 Apply specified curing sealing compound at the rate recommended by the manufacturer.
 - .4 Hardener and sealing compounds to be installed in strict accordance with manufacturer's directions.
 - .5 The manufacturer of the hardener and sealing compound shall be notified prior to the application in order that they can supervise the use on this project. The manufacturer shall submit a concrete slab-on-grade field service report to the Architect and Structural Consultant for each application of these products, verifying that the products have been applied in accordance with the manufacturer's recommendations. A sample report form shall be provided by the Structural Consultant at the Pre-Construction Meeting.
 - .6 See Architectural Drawings and Finish Schedules for required locations.
 - .7 Refer to **Quality Control** in this section.

3.8 POLISHED CONCRETE FINISH

- .1 FOR AREAS NOTED ON THE ARCHITECTURAL DRAWINGS AND FINISH SCHEDULE TO RECEIVE A "POLISHED CONCRETE FINISH", THE COLOURED FINISH SHALL BE INSTALLED BY A SPECIALIST CONTRACTOR.
- .2 POLISHED CONCRETE SHALL MEET AGGREGATE EXPOSURE CLASS A, AND GLOSS LEVEL 2.
- .3 PRE-CONSTRUCTION MEETING FOR CONCRETE SLABS TO RECEIVE "POLISHED CONCRETE FINISH" SHALL BE CONVENED NO LATER THAN THREE (3) WEEKS PRIOR TO THE SLAB POUR.
 - .1 The meeting shall be arranged by the General Contractor and shall include representatives of:
 - The Owner
 - The Architect
 - The Structural Consultant
 - The Geotechnical Consultant

The Inspection and Testing Company (if different from the Geotechnical Consultant)
The Concrete Supplier
The Floor Finishing Contractor (Base Slab)
Polishing Contractor
The Reinforcing Steel Placer
The General Contractor

- .2 The meeting shall review specifications for work included under this section and determine a complete understanding of the requirements and responsibilities relative to the work including, storage and handling of materials, scheduling, sequence and quality control, project staffing, restrictions on areas of pour and other matters affecting the construction so as to permit compliance with the intent of this section.

.4 BASE SLAB

- .1 The base slab shall be placed, screeded and trowelled to the levels and slopes shown with the specified Class A Conventional (Smooth) classification and to the requirements of the "Floor Polishing" Contractor's representative who shall be on site to advise, review and approve the installation and curing.
- .2 The General Contractor shall advise the "Floor Polishing" Contractor sufficiently in advance so that the representative shall be on site.

.5 PRIOR TO POURING:

- .1 Obtain the Geotechnical Consultant's approval of the granular fill material and compaction and placement of polyethelene vapour barrier.
- .2 The General Contractor and the Floor Finishing Contractor shall inspect and report on any variations in elevations which exceed the ± 10 mm tolerances specified in CSA A23.1. Under no circumstances shall concrete be poured until any excess variations have been corrected.
- .3 The Contractor shall maintain sufficient labour to position reinforcing bars on concrete chairs so as not to permit any settlement or displacement.
- .6 The specified concrete brick chairs shall be spaced as required, but at a maximum not to exceed 1400 mm [4'-7"] centres each way. The Contractor shall install fixed screeds at, or a minimum, the high points and mid-points of slopes and shall ensure that slopes to drain are achieved as indicated on the drawings.
- .7 THE CONCRETE SHALL BE "WET CURED" FOR 7 DAYS WITHOUT INTERMITTENT DRYING UTILIZING PROPRIETARY MATS, ULTRACURE BY EZ

FORM (MCTECH GROUP) OR APPROVED EQUIVALENT, AND IN ACCORDANCE WITH CSA A23.1.

- .8 REFER TO PROTECTION OF SLABS ELSEWHERE IN THIS SECTION. THESE MEASURES ARE MANDATORY.
- .9 PRIOR TO THE "POLISHING CONTRACTOR" STARTING WORK THE FLOOR SURFACE SHALL BE PREPARED, ANY DEFECTS REPAIRED, AND CLEANED ALL TO THE SATISFACTION OF THE "POLISHING CONTRACTOR."
- .10 AFTER COMPLETION OF THE INSTALLATION OF THE "POLISHED COLOURED FINISH", THE POLISHED FINISH SUPPLIER SHALL PROVIDE A LETTER INDICATING THAT THE FINISH HAS BEEN INSTALLED TO THEIR SATISFACTION. THIS SHALL BE DONE WITHIN 7 DAYS AFTER THE COMPLETION OF THIS WORK.

3.9 FINISHING OF FORMED SURFACES

- .1 Conform to the requirements of CSA A23.1 Clause 7.9.
- .2 Refer to Architectural Finish Schedules and Drawings.
- .3 Refer to **Architectural Quality Concrete** later in this section.

3.10 SEALING AND CURING

- .1 Apply specified compounds in strict accordance with manufacturer's directions.
- .2 All floor slabs and all EXPOSED concrete surfaces, such as walls, beams, columns, etc., are to receive a minimum of one coat of curing and sealing compound unless not compatible with architectural finishes.
- .3 CURING
 - .1 Conform to the requirements of CSA A23.1 including but not limited to the following:
 - .1 Basic curing period.
 - .2 Additional curing for durability.
 - .3 Additional curing for structural safety.
 - .4 Methods for curing.
 - .5 Cold weather curing.
 - .6 Hot weather curing.
 - .7 Curing for Accelerated Strength Development.

- .4 Refer also to **Cold Weather Conditions** and **Hot Weather Protection Requirements**, elsewhere in this section.

3.11 PROTECTION OF SLAB SURFACES

- .1 Fully protect exposed concrete finishes from damage and staining.
- .2 Protect all exposed surfaces from dropping plaster, welding debris, paint, dirt or other marring agents, by heavy building paper, tarpaulins or other appropriate means. The surface must be perfectly dirt-free before this protection is placed.
- .3 Do not allow any pipe threading or similar machines using oil or other permanently staining liquid on any concrete floor unless set up on large oil-tight and properly constructed metal pans. Plywood sheets or other absorbent materials will not be permitted as a substitute for pans.

3.12 MISCELLANEOUS ITEMS

- .1 This section to provide and place concrete, formwork and reinforcing and/or grout fill for all concrete work shown on or implied by the drawings and specifications.
- .2 DRY-PACK GROUT: Provide and install specified non-shrink grout as required, in accordance with manufacturer's directions.
- .3 REINFORCED MASONRY LINTELS: Where required, provide reinforcing and place concrete in accordance with the Typical Notes and Details on the drawings.
- .4 VERTICAL MASONRY WALL REINFORCING BARS: Provide, for installation by the Mason, bars as required by the drawings and typical details.
- .5 MASONRY GROUT: Co-ordinate with the Mason for supply and installation of grout. Grout as specified on the drawings.
- .6 BONDING AGENT: Provide and install specified agent as required in accordance with manufacturer's directions.
- .7 Drilled and Set Anchors and Dowels:

Provide and install the specified products and materials as required in accordance with manufacturer's directions.

3.13 TOPPINGS

- .1 GENERAL
 - .1 Conform to CSA A23.1 and the requirements noted below, unless noted otherwise in the contract documents.
 - .2 Set screeds and bulkheads rigidly and accurately to prevent displacement during concreting.

- .3 Special provisions for bonded and unbonded toppings:
 - .1 The maximum pour size for bonded and unbonded toppings is to be limited to [100 m²] 1000[ft²].
 - .2 Maintain a one to one length to width aspect ratio for all pours, here extent and geometry of topping permits.
 - .3 Toppings are to be poured in a “checker board” pattern to minimize the effects of shrinkage. Adjacent sections of topping shall be poured no sooner than 3 days after the adjoining section was poured.
 - .4 Ensure temperature of base course is 10°C (50°F) minimum prior to pouring toppings.
 - .5 Provide hot and cold weather protection for toppings in accordance with CSA A23.1.

.2 MONOLITHIC TOPPINGS:

- .1 Monolithic toppings are constructed by applying a concrete mixture to a “freshly” poured base course that has lost all slump and bleed water, prior to its final set. Alternatively, monolithic toppings can be poured with the main base course to a final thickness equal to the thickness of the base course plus the thickness of the topping.
- .2 Where monolithic toppings are specified, place reinforcement and maintain cover requirements based on the thickness of the base slab only. Provide additional layer of reinforcement in monolithic toppings where noted on the contract documents.

.3 UNBONDED (LOOSE LAID) TOPPINGS

- .1 Unbonded or loose laid toppings are constructed by applying the topping mixture over a bond breaker and hardened concrete base, to which no bonding agent has been applied. By definition, unbonded toppings are specifically designed so as not to bond to the concrete base.
- .2 Base course Finishing and Preparation.
 - .1 Base courses which are to receive unbonded or loose laid toppings are to be finished smooth by means of a steel trowel.
- .3 Placing and Finishing Toppings
 - .1 Place toppings on bond breaker and finish the toppings in accordance with CSA A23.1

.4 Curing

- .1 Continuously wet cure unbonded toppings for a minimum of seven days.

.5 Jointing

- .1 Unbonded toppings are to be sawcut, as per the typical detail for slabs on grade, at a maximum spacing of 3.0 metres (10 feet) in both directions, unless noted otherwise. For toppings that are to receive hard architectural floor finishes, the jointing shall be laid out in accordance with the architect's requirements and is subject to final approval by the architect.

.4 CRACKS IN TOPPINGS

- .1 All cracks in concrete toppings must be repaired by the Contractor. Extent of repair and method of crack repair must meet the requirements of flooring installation contractor and the Owner.

3.14 ARCHITECTURAL QUALITY CONCRETE

Where concrete surfaces are denoted as Architectural Quality or Architectural Finished Concrete, comply with the following:

- .1 Refer to MATCH SAMPLE FOR ARCHITECTURAL QUALITY CONCRETE earlier in this section.
- .2 Use same formwork and joint sealing on final work as was used on "Match" sample.
- .3 Conform with the requirements of CSA A23.1 Clause 8.3 and ACI 303.

.4 DESIGN

- .1 The mix shall be designed by the Contractor so that it will achieve all the properties specified and in addition will achieve a high workability.
- .2 Regardless of specified strength, architectural concrete exposed to weather shall have a maximum water cement ratio of 0.48 by mass.
- .3 The maximum slump permitted is 90 mm [3.5"].
- .4 Take care to reduce variation in mix proportions and particularly the quality of water used in various batches, in order to ensure reasonable colour uniformity of concrete.
- .5 Architectural quality concrete shall meet the standards set out below when the forms are stripped, without further finishing work other than treatment of tie holes and clean-up:

- .1 Dense, even concrete, uniform in colour and free of defects such as colour change, honeycombing, voids, loss of fines, flow lines, cold joint lines or other similar imperfections. Patching, unless it is required to only an insignificant extent, will not be permitted to repair these defects. Where patching is permitted, it must accurately match the colour and texture of the surrounding concrete to be acceptable. The judgement as to what constitutes insignificant defects which may be patched and the acceptance of the patch shall be made solely by the Architect.
- .2 Concrete members of generally uniform colour.
- .3 Concrete members with true, accurate definition at corner, arises, reglets and the like, generally free of chipped or spalled areas and within dimensional tolerances set out in ACI 303.
- .4 Weathertight construction joints in members exposed to weather.
- .5 Under no circumstances shall patches or repair to any architectural concrete be undertaken without the Architect's written consent. Concrete members which are patched without the Architect's consent will be classified as defective work and the Architect may require their removal and replacement.
- .6 Colour and texture matching the sample panel designated by the Architect.
- .6 Forms
 - .1 Use approved cone type form ties, spaced as required by the Architect. Align vertical and horizontal form panel joints.
 - .2 Seal joints on exterior side between form panels with an approved joint seal and securely fasten 25 x 50 mm [1" x 2"] wood battens over each joint seal.
 - .3 Provide formwork for reveals as detailed on the architectural drawings to the Architect's satisfaction.
- .7 SANDBLAST FINISH: Where denoted.
 - .1 Sandblast the exposed surface of concrete members as required to a depth sufficient to at least remove the surface skin and expose the coarse aggregate and match the approved sample designated by the Architect.
 - .2 Sandblast individual concrete members at the same age to ensure reasonable colour uniformity. Protect adjacent surfaces not noted to be sandblasted.
 - .3 Do not proceed with sandblasting operations until the Architect has inspected and approved the surfaces to be sandblasted.

- .8 When specified or shown on the drawings fill form tie holes with Mills gray concrete plugs in strict accordance with the manufacturer's recommendations.

3.15 DEFECTIVE CONCRETE

- .1 Concrete not meeting the requirements of the specifications and drawings shall be considered defective concrete.
- .2 Defective concrete and concrete not conforming to lines, details, quality and grade specified or as shown on the Drawings shall be modified or replaced at no extra cost to the Owner, and to the satisfaction of the Architect.
- .3 Finished lines, dimensions and surfaces shall be correct and true within tolerances specified.
- .4 Non-exposed Surfaces: Honeycombing shall be cut out and filled and any fins which interfere with strapping, etc., shall be cut back. Holes left by form separators shall be filled.
- .5 Crack Repair: After concrete has cured, examine concrete floor surfaces and repair all cracks. Route out cracks with mechanical router to a minimum depth of 13 mm [1/2"]. Then clean and fill cracks in same manner as control joints.
- .6 Use approved curing/sealing compound in strict accordance with manufacturer's recommendations.

3.16 QUALITY CONTROL

- .1 Implement a system of quality control to ensure that the minimum standards specified herein are attained.
- .2 Bring to the attention of the Consultant any defects in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.
- .3 The Consultant 's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility. The contractor is solely responsible for quality control and shall implement its own supervisory and quality control procedures.
- .4 Refer to **Source Quality Assurance** included in this section.
- .5 If requested, provide a copy of the Concrete Suppliers Certificate confirming that the specified fibre reinforcement at the specified dosage was added to all required concrete delivered to the job site.

3.17 NOTIFICATION

1. Prior to commencing significant segments of the work, give the Consultant and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review the work. Failure to meet this requirement may be cause for the Consultant to classify the work as defective. . A minimum notification of 24 hours in advance of placing concrete is required.

3.18 INSPECTION AND TESTING

1. The Owner will appoint an Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct. The representative of the Inspection and Testing Company shall NOT be required to supervise or instruct the Contractor.
2. The following are responsibilities of the contractor regarding the Inspection and Testing Company:
 - .1 Co-operate with the representatives of the Inspection and Testing Company.
 - .2 Provide the Inspection and Testing Company with a set of construction documents to enable them to understand the scope of their services.
 - .3 Provide an insulated storage box according to the specification and drawing supplied by the Inspection and Testing Company.
 - .4 Protect test cylinders.
 - .5 Keep a record set of drawings upon which shall be marked by the contractor's superintendent, the time and date of pouring of each section of concrete, the date of removal of forms and a daily record of the temperature.

3.19 DEFECTIVE MATERIALS AND WORK

- .1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength, made and the like, in order to help determine whether the work must be corrected or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the work may be acceptable.
- .2 All testing shall be conducted in accordance with the requirements of The Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.

- .3 Materials or work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 03 30 53

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Delivery, Storage, and Handling
- .7 1.7 Field Conditions
- .8 2.1 Materials
- .9 3.1 Workmanship
- .10 3.2 General Erection Tolerances
- .11 3.3 Laying Masonry Units
- .12 3.4 Exposed Masonry
- .13 3.5 Jointing
- .14 3.6 Built-In *Work*
- .15 3.7 Reinforced Masonry
- .16 3.8 Provision for Movement
- .17 3.9 Loose Lintels
- .18 3.10 Lateral Supports
- .19 3.11 Movement (Control) Joints
- .20 3.12 Temporary Bracing
- .21 3.13 Field Quality Control
- .22 3.14 Adjusting and Cleaning
- .23 3.15 Protection

1.3 SUMMARY

Masonry procedures for masonry work.

1.4 SUBMITTALS

Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.

Product data sheets:

- .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in masonry assemblies.

Shop Drawings:

- .2 Submit *Shop Drawings* for masonry unit wall assemblies indicating:

- .1 Proposed locations of control joints.
- .2 Types of masonry units, grade, texture, typical dimensions, colours, special shapes and shape dimensions.
- .3 Layout/coursing for each type of masonry unit. Units are not to be cut without approval from the *Consultant*: Layout using full brick masonry units.

Samples:

- .3 Two of each type of brick masonry unit specified.
- .4 Two of each type of concrete masonry unit specified.
- .5 Two of each type of architectural concrete masonry unit specified including corner units and in varying degrees of "roughness" or texture.
- .6 One of each type of masonry accessory specified
- .7 One of each type of masonry reinforcement and tie proposed for use.

Masonry reinforcing and connector certification: The *Contractor* shall submit the manufacturer's written certification that masonry reinforcing and connector *Products* supplied for the masonry parts of the *Work*, comply with CAN/CSA A370-15. The Contractor shall ensure that the Certification is typewritten and signed on manufacturer's letterhead and includes a lists and quantities of reinforcing and connector *Products* provided in the *Work*.

1.5 QUALITY ASSURANCE

Qualifications:

- .1 Installers / applicators / erectors: *Provide* work of this Section, executed by competent installers with a minimum five years' experience in application of products, systems and assemblies specified and with approval of *Product* manufacturers.

Mock-ups:

- .2 *Provide* mock-ups in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Quality control mock-ups for masonry veneer walls:
 - .1 Construct mock-up panel of each type of masonry veneered wall construction 2000 mm x 2000 mm (78" x 78") at locations designated by the *Consultant* showing masonry colours and textures, use of reinforcement, ties, through-wall flashing, weep holes, jointing, coursing, mortar colours and workmanship.
 - .2 Select masonry units for use in mock-ups that represent the maximum variation in texture and colour.
 - .3 Mock-up shall remain in place until acceptance of masonry and as directed by the *Consultant*.

Accepted mock-ups may not remain as part of the completed *Work*.

1.6 DELIVERY, STORAGE, AND HANDLING

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

Keep materials dry until use.

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

1.7 FIELD CONDITIONS

Cold weather construction requirements:

- .1 Comply with requirements of CAN/CSA A371-04, and as follows:

Air Temperature	General requirements during construction
0 to 4.....	Sand or mixing water shall be heated to a minimum of 20°C and a maximum of 70°C.
-4 to 0.....	Sand and mixing water shall be heated to a minimum of 20°C and a maximum of 70°C.
-7 to -4.....	(1) Sand and mixing water shall be heated to a minimum of 20°C and a maximum of 70°C. (2) Source heat shall be provided on both sides of the walls under construction. (3) Windbreaks shall be employed when the wind speed exceeds 25 km/h.
-7 and below.....	(1) Sand and mixing water shall be heated to a minimum of 20°C and a maximum of 70°C. (2) Enclosures and supplementary heat shall be provided to maintain an air temperature above 0°C. (3) The temperature of the unit when laid shall be not less than 7°C.
.2	Grout shall be placed in masonry at a minimum temperature of 20°C and a maximum temperature of 50°C.
.3	Mortar temperature shall not exceed 50°C to avoid flash set.
.4	Maintain dry beds for masonry and use dry masonry units only. Do not wet masonry units in winter.

Cold weather protection requirements:

- .5 Comply with requirements of CAN/CSA A371-04, and *Provide* protection requirements for completed masonry or sections not in progress shall be as follows:

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

Hot weather construction requirements:

- .6 Comply with requirements of CAN/CSA A371-04, and as follows:
- .1 The spreading of mortar beds shall be limited to 1.2 m, and the masonry units shall be set within 1 minute of spreading the mortar, when the air temperature is above:
- .1 38°C; or
- .2 32°C, with a wind velocity greater than 13 km/h.
- .7 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

Masonry units, cementitious materials, and sand stored on *Site* shall be protected from contaminants and shall not be wetted by rain, snow, or groundwater. Other materials and components to be installed by the mason shall be handled and stored in accordance with the manufacturer's instructions.

When work is not in progress, the exposed top surfaces of masonry shall be covered to prevent intrusion of precipitation with non-staining coverings. The cover shall extend a minimum of 600 mm (24") down both sides and shall be held securely in place until masonry work is protected by flashings or other permanent construction. Ensure that coverings are secured to resist wind loads.

PART 2 - PRODUCTS

2.1 MATERIALS

Mortar and grout for masonry: in accordance with Section 04 05 13 – Mortar and Grout for Masonry.

Masonry reinforcement and connectors: in accordance with Section 04 05 19 – Masonry Reinforcement and Connectors.

Masonry accessories: in accordance with Section 04 05 23 – Masonry Accessories.

Brick masonry units: in accordance with Section 04 21 00 – Brick Masonry Units.

Concrete masonry units: in accordance with Section 04 22 00 – Concrete Masonry Units.

Architectural concrete masonry units: in accordance with Section 04 22 00 - Concrete Masonry Units.

PART 3- EXECUTION

3.1 WORKMANSHIP

Build masonry plumb, level, and true to line, with vertical joints in proper alignment. Lay masonry to tolerances specified in CAN/CSA A371-04.

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

Masonry mortar and grout work: in accordance with CAN/CSA A179-04 except where specified otherwise.

Masonry work: in accordance with CSA S304.1-04, CAN/CSA A370-15 and CAN/CSA A371-04 except where specified otherwise.

3.2 GENERAL ERECTION TOLERANCES

Lay masonry units with required mortar joint thickness specified below, not to exceed 12.7 mm (1/2").

Construction tolerances:

- .1 Maximum variation from plumb in vertical lines and surfaces of columns, walls and arrises:
 - .1 6.4 mm (1/4") in 3 m (10').
 - .2 9.6 mm (3/8") in a storey height not to exceed 6 m (20').
 - .3 12.7 mm (1/2") in 12 m (40') or more.
- .2 Maximum variation from plumb for external corners, expansion joints and other conspicuous lines:

- .1 6.4 mm (1/4") in any story or 6 m (20') maximum.
- .2 12.7 mm (1/2") in 12 m (40') or more.
- .3 Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
 - .1 6.4 mm (1/4") in any bay or 6 m (20').
 - .2 12.7 mm (1/2") in 12 m (40') or more.
- .4 Maximum variation from plan location of related portions of columns, walls and partitions:
 - .1 12.7 mm (1/2") in any bay or 6 m (20').
 - .2 19 mm (3/4") in 12 m (40') or more.
- .5 Maximum variation in cross-sectional dimensions of columns and thicknesses of walls from dimensions shown on the *Drawings*:
 - .1 Minus 6.4 mm (1/4").
 - .2 Plus 12.7 mm (1/2").
- .6 Where masonry surfaces serve as substrate for thin-set tile and direct applied and insulated finish coatings, build to tolerance of 3.2 mm in 2440 mm (1/8" in any 8') under a straight edge.

3.3 LAYING MASONRY UNITS

Coursing design:

- .1 Brick masonry units: Fifty percent running bond.
- .2 Concrete masonry units: 1/3 running bond.
- .3 Architectural concrete masonry units: Fifty percent running bond.

Installation and materials shall meet or exceed that of accepted samples and mock-up.

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

Keep cavity space at cavity and/or veneer walls clear of mortar droppings and debris.

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

Do not tooth at wall terminations. Rake back ½ unit length where stop-off occurs in horizontal run of masonry.

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

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

Mixing and blending: Mix units from a minimum of 3 pallets to ensure uniform blend of colour and texture and comply with manufacturer's recommended installation instructions. Distribute masonry units of varying textures to avoid spotty appearance over wall surfaces exposed to view. Do not use units which contrast too greatly with overall range.

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

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

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

Grouted reinforced masonry: incorporate reinforcing steel and construct masonry to indicated on the Shop drawings requirements.

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

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

Fully bond intersections, and external corners.

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

Cut masonry around obstructions, leaving maximum joint size as specified in this Section (below).

Build chases, do not cut them.

Lay hollow concrete masonry units so that shells rest and align.

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

3.4 EXPOSED MASONRY

Do not lay chipped, cracked, blemished, and otherwise damaged units in exposed masonry.

Do not lay chipped, cracked, and otherwise damaged units in concealed masonry.

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

Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

Maintain and control water-to-cement ratio, rate of hydration, environmental conditions, tooling of the mortar joints, and cleaning procedures, to produce masonry of uniform appearance matching accepted mock-up.

3.5 JOINTING

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

Tool with non-staining pointing tool to *Provide* smooth, compressed, uniformly formed joints as follows:

- .1 For exposed brick masonry: Concave.
- .2 For exposed concrete unit masonry: Concave.
- .3 For exposed architectural concrete unit masonry: Concave.

- .4 For concealed masonry: strike flush joints concealed in walls and joints in walls to receive plaster, stucco, tile, insulation, resilient bases, or other applied material except paint or similar thin finish coating. Ensure that no mortar protrudes from joints on wall surfaces to receive materials and coatings.
- .5 Joint thickness:
 - .1 Maintain mortar joint thickness of 10 mm (3/8"), unless otherwise specified or indicated on the Shop drawings.
 - .2 At masonry cut around obstructions: maximum joint size of 13 mm (1/2").

Make joints of uniform thickness with vertical joints in alignment.

Trowel point joints in unparged masonry at below grade locations in contact with earth.

Form reglets where indicated on the Shop drawings for metal flashing in masonry.

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

Rake out joints at junctions of masonry with concrete walls and columns, and at intersection of masonry walls and partitions where joint reinforcement is installed. These joints shall be sealed in accordance with Section 07 92 00 – Joint Sealants.

3.6 BUILT-IN WORK

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

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

Metal door frames:

- .1 Build masonry around metal door frames.
- .2 Ensure that anchors are secured solidly, and that frames are true and plumb.
- .3 Fill back void of frames with Type N or S mortar unless otherwise indicated on the Shop drawings.
- .4 Protect frame with protective covering and leave no mortar on exposed frame faces.

3.7 REINFORCED MASONRY

Conform to requirements of CAN/CSA A371-04.

Grout beneath bearing plates: Fill voids beneath steel bases bearing on masonry with approved non-shrink grout having minimum compressive strength at 28 Days cure time of 35 MPa. In addition, use non-ferrous grout where grout is exposed to view, in-service moisture conditions, and weather.

Reinforced block lintels:

- .1 Install reinforced block lintels over doorways, other openings and recesses as indicated on the Shop drawings.
- .2 Support masonry units of reinforced block lintels built in place. *Provide* a level platform, true to the proper elevation and of sufficient strength to support the load without visible deflection.

Maintain supports in place for a minimum of 7 Days and for a period sufficient to permit the concrete to cure and gain sufficient strength to safely support all loads.

- .3 Lay masonry units with full mortar coverage on abutting edges with joints shoved tight. Where masonry construction is continued above the lintel, place the first course of masonry units on the lintel in full mortar bed.
- .4 Fill voids of masonry units that form the fill depth of lintel beams at one time per beam, with grout having minimum compressive strength at 28 Days curing time of 35 MPa.

3.8 PROVISION FOR MOVEMENT

Deflection space:

- .1 Incorporate deflection space between tops of non-load-bearing walls/partitions and structure to prevent transference of structural loads to masonry.
 - .1 Exterior masonry wall deflection space: 12.7 mm (1/2").
 - .2 Interior masonry partition deflection space: 25 mm (1").
- .2 Coordinate work of this Section with installation of lateral supports.

3.9 LOOSE LINTELS

Loose lintels: Install loose lintels as required to suit required openings. Set and level lintels, centred over opening width, on a 20 mil PVC slip-sheet membrane, placed over bed or mortar. Allow suitable movement joint at ends of lintels for expansion and contraction movement at exterior lintels.

3.10 LATERAL SUPPORTS

1. In addition to requirements of the *Contract Documents*, *Provide* horizontal and vertical wall and partition lateral support anchors in accordance with CAN/CSA A370-15.

3.11 MOVEMENT (CONTROL) JOINTS

1. For masonry without openings, space vertical movement joints at no more than 7620 mm (25') on centre.
2. For masonry with multiple openings, *Provide* symmetrical placement of movement joints and reduced spacing of no more than 6096 mm (20 ft) on center.
3. Place movement joints at changes in wall direction, changes in building heights, at door and window locations where necessary and directed, at major changes in thickness of wall.
4. Extend control (movement) joints to top of masonry, including parapets.
5. Review and coordinate control joint locations with the *Consultant* prior to installation of masonry.

3.12 TEMPORARY BRACING

Provide adequate temporary bracing to masonry walls until floor and roof decks are installed and can develop adequate diaphragm action to brace walls.

3.13 FIELD QUALITY CONTROL

Conduct quality control in accordance with Section 01 45 00 – Quality Control and perform field control tests in accordance with CSA S304.1-04.

3.14 ADJUSTING AND CLEANING

Protect masonry and adjacent work from damage from cleaning work.

Clean masonry in accordance with masonry manufacturer's printed instructions. Remove masonry and install new masonry, if masonry is damaged by cleaning work, at the *Contractor's* expense.

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

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

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

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

Remove mortar from exposed masonry face immediately after pointing and prior to full set to avoid mortar staining of masonry units. Remove efflorescence and mortar deposits from surfaces to receive coatings and surfaces which are exposed to view. Remove masonry and install new masonry, if mortar staining cannot be removed without damaging masonry work.

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

Remove efflorescence and mortar deposits from surfaces to receive coatings or surfaces which are exposed to view, occurring within a time period of one year from the date of *Substantial Performance of the Work* as required by the *Consultant* or the *Owner*.

3.15 PROTECTION

Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

Protect other materials and finishes from contamination by mortar droppings.

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Delivery, Storage, and Handling
- .6 1.6 Field Conditions
- .7 2.1 Materials
- .8 2.2 Material Source
- .9 2.3 Mortar Types
- .10 2.4 Mortar Colour
- .11 2.5 Grout Types
- .12 3.1 Masonry Procedures
- .13 3.2 Measurement and Mixing
- .14 3.3 Grout
- .15 3.4 Field Quality Control
- .16 3.5 Protection

1.3 SUMMARY

- .1 Mortar and grout for masonry work.
- .2 Pigmented mortar at following masonry assemblies; locations as indicated on the Shop drawings:
 - .1 Brick masonry units.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 04 05 00 – Masonry Procedures.
- .2 Test and evaluation reports: Submit test results confirming compliance of aggregates with CAN/CSA A179-04.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Protect cementitious materials against moisture.
- .2 Prevent contamination by foreign materials, and freezing.

1.6 FIELD CONDITIONS

- .1 Heat materials as follows to produce mortar temperature between 4°C and 50°C:

- .1 When air temperature is between 4°C and 0°C, heat either sand or water to produce specified mortar temperature.
- .2 When air temperature is below 0°C, heat both sand and water to produce specified mortar temperature.
- .3 Do not heat water or sand above 50°C.
- .4 Produce mortar batches subsequent to the first within plus 6°C of the first.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Mortar and grout: Comply with CAN/CSA A179-04.
- .2 Portland cement: in accordance with CSA A3001-08, Type 10. For exposed mortar, maintain uniformity of cement manufacturer and batch for colour uniformity.
- .3 Hydrated lime: in accordance with ASTM C207-06(2011), Type S.
- .4 Sand: in accordance with CAN/CSA A179-04.
- .5 Mortar pigment:
 - .1 Mortar colours shall contain pure, concentrated mineral pigments especially processed for mixing into mortar and complying with ASTM C979-05.
 - .2 Allow for blended mortar pigment colours to match each type of masonry veneer.
 - .1 Colours: to be selected by *Consultant*.
 - .1 Colours shall be selected from full pricing range.
 - .2 Loading (% of cementing material):
 - .1 3% (half loading).
 - .2 6% (full-loading).
 - .3 Acceptable manufacturers:
 - .1 Davis Colors 'True Tone Sweet 16 Cement Colors'.
 - .2 Lanxess Corporation 'Bayferrox Iron Oxide Pigments'.
 - .3 Solomon Colors, Inc. 'Concentrated Mortar Colors'.
 - .4 Or *Equivalent*.

2.2 MATERIAL SOURCE

- .1 Mortar and grout shall be factory prepared premix including sand and colour. *Site* mixing of bags and sand will not be accepted. Use mortar and grout as supplied by silo batched systems.
- .2 Maintain uniformity of mortar material manufacturers, mortar materials and source of aggregate throughout the *Work*.

2.3 MORTAR TYPES

- .1 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type S.
- .2 Mortar for exterior masonry above grade:
 - .1 Loadbearing: Type S.
 - .2 Non-loadbearing: Type N.
 - .3 Mortar for exterior exposed masonry veneer: Type N, Portland Cement/Lime/Sand mix.
- .3 Mortar for interior masonry:
 - .1 Loadbearing: Type S.
 - .2 Non-loadbearing: Type N.

2.4 MORTAR COLOUR

- .1 Mortar colour; for use as indicated on the Shop drawings:
 - .1 Except where pigmented mortar is specified or indicated: Control mortar materials and workmanship to produce uniform grey colour (non-pigmented).

2.5 GROUT TYPES

- .1 Grout for masonry: Grout in accordance with CAN/CSA A179-04.
 - .1 Compressive strength:
 - .1 20 MPa minimum unless otherwise indicated.
 - .2 Beneath bearing plates: 35 MPa.
 - .2 Slump: 200 mm (8") unless otherwise indicated.
- .2 Grout for hollow metal frames: Fine grout in accordance with CAN/CSA A179-04.
 - .1 Compressive strength: 15 MPa minimum.

PART 3 - EXECUTION

3.1 MASONRY PROCEDURES

- .1 Masonry procedures shall be in accordance with Section 04 05 00 – Masonry Procedures as supplemented in this Section.
- .2 Comply with CAN/CSA A179-04, except where indicated otherwise.

3.2 MEASUREMENT AND MIXING

- .1 Mix mortars and grout as specified in CAN/CSA A179-04. Use only dry aggregate. Test for bulking to determine accurate proportioning.
- .2 Adjust water in mortar mix to suit absorption rates of masonry units.
- .3 Concrete grout: mix as required to achieve specified compressive strength.

3.3 GROUT

- .1 Place and grout reinforcing and bearing in accordance with Section 04 05 00 – Masonry Procedures, CAN/CSA A371-04, and as indicated on the Shop drawings.

3.4 FIELD QUALITY CONTROL

- .1 *Provide* mortar for strength testing in accordance with CAN/CSA A179-04 and Section 01 45 00 – Masonry Procedures.

3.5 PROTECTION

- .1 *Provide* protection where required at mixing areas to prevent damage attributed to materials of this Section.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 2.1 Materials
- .6 3.1 Control Joints
- .7 3.2 Horizontal Reinforcing
- .8 3.3 Masonry Veneer Connectors
- .9 3.4 Reinforced Masonry
- .10 3.5 Bolts and Anchors
- .11 3.6 Lateral Support and Anchorage

1.3 SUMMARY

- .1 Masonry reinforcing and anchorage.
- .2 Connectors for anchorage of masonry veneer to the following support assemblies:
 - .1 Concrete unit masonry.
 - .2 Wind bearing metal studs.
- .3 Horizontal reinforcing for masonry block wall and partition assemblies.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 04 05 00 – Masonry Procedures.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 General: in accordance with the Ontario Building Code (as amended) and CAN/CSA A370-15.
- .2 Corrosion protection; metal materials: in accordance with the Ontario Building Code and CAN/CSA A370-15:
 - .1 Hot dipped after fabrication in accordance with ASTM A1064/A1064M-15, and ASTM A153/A153M-09 Class B2 (457 g/m²).
 - .1 Interior to air barrier location: Use mill galvanized.
 - .2 For metal located exterior to the air barrier membrane: Stainless steel Type 304/316.
- .3 Joint reinforcement: Acceptable manufacturers:

- .1 Blok-Lok Limited
- .2 Or *Equivalent* (substitutions in accordance with Section 01 25 00 – Product Substitution Procedures).
 - .1 Exterior wall assemblies: 4.75 mm (3/16") wire, welded rod, ladder design unless otherwise indicated.
 - .2 Interior wall assemblies: 9 gauge mill galvanized wire ladder reinforcement.
- .4 Exterior masonry veneer connectors for connection to concrete masonry unit back-up:
 - .1 Description: Stainless steel ASTM A666-15 Type 304 or 316 formed plate construction, wire V-TIE or TRI-TIE or equivalent masonry veneer connector (4.76 mm (3/16") cold drawn stainless steel Type 304 or 316 in accordance with ASTM A580/A580M-15), stainless steel or polyethylene insulation securement plates for insulation sheathing:
 - .2 Acceptable Products:
 - .1 Fero 'Slotted Block Tie (Type 1)'.
 - .2 Or *Equivalent*.
- .5 Masonry veneer connectors; stud back-up (installed on top of air barrier membrane and sheathing material):
 - .1 Description: Stainless steel ASTM A666-15 Type 304 or 316 plate construction, wire V-TIE or TRI-TIE masonry veneer connector (4.76 mm (3/16") cold drawn stainless steel Type 304 or 316 to ASTM A580/A580M-15), stainless steel or polyethylene insulation securement plates for insulation sheathing:
 - .2 Acceptable Products:
 - .1 Blok-Lok Limited 'BL-407'.
 - .2 Fero 'Slotted Rap-Tie'.
 - .3 Or *Equivalent*.
 - .3 Fasteners: minimum of 2 screws per tie, No. 12, Climaseal or equivalent coated galvanized steel, self-drill type, #10 minimum.

PART 3 - EXECUTION

3.1 CONTROL JOINTS

- .1 Stop reinforcing 25 mm (1") short of each side of control joints unless otherwise indicated.

3.2 HORIZONTAL REINFORCING

- .1 Joint reinforcement:
 - .1 Install horizontal joint reinforcement in cavity walls, solid walls, and partitions in accordance with CAN/CSA A371-04 and as indicated in the *Contract Documents*, the more stringent requirements shall govern.
 - .2 Place reinforcement continuously in horizontal joints at vertical spacing not exceeding 400 mm (16"), beginning with course 400 mm (16") above bearing, unless otherwise indicated.

- .3 Do not carry reinforcement through intersections where lateral support anchors are installed, at intersections of walls and partitions with solid piers and at block control joints.
- .4 Reinforcement shall be lapped 300 mm (12"), minimum, with laps staggered 750 mm (30"), minimum, from course to course. Any cross wires in the lap length of the lapped reinforcement shall be removed.

3.3 MASONRY VENEER CONNECTORS

- .1 Tie masonry veneer to structural backing in accordance with CAN/CSA A370-15 with masonry veneer connectors at following maximum spacing:
 - .1 Maximum spacing unless otherwise indicated: 600 mm (24") vertically x 820 mm (32") horizontally.
 - .2 Stud back-up assemblies: 600 mm (24") vertically and 400 mm (16") horizontally. Ties are permitted be staggered horizontally on alternating studs provided the stud spacing does not exceed 410 mm (16") o.c. and the resulting horizontal tie spacing does not exceed 820 mm (32") o.c. The stagger shall be arranged so that all studs have ties including the top row of ties.
 - .3 At openings in masonry walls: 600 mm (24") apart around opening, and not more than 300 mm (12") from edge of opening.
 - .4 At tops and bottoms of walls: 300 mm (12") from edge of top of wall, and 400 mm (16") from edge of bottom support.
 - .5 At movement joints: 300 mm (12") from joint.

3.4 REINFORCED MASONRY

- .1 Reinforce masonry lintels and bond beams as indicated on the Shop drawings. Make joints in lintels and bond beams to match adjacent walls.
- .2 Reinforce masonry walls as indicated on the structural *Drawings*.
- .3 Place and grout reinforcing in accordance with CSA S304.1-04. Use concrete of 20 MPa strength in accordance with Section 03 30 00 – Submittal Procedures.
- .4 *Provide* minimum 150 mm (6") bearing on supports for lintels.
- .5 Place 100% solid block at each jamb under lintels.

3.5 BOLTS AND ANCHORS

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

3.6 LATERAL SUPPORT AND ANCHORAGE

- .1 Install lateral support and anchorage in accordance with CAN/CSA A370-15 and as indicated on the structural *Drawings*.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 2.1 Materials
- .6 3.1 Masonry Installation and Procedures
- .7 3.2 Control Joints
- .8 3.3 Vents
- .9 3.4 Masonry Flashing
- .10 3.5 Deflection Space Filler
- .11 3.6 Slip Sheet at Metal Lintels
- .12 3.7 Shelf angle supports and Shelf angles

1.3 SUMMARY

- .1 Control joint filler at masonry veneer.
- .2 Weep vents at cavity masonry veneer. Deflection space filler at top of non-fire rated masonry partitions.
- .3 Deflection space filler at top of fire-rated masonry partitions.
- .4 Preformed control joint filler at concrete walls/partition assemblies.
- .5 Slip-sheet membrane for steel lintel bearing over masonry to allow lintel movement (thermal expansion/contraction).

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 04 05 00 – Masonry Procedures.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Control joint filler at masonry veneer: sealant and backer rod in accordance with Section 07 92 00 – Joint Sealants.
- .2 Weep vents: Full height of masonry unit, designed to keep weep hole open for passage of air and water, UV stabilized polypropylene.
 - .1 Size: Height of head joint x depth of masonry unit x thickness of mortar joint.

- .2 Colour: to later selection by the *Consultant* from manufacturer's full range.
- .3 Acceptable *Product*:
 - .1 Advanced Building Products, Inc. 'Mortar Maze Cell-Vents'.
 - .2 Blok-Lok Limited 'Cell-Vent'.
 - .3 Mortar Net Solutions 'CellVent'.
 - .4 Wire-Bond 'Cell-Vent'.
 - .5 Or *Equivalent*.
- .3 Deflection space filler (non-fire rated walls):
 - .1 Acceptable *Product*:
 - .1 Johns Manville 'MinWool Sound Attenuation Fire Batts'.
 - .2 Roxul "AFB".
 - .3 Or *Equivalent*.
- .4 Deflection space filler (fire rated walls):
 - .1 Mineral type in accordance with Section 07 84 00 – Firestopping and Smoke Seals.
- .5 Control joint filler; concrete block wythes:
 - .1 PVC, designed to fit into sash grooves.
 - .2 Acceptable *Product*: Blok-Lok Limited 'VS Series' or *Equivalent*.
- .6 Slip-sheet flashing membrane (for lintel bearing locations):
 - .1 Minimum 0.5 mm (0.020") thick, PVC membrane, low temperature flexible to 40°C below zero.
 - .2 Acceptable *Products*:
 - .1 Blok-Lok Limited 'Flex-Flash'.
 - .2 Lexcor F20.
 - .3 Or *Equivalent*.
- .7 Shelf angle supports and Shelf angles
 - .1 Shelf angle supports: FAST Thermal Bracket System, consisting of FAST Thermal [Standard, Lintel, Inverted, TTS, or other custom] Brackets, Rectangular Washers, Shim Rods, and Shim Plates.
 - .1 All components manufactured by FERO Corporation, Edmonton, AB.
 - .2 FAST Thermal Bracket sized accordingly to shelf angle size.
 - .3 FAST Thermal Bracket sized accordingly to anchor diameter (anchor typically determined by EOR).
 - .4 FAST Thermal Bracket sized accordingly to suit wall assembly.

- .5 FAST Thermal Bracket to not exceed maximum spacings listed in FERO published load table and technical information, unless directed otherwise by a professional engineer registered or licensed in the local jurisdiction.
- .2 Shelf angles: FERO FAST Punched Angle to be used above openings with FAST™ Thermal Lintel Brackets hot dipped galvanized angle to be used with the FAST™ Thermal Standard Brackets
 - .1 FERO FAST Punched Angle to be manufactured by FERO Corporation, Edmonton, AB.
 - .2 Shelf angles for the Standard FAST Thermal Brackets can be supplied locally
 - .3 Installer is responsible for sizing FAST™ system to suit wall assembly and field conditions.
- .3 FAST Thermal Bracket depth to fill wall cavity or as shown in construction documents.
- .4 FAST Thermal Bracket height to meet anchor to shelf and distance.
- .5 FERO shim plates to be used for meeting construction tolerances.
- .6 Installer to install FAST Thermal Bracket System in compliance with FERO published technical documentation.
- .7 Shelf angle thickness and FAST Thermal Bracket anchorage requirements to be designed by a professional engineer registered or licensed accordingly to local jurisdiction.
- .8 All shop drawings relating to shelf angle supports and shelf angles to be reviewed and stamped for approval by a professional engineer registered or licensed accordingly to local jurisdiction, which can be done by contractor or delegated to FERO.
- .9 All components to be hot dipped galvanized after fabrication to meet the requirements of ASTM A123 and CSA A370-14.

PART 3 - EXECUTION

3.1 MASONRY INSTALLATION AND PROCEDURES

- .1 Masonry installation and procedures shall be in accordance with Section 04 05 00 – Masonry Procedures, as supplemented in this Section.

3.2 CONTROL JOINTS

- .1 Keep control joints clear for application of joint sealants.
- .2 *Install* control joint filler in accordance with manufacturer's recommendations.

3.3 VENTS

- .1 *Install* weep vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at uniform and consistent horizontal spacing not exceeding 610 mm (24"). Do not locate vents within 610 mm (24") adjacent to corners of buildings.

3.4 MASONRY FLASHING

- .1 General: *Install* embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated on the Shop drawings.
- .2 *Install* flashing as follows unless otherwise indicated on the Shop drawings:

- .1 *Install* flashings in masonry in accordance with CAN/CSA A371-04.
- .2 Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through- wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal laps and penetrations in flashing watertight in accordance with manufacturer's installation instructions.
- .3 At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and project face of sheathing or inner wythe minimum of 150 mm (6"); with upper edge tucked under air/vapour barrier membrane and fully adhered to substrate unless otherwise indicated on the Shop drawings, lap joints minimum of 100 mm (4").
- .4 At lintels and shelf angles, extend flashing a minimum of 150 mm (6") into masonry at each end. At heads and sills, extend flashing minimum of 150 mm (6") at ends and turn up 50 mm (2") minimum to form end dams.
- .5 Flashings shall be installed to shed water in masonry cavity to exterior. Make flashings watertight.
- .6 *Install* masonry flashing to perform as dampproof course in walls that extend below grade except walls which are not exposed to moisture or protected by moisture retarding materials. Locate more less than 150 mm (6") above finished grade.

3.5 DEFLECTION SPACE FILLER

- .1 Non-fire rated walls: Fill deflection space with deflection space filler. Where deflection space is exposed, tamp filler into deflection space 25 mm (1").
- .2 Fire-rated walls: Refer to requirements of Section 07 84 00 – Firestopping and Smoke Seals.

3.6 SLIP SHEET AT METAL LINTELS

- .1 *Install* at loose lintel locations between bearing area of lintel and bed. Trim away exposed slip sheet.

3.7 SHELF ANGLE SUPPORTS AND SHELF ANGLES

- .1 Install in accordance with manufactures recommendations and the Contract Documents.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 2.1 Materials
- .6 3.1 Laying

1.3 SUMMARY

- .1 Clay brick.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 04 05 00 – Masonry Procedures.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Manufacture: Manufacture total required brick in one continuous batch, for maximum colour and texture uniformity.
- .2 Clay brick:
 - .1 Exterior kiln fired clay brick veneer: in accordance with CAN/CSA A82.1-M87.
 - .1 Grade SW.
 - .2 Type: FBX.
 - .2 Size: Modular: 57 mm x 92 mm x 194 mm (2-1/4" x 3-5/8" x 7-5/8").
 - .3 Acceptable *Product*: 'Endicott Manganese Ironspot Velour' complete with pigment mortar, as distributed by Thames Valley or *Equivalent*.

PART 3 - EXECUTION

3.1 LAYING

- .1 Lay masonry in accordance with good practice, CAN/CSA A371-04 and as accepted in mock-up sample wall and as specified in Section 04 05 00 – Masonry Procedures.
- .2 Review locations of coursing alignment and layout with the *Consultant*, and seek approval, prior to commencement of the work of this Section.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 2.1 Materials
- .6 2.2 Source Quality Control
- .7 3.1 Preparation
- .8 3.2 Masonry Procedures

1.3 SUMMARY

- .1 Concrete masonry units:
 - .1 Normal weight units.
 - .2 Ultra light weight units.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 04 05 00 – Masonry Procedures.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Concrete masonry units:
 - .1 Comply with CAN/CSA A165 SERIES-04.
 - .2 Include shapes, such as end, bond, sash groove, ledge and lintel units, required to complete the *Work*, with uniform appearance.
 - .1 *Provide* open end blocks where vertical reinforcing occurs in walls.
 - .2 *Provide* knock-out blocks where horizontal reinforcing bars occur in walls.
 - .3 Solid concrete masonry units may be used where grouted block is indicated on the Shop Drawings, whenever reinforcing is not indicated, in lieu of grouted solid installation method.
 - .4 Size: metric.
- .3 Normal weight units:
 - .1 Hollow units: H/15/A/M, H/20/A/M, and H/30/A/M.

- .2 Semi-solid units: SS/15/A/M, SS/20/A/M, and SS/30/A/M.
- .3 Full solid units: SF/15/A/M, SF/20/A/M, and SF/30/A/M.
- .4 Colour: grey.
- .5 Profiles: as indicated on the Shop Drawings.
- .4 Ultra light weight units:
 - .1 Hollow units: H/15/D/M.
 - .2 Semi-solid units: SS/15/D/M.
 - .3 Full solid units: SF/15/D/M.
 - .4 Colour: grey.
 - .5 Profiles: as indicated on the Shop Drawings.
 - .6 Acceptable *Products*:
 - .1 Richvale Block 'Ultra Lite'
 - .2 Permacon 'Super Lightweight'.
 - .3 Or *Equivalent*.

2.2 SOURCE QUALITY CONTROL

- .1 Perform tests on masonry units to determine compressive strength as required by the *Authorities Having Jurisdiction* in accordance with CAN/CSA A165 SERIES-04.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 MASONRY PROCEDURES

- .1 Lay masonry in accordance with Section 04 05 00 – Masonry Procedures and CAN/CSA A371-04, as accepted by the Consultant in mock-up sample wall.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- .1 The Contractor shall ensure that no asbestos containing materials are used in connection with the work of this section.

1.2 REFERENCE STANDARDS

- .1 Comply with The Building Code Act, as amended, the 2012 Ontario Building Code (OBC) as amended and Regulations and by-laws of other authorities having jurisdiction, including latest amendments thereto; all hereafter referred to as Building Code.
- .2 All codes, standard specifications and by-laws referred to in this Specification shall be current editions including all latest revisions, addenda and supplements, unless otherwise noted in the Building Code.
- .3 Conform to the following CSA Standards:
 - .1 S16..... Design of Steel Structures.
 - .2 W59..... Welded Steel Construction (Metal Arc Welding).
 - .3 W47.1..... Certification of Companies for Fusion Welding of Steel.
 - .4 G40.20/G40.21..... General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 S136..... North American Specification for the Design of Cold-Formed Steel Structural Members.
- .4 Conform to the following ASTM Standards:
 - .1 A108..... Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - .2 A123/A123M Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 A563..... Standard Specification for Carbon and Alloy Steel Nuts.
 - .4 F436/436M Standard Specification for Hardened Steel Washers Inch and Metric Dimensions

- .5 F1554..... Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
- .6 F3125/F3125M..... Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- .5 Conform to:
 - .1 CISC/CPMA 1-73a A Quick-Drying One-Coat Paint for Use on Structural Steel.
 - .2 CISC/CPMA 2-75 A Quick-Drying Primer for Use on Structural Steel.
- .6 In the event of conflict between reference standards, codes, drawings and specifications, the Contractor shall request clarification by the Consultant. The Consultant's decision as to which requirements govern shall be final and binding. Generally the more stringent provision shall govern. No extras to the contract will be approved due to such clarification.
- .7 Conform to the Occupational Health and Safety Act, R.S.O. 1990, c. O.1, last amendment.

1.3 SOURCE QUALITY ASSURANCE

- .1 The following is MANDATORY:
 - .1 The bidding Contractors are advised that their bids may be rejected unless documentation is submitted.
 - .2 Submission does not mean acceptance. Acceptance shall be in writing issued by the Consultant.
 - .3 The steel fabricator and erector shall have a minimum of 5 years of experience on projects of similar size and scope. If requested, the fabricator and erector shall provide documentation with references including contact names and phone numbers.
- .2 When requested, submit two (2) certified copies of mill reports covering chemical and physical properties of steel used in this work.

1.4 DESIGN OF DETAILS AND CONNECTIONS

- .1 Design details and connections by a Professional Engineer licensed in the Province of Ontario, to requirements of CSA S16 or CSA S136 to resist forces, moments and shears indicated on or implied by the drawings.
- .2 Unless otherwise noted, beam connections shall be designed for a minimum of 50% of the shear capacity of the beam.
- .3 Conform to the Fire Rated Assembly Design specified for the project.
- .4 Bolts in the following types of connections are to be **pretensioned** in accordance with the requirements of S16:
 - .1 Slip-critical connections.
 - .2 Connections governed by seismic requirements.
 - .3 Connections for all elements resisting crane loads.
 - .4 Connections for members directly supporting running machines or other live loads that produce impact or cyclic load.
 - .5 Connections where bolts are subject to tensile loads.
 - .6 Connections using oversized or slotted holes unless specifically designed to accommodate moment.
- .5 The following types of connections are to be designed as **slip-critical connections**:
 - .1 Connections where slippage cannot be tolerated, including:
 - 1. All moment connections (unless end plate type moment connections are used.
 - 2. Connections where welds and bolts share in transmitting shear forces at a common faying surface.
 - .2 Connections that utilise oversized holes.
 - .3 Connections subject to fatigue or frequent load reversals.

1.5 SUBMISSIONS

- .1 Refer also to **Source Quality Assurance**.
- .2 Refer also to **Quality Control**.

- .3 Prior to submission of SHOP DRAWINGS, submit calculations and sketches for review that bear the stamp and signature of the Licensed Professional Engineer responsible for the design. The following are MANDATORY REQUIREMENTS:
 - .1 TYPICAL MOMENT CONNECTIONS.
 - .2 VERTICAL BRACINGS.
 - .3 COLUMN TO BASE PLATE CONNECTIONS.
 - .4 BEAM TO COLUMN SHEAR CONNECTIONS.
 - .5 BEAM TO BEAM CONNECTIONS.
 - .6 COLUMN TO COLUMN "VERTICAL" AND "FUTURE" CONNECTIONS.
 - .7 NON-STANDARD CONNECTIONS.
- .4 Submitted Shop Drawings shall cross reference to reviewed and approved calculations and sketches.
- .5 **Shop Drawings**
 - .1 Provide erection drawings having a scale no less than the structural framing plans and detail drawings of individual members and complete information necessary for fabrication and erection.
 - .2 Copies of Structural Framing Plans and Sections utilized as erection drawings are not permitted unless permission is first sought from and granted by the Structural Consultant.
 - .3 Submit shop drawings for review as directed.
 - .4 All shop drawings shall bear a Professional Seal and Signature.
 - .5 Fabrication shall not commence until shop drawings are reviewed.
 - .6 Allow ten (10) working days for the review of drawings and supply as many copies for review and distribution as directed. Shop drawings shall be checked in detail by the Contractor and shall bear the checker's initials before submission.
 - .7 Drawings which fail to meet these requirements shall be returned marked **NOT REVIEWED** and must be re-submitted after correction.
 - .8 The review of shop drawings shall not relieve the Contractor of the responsibility of seeing that this work is complete, accurate and in conformity with the drawings and this specification.
 - .9 Only shop drawings bearing the review stamps shall be kept at the site.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 MATERIALS

- .1 Structural steel sections and plates and all connection angles and plates shall conform to CSA Standard G40.20/G40.21 as follows:

W shapes – Grade 350W.
S shapes – Grade 300W.
HSS Shapes – Grade 350W (Class C unless noted).
Channels, Angles – Grade 350W.
Plates and Rod – Grade 300W.

Note that ASTM A500 Grade C HSS columns are NOT an acceptable direct substitution for CSA G40.21.

- .2 Welding materials: to conform to CSA Standard W59.
- .3 High Strength Fasteners: Bolts, Nuts, and Washers to conform to ASTM F3125/3125M, grade A325.
- .4 Anchor Rods: to conform to ASTM F1554, Grade 36, unless otherwise noted on the drawings.
- .5 Sag Rods: to conform to CSA G40.20/G40.21.
- .6 Strap Anchors: to conform to CSA G40.20/G40.21.
- .7 Shear Stud Connectors: to conform to ASTM A108, $F_y = 345 \text{ MPa}$ [50 ksi].
- .8 PAINT:

- .1 General Steel: Shop Primer and Field “touch-up” Paint to conform to SSPC-PAINT 20 (Type I)
- .2 For exterior exposed steel where surfaces are to be primed provide a Corrosion Resistant and Field “touch-up” Primer as follows:

Acceptable product:

- .1 CARBOZINC 11, (Solvent based inorganic zinc)
- .2 Colour, 0300 (GREEN) or 0700 (GRAY)
- .3 Steel Surface Preparation:

A minimum, non-immersion SSPC-SP6 and obtain a 25 to 75 micrometres [1 – 3 mils] Angular Blast Profile.

- .4 Dry Film Thickness:
50 to 75 micrometres [2 – 3 mils] applied by spray (airless or conventional) with constant agitation.
- .5 Field Touch-Up:
Areas less than 0.1 m² [1 ft²]: clean (SSPC SP-1) , manually abrade (SSPC SP-2 or SP-3) and touch-up with Carbozinc 859 (organic zinc, SSPC Paint 20, type II).
Areas more than 0.1 m² [1 ft²]: Tape, re-blast to SSPC SP-6 and spray apply Carbozinc 11 (Inorganic Zinc, SSPC Paint 20, Type I).
- .3 Where an epoxy paint (SSPC Paint 20) is specified in combination with a zinc-rich primer, provide a compatible epoxy paint as follows:

Acceptable product:
 - 1. CARBOGUARD 890 (Cycloaliphatic Amine Epoxy)
 - 2. Dry Film thickness: 100 to 150 micrometres [4.0-6.0 mils]
- .4 For field “touch-up” of galvanized surfaces provide same product as touch-up primer.
- .9 GALVANIZING: For connections at all members specified to be galvanized, provide galvanized nuts, bolts, washers, clip angles and plates etc.

PART 3 – EXECUTION

3.1 FABRICATION

- .1 Fabricate structural steel and joists to CSA S16 and W59, and in accordance with reviewed shop drawings.
- .2 Provide drain holes in closed HSS Sections to prevent moisture build-up within the member.

3.2 PROTECTION

- .1 Cleaning Steel
 - .1 Clean structural steel and joists in accordance with the table below.

- .2 Clean surfaces within 50 mm (2") of any field weld location of materials which would prevent proper welding or produce objectionable fumes while welding is being completed.

.2 Painting

- .1 Shop paint or galvanize structural steel in accordance with the table below. Refer also **Galvanized Sections** for additional requirements.
- .2 Apply coating under cover, on dry surfaces only and when surface and air temperatures are above 5°C [41°F].
- .3 Maintain dry conditions and 5°C [41°F] minimum temperature until coating thoroughly dry.
- .3 Joints which are to be field welded shall be kept free of primer or other coating that could be detrimental to achieving sound weldment.
- .4 FIELD TOUCH-UP for welds, scrapes, etc.
- .1 General Interior Surfaces: With specified coating
- .2 Exterior Exposed Surfaces:.... With specified coating
- .3 Galvanized Surfaces:..... GALVAFROID or approved equal

Environment	Structural Member	Preparation	Protection	Remarks
Dry enviroment with structural steel encased in concrete, or masonry, or covered in non-corrosive contact type fire proofing	Structural Steel	SSPC-SP3 Power Tool Cleaning	Leave Unpainted	
Protected (Inside vapour barrier)	Structural Steel not exposed to view	SSPC-SP3 Power Tool Cleaning	CISC/CPMA 1-73a OR [Leave Unpainted]	
	Structural Steel exposed to view, but not designated as AESS	SSPC-SP7 Brush-Off Blast Cleaning	CISC/CPMA 2-75	.
Unprotected (outside vapour barrier and/or	Structural Steel	SSPC-SP7 Brush-Off Blast Cleaning	Hot Dip Galvanize	Note additional requirements for galvanizing in

unconditioned space) but not exposed to chlorides. (See note (a))		+ SSPC-SP8 Pickling		specification sections.
Unprotected (outside vapour barrier and/or unconditioned space) exposed to chlorides.	Structural Steel	SSPC-SP10 Near White Blast Cleaning	Inorganic zinc-rich primer (SSPC Paint 20, type I) and epoxy paint (SSPC Paint 22)	Provide topcoat SSPC Paint 36, Level 3, when exposed to sunlight
High Humidity (inside vapour barrier)	Structural Steel	SSPC-SP6 Commercial Blast Cleaning	Inorganic zinc-rich primer (SSPC Paint 20, type I)	
Chemical exposures (acidic, alkaline, oxidizing, solvents, etc.)	Structural Steel	SSPC-SP10 Near White Blast Cleaning	Inorganic zinc-rich primer (SSPC Paint 20, Type I) with chemically resistant finish coat system (SSPC Paint 22) specially chosen to protect primer and base metal against specific chemical agent. (See Note (b))	

Notes:

- (a) This includes canopies, outdoor screens, exterior mechanical support framing, shelf angles (including supporting brackets) and lintels in exterior walls.

3.3 GALVANIZED SECTIONS

- .1 Apply galvanizing to all steel members as noted in clause 3.2.
- .2 Fabricate all framing prior to galvanizing providing all required vent holes and cap plates to ensure complete internal and external coverage is required.
- .3 Galvanize in accordance with A123/A123M to minimum coating of 610 g/m² [2 oz/ft²].
- .4 All bolts, nuts, washers, connector plates, clips, etc. at member connections shall be galvanized.
- .5 Galvanize members after shop welding has been completed.

- .6 When welding after galvanizing is in place, grind away galvanizing at areas to be welded and touch-up with two coats of coating complying with SSPC PAINT 20, Type II.
- .7 In cases where galvanized framing is in contact with plain carbon steel locally provide two coats of coating to the plain steel complying with SSPC PAINT 32 where members are in contact.
- .8 Where the galvanizing process of members may cause distortion of the structural framing, submit procedures for review by the Consultant and make good to tolerances noted in the contract documents.
- .9 Identify at time of tender any splices or additional fabrication requirements due to the size, length or weight constraints imposed by the galvanizing process.
- .10 FINISH PAINTING

Where finish painting is specified for galvanized surfaces, the galvanizer is to eliminate any after-galvanizing treatment that would normally be applied to the coating that will adversely affect paint adhesion.

3.4 BEARING/WALL PLATES FOR BEAMS

- .1 Provide a minimum of two (2) anchors, 12 mm [1/2"] diameter by 300 mm [12"] long with 50 mm [2"] hook, for all bearing plates on masonry embedded vertically and grouted in solid unless specifically noted otherwise on the drawings.
- .2 Weld beams to plates with a minimum of two (2) 3 mm x 25 mm [3/16" x 1"] fillet welds unless noted otherwise.

3.5 RELATION TO OTHER TRADES

- .1 Give all necessary directions for setting anchor rods, bearing plates and other members required to be built in with the work of other trades.
- .2 Verify the location and condition of all bearing surfaces placed by others. All such surfaces shall be at the elevations called for on the drawings and shall be truly level.
- .3 Commencement of erection implies acceptance of the work of other sections which affect the work of this section.
- .4 No claim for relief from contractual responsibility or for extras to the contract will be allowed unless such claim is made in writing prior to commencement of the work.
- .5 Ensure the proper bearing surface and amount of bearing is available to support steel members.

- .6 Supply materials and all necessary directions for installation of all anchor rods, & bearing plates, and also clips, angles and weld plates for steel deck if and as required. Co-ordinate with steel deck supplier for their actual requirements.
- .7 Weld approved anchor slots at 600 mm [24"] on center for adjustable masonry anchors, on all steel surfaces to be built into masonry.
- .8 Provide and reinforce to the approval of the Consultant, openings through beams required by other trades. Obtain approval of the Consultant for location of the holes. The cost for this work shall be paid for by the trade requiring the openings. Reinforce openings to maintain required design strength.
- .9 Provide at any time before the drawings are approved, punched holes from 11 to 27 mm [0.43" to 1.1"] diameter for the convenience of other trades as requested by them. Holes shall be placed so as not to cause any appreciable reduction in the strength of such members.
- .10 Co-ordinate with the Mechanical and Electrical Drawings and Trades to ensure that there is no interference between ductwork, suspended lighting fixtures and hangers, and structural steel members.

3.6 LINTELS

- .1 Generally lintels will be supplied only by this section and be placed by the General Contractor.
- .2 Lintels shall conform to the Lintel Schedules, Notes and Typical Details on the Structural drawings.
- .3 While every effort has been made to show all lintels which occur in load bearing masonry walls, it is the Contractor's responsibility to ensure that the correct size and quantity of lintels are provided.
- .4 Lintels in non-load bearing walls and partitions are generally NOT SHOWN ON THE DRAWINGS. All such lintels shall be provided as required and shall conform to the Notes & Typical Details on the structural drawings.
- .5 Refer also to **Galvanizing** earlier in this section.

3.7 ERECTION

- .1 Commencement of erection implies acceptance of the work of other sections which affect the work of this section.
- .2 No claim for relief from contractual responsibility or for extras to the contract will be allowed unless such claim is made in writing prior to commencement of the work.
- .3 Conform to the requirements of CSA S16.
- .4 Provide a competent and experienced supervisor.

- .5 Provide all necessary temporary bracing to keep structure safe and plumb. Bracing on structural drawings is for the finished building only.
- .6 Report all lack of fit to the Consultant before correction.
- .7 Obtain written approval from the Consultant prior to field cutting or altering structural steel framing or open web steel joists or bridging.
- .8 Touch-up shop primer to bolts, welds, burned or scraped surfaces at completion of erection.
- .9 Provide proper coordination between the structural steel contractor, the mechanical and electrical contractors to ensure that all required openings through structural steel members are approved and are clearly detailed on the Shop Drawings before fabrication and erection. (Openings are to be reinforced to maintain the required design strengths.) The costs of such openings and/or for the provision of openings installed in the field, are to be borne by the Contractor or the trade requiring the opening, and are not extra to the Contract.

3.8 TOLERANCES

- .1 Conform to CSA-S16 and to the Typical Notes on the Drawings.

3.9 QUALITY CONTROL

- .1 Implement a system of quality control to ensure that the minimum standards specified herein are attained.
- .2 Bring to the attention of the Consultant any defects in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.
- .3 The Consultant 's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility. The contractor is solely responsible for quality control and shall implement its own supervisory and quality control procedures.
- .4 The structural steel fabricators shall be certified by the Canadian Welding Bureau to the requirements of CSA W47.1, division 1 or 2.
- .5 Searching visual inspection aided by a magnifying glass shall be carried out regularly on all joints during the course of welding and after completion by the fabricators designated welding supervisor, and also by the inspection company's representative. Emphasis shall be placed upon visual inspection to establish correct "Fit-Up" and "Pre-heating".

- .6 All welds are to be stamped with the operator's number or symbols and the fabricator's number assigned by the Canadian Welding bureau with the requirements of CSA Standard W59.
- .7 Finished shop work must be inspected and approved before shipping to site and field work must be inspected and approved before the removal of erection equipment from the job.

3.10 NOTIFICATION

- 1. Prior to commencing significant segments of the work, give the Consultant and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review the work. Failure to meet this requirement may be cause for the Consultant to classify the work as defective. Advise the Inspection and Testing Company at least twenty-four (24) hours in advance of each fabrication and/or erection sequence.

3.11 INSPECTION AND TESTING

- 1. The Owner will appoint an Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct. The representative of the Inspection and Testing Company shall NOT be required to supervise or instruct the Contractor.
- .2 The following are responsibilities of the contractor regarding the Inspection and Testing Company:
 - .1 Co-operate with the representatives of the Inspection and Testing Company.
 - .2 Provide the Inspection and Testing Company with a copy of Specification, Structural Drawings and reviewed copies of shop drawings.
 - .3 Co-ordinate a program of inspection and testing with the Inspection and Testing Company, and advise the Consultant accordingly.

3.12 DEFECTIVE MATERIALS AND WORK

- .1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength, made and the like, in order to help determine whether the work must be corrected or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the work may be acceptable.
- .2 All testing shall be conducted in accordance with the requirements of The Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this

case, the tests shall be conducted in accordance with the standards given by the Consultant.

- .3 Materials or work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 05 12 23

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- .1 The Contractor shall ensure that no asbestos containing materials are used in connection with the work of this section.

1.2 REFERENCE STANDARDS

- .1 Comply with The Building Code Act, as amended, the 2012 Ontario Building Code (OBC) as amended and Regulations and by-laws of other authorities having jurisdiction, including latest amendments thereto; all hereafter referred to as Building Code.
- .2 All codes, standard specifications and by-laws referred to in this Specification shall be current editions including all latest revisions, addenda and supplements, unless otherwise noted in the Building Code.
- .3 Conform to the following CSA Standards:
 - .1 S136..... North American Specification for the Design of Cold Formed Steel Structural Members.
 - .2 W47.1..... Certification of Companies for Fusion Welding of Steel.
 - .3 W59..... Welded Steel Construction (Metal Arc Welding).
- .4 Conform to the following ASTM Standards:
 - .1 A653/A 653M Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .5 Conform to the following Canadian Sheet Steel Building Institute Standards:
 - .1 CSSBI 10M Standard for Steel Roof Deck.
 - .2 CSSBI B13..... Design of Steel Deck Diaphragms.
- .6 Comply with any Fire Rated Assembly Design specified for the project.
- .7 In the event of conflict between reference standards, codes, drawings and specifications, the Contractor shall request clarification by the Consultant. The Consultant's decision as to which requirements govern shall be final and binding. Generally the more stringent provision shall govern. No extras to the contract will be approved due to such clarification.

- .8 Conform to the Occupational Health and Safety Act, R.S.O. 1990, c. O.1, last amendment.

1.3 DESIGN REQUIREMENTS

- .1 Design steel deck using limit states design in accordance with CSA S136 and CSSBI 10M.
- .2 Wherever structural framing permits, steel deck shall be designed and fabricated to span continuously over at least four (4) supports (3 spans).
- .3 Provide an adequate increase in thickness of metal to compensate for continuity wherever fewer supports may occur.
- .4 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, and uplift as indicated.
- .5 Deflection of roof deck under specified live or snow load not to exceed 1/300 of span.

1.4 SHOP DRAWINGS

- .1 Submit erection drawings in accordance with directions.
- .2 Fabrication shall not commence until drawings are reviewed.
- .3 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.
- .4 Shop drawings are to bear the Seal and Signature of the Licensed Professional Engineer responsible for the design.
- .5 When requested submit design calculations complete with Stamp and Signature of the responsible Professional Engineer.
- .6 Allow ten (10) working days for the review of shop drawings and supply as many copies for review and distribution as directed. Shop drawings shall be checked in detail by the General Contractor before submission. Drawings which fail to meet this requirement shall be returned marked NOT REVIEWED.
- .7 The review of such drawings shall not relieve the Contractor of the responsibility of seeing that this work is complete, accurate and in conformity with the drawings and the specification.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 STEEL SHEET to ASTM A653/A653M (Structural quality) minimum grade 275 MPa [40 ksi] with a base nominal thickness (BNT) as noted on the drawings.
- .2 ZINC COATING
 - .1 Unless otherwise noted, provide a ZF75 (galvanneal) coating as designated by ASTM A653/A653M.
 - .2 Where specified on drawings as GALVANIZED DECK, provide a Z275 coating as designated by ASTM A653/A653M.
 - .3 Deck surfaces which are designated for finish painting (Refer to Architectural Drawings & Finish Schedules) shall not receive chemical treatment that will adversely affect paint application.
- .3 TYPES OF DECKING:
 - .1 Roof deck: Shall be single fluted element with ribs of depth as shown on the drawings.
 - .2 Pre-finished deck: where designated is to be pre-painted, provide:
 - .1 Colorite HMP
 - .2 10000 Series
 - .3 Metallic Series
 - .4 Barrier Series
 - .5 Weather X

Colour to be selected later by the Architect from the manufacturer's standard colour chart.
- .4 FASTENERS FOR PRE-FINISHED DECK:
 - .1 Unless otherwise noted, provide self-drilling or self-tapping corrosion resistant fasteners.

Acceptable type: #14 TEK screws or an approved equivalent.
- .5 CLOSURES:
 - .1 Provide cover plates, edge stiffeners, cell closures and flashings from sheet steel similar to decking with a base nominal thickness of 0.76 mm [0.03"] (22 gauge). (Refer to Architectural Drawings).
 - .2 Provide and install closures at the top of all walls. Type to match the profile and finish of selected decking.

- .6 PRIMER: conform to CAN/CGSB-1.181
 - .1 Acceptable product: CARBOZINC II by Carboline.
- .7 METAL UPSTANDS/CURBS:
 - .1 Where required by the Architectural Drawings provide and install 1.6 mm [0.063"] (16 gauge) galvanized metal upstands.

PART 3 – EXECUTION

3.1 PREPARATION

- .1 Verify the location and condition of all bearing surfaces placed by others. All such surfaces shall be at the elevation called for on the drawings.
- .2 Commencement of erection implies acceptance of the work of other sections, which affect the work of this section.
- .3 No claim for relief from contractual responsibility or for extras to the contract will be allowed unless such claim is made in writing prior to commencement of the work.
- .4 Protect steel deck during shipping and handling in accordance with CSSBI standards.
- .5 The steel deck welder must be certified to CSA W47.1 for fusion welding of steel deck.

3.2 FABRICATION & ERECTION

- .1 Conform to CSA S136, CSA W59, CCSBI 10M.
- .2 Erect steel decking as indicated to manufacturer's direction and to reviewed shop drawings.
- .3 No hangers or brackets supporting mechanical and electrical services, artwork, ceilings, bulkheads, lighting, etc. shall be hung directly from the floor or roof deck. All point loads must be applied directly to structural steel framing unless otherwise shown or approved by structural consultant.
- .4 Accurately align the deck and lap at supports. Use 50 mm [2"] minimum lap.
- .5 Supply and place steel packing as required to produce an even bearing pressure at supports.
- .6 Any material which has been damaged shall be replaced at no expense to the owner.

- .7 Provide for ribs to bear on beams parallel to flutes when tops of such beams are at same elevation as deck bearing.
- .8 Provide reinforcing stiffeners for unsupported edges of metal deck.
- .9 Install 50 x 50 x 6 mm [2" x 2" x ¼"] steel angles or formed channels perpendicular to flutes, welded to 2 flutes each side of opening for deck openings from 150 to 450 mm [6" to 18"] in size. No reinforcement required for openings cut in the deck that are smaller than 150 mm [6"] square.
- .10 For deck openings over 450 mm [18"] and for areas of concentrated load, reinforce in accordance with structural framing details.
- .11 Install closures and upstands as shown on drawings and reviewed shop drawings.
- .12 After alignment and levelling and unless otherwise noted on drawings, the minimum attachment of the deck to the bearing surfaces and the minimum side lap connections between deck units shall be:
- .13
 - .1 For 38 mm deck profiles, connect the first, third, fifth and seventh low corrugations (36/4 configuration), and each support parallel to flute direction at 300 mm [12"] maximum centers. Connections shall be made using either an arc spot weld with 20 mm [¾"] nominal top diameter, or mechanically fastened using Hilti powder actuated fasteners (X-HSN24, HILTI X-ENP19, or equivalent).
 - .2 For 76 mm deck profiles, connect the first, third and fifth low corrugations (24/3 configuration), and each support parallel to flute direction at 300 mm [12"] maximum centers. Connections shall be made using either an arc spot weld with 20 mm [¾"] nominal top diameter, or mechanically fastened using Hilti powder actuated fasteners (X-HSN24, HILTI X-ENP19, or equivalent).
 - .3 Side laps of adjacent nestable units shall be crimped together at 900 mm [36"] centres, or fastened with Hilti M HWH screws (SLCO1, SLC02, or equivalent) at 900mm [36"] on centre.
- .14 Immediately after decking is permanently secured in place, where top and/or bottom surfaces have been burned by welding or where surface coating has been damaged during transit or in erection.
 - .1 Touch-up galvanized surfaces with coating complying with SSPC-PAINT 20.

3.3 QUALITY CONTROL

- .1 Implement a system of quality control to ensure that the minimum standards specified herein are attained.

- .2 Bring to the attention of the Consultant any defects in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.
- .3 The Consultant 's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility. The contractor is solely responsible for quality control and shall implement its own supervisory and quality control procedures.

3.4 NOTIFICATION

1. Prior to commencing significant segments of the work, give the [Consultant] and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review the work. Failure to meet this requirement may be cause for the [Consultant] to classify the work as defective.

3.5 INSPECTION AND TESTING

1. The Owner will appoint an Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Companies shall be responsible only to the Consultant and shall make only such inspections or tests as the Consultant may direct. The representative of the Inspection and Testing Company shall NOT be required to supervise or instruct the Contractor.
- .2 The following are responsibilities of the contractor regarding the Inspection and Testing Company:
 - .1 Co-operate with the representatives of the Inspection and Testing Company.
 - .2 Provide the Inspection and Testing Company with a copy of Specification, Structural Drawings and reviewed copies of shop drawings.

3.6 DEFECTIVE MATERIALS AND WORK

- .1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the [Consultant] may have tests, inspections or surveys performed, analytical calculations of structural strength, made and the like, in order to help determine whether the work must be corrected or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the [Consultant]'s opinion, the work may be acceptable.

- .2 All testing shall be conducted in accordance with the requirements of The Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- .3 Materials or work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 05 31 23

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Delivery, Storage, and Handling
- .7 2.1 Performance/Design Requirements
- .8 2.2 Materials
- .9 2.3 Accessories
- .10 2.4 Finishes
- .11 2.5 Fabrication
- .12 3.1 Examination
- .13 3.2 Installation
- .14 3.3 Field Quality Control
- .15 3.4 Adjusting and Cleaning
- .16 3.5 Protection

1.3 SUMMARY

- .1 The *Work* of this Section includes metal fabrications and related metals including, but not limited to, the following:
 - .1 Pipe rails.
 - .2 Handrails, guards, balustrades, toe guards, steel guardrail mesh.
 - .3 Bollards.
 - .4 Loose steel lintels.
 - .5 Steel angles.
 - .6 Roof access ladders.
 - .7 Four-fold door frames.
 - .8 Overhead door frames.
 - .9 Steel posts for patio fence.
 - .10 Steel pedestals.
 - .11 Steel caging.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit list of fabrications to be provided as part of the work of this Section.
- .3 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .4 *Shop Drawings*:
 - .1 Submit engineered *Shop Drawings*.
 - .2 Include plans, sections and large scale details, and shall indicate components and methods of assembly, materials and their characteristics, fastenings, metal finishes, welds, and their structural characteristics relative to their purpose, and other fabrication information required.
 - .3 Indicate proposed *Site* connections and methods.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors: The *Contractor* shall ensure that the work of this Section is executed only by a *Subcontractor* who has adequate plant, equipment, and skilled tradespersons to perform work expeditiously, and is known to have been responsible for satisfactory installations similar to that required in the *Work* during a period of at least the immediate past five years.
 - .2 Licensed professionals: retain a *Professional Engineer* to design the work of this Section; to prepare, seal and sign *Shop Drawings*; and to perform field review. *Shop Drawings* shall show both design and installation requirements.
- .2 Requirements of regulatory agencies: the work of this Section that functions to resist forces imposed by dead and live loads shall conform to requirements of the *Authorities Having Jurisdiction*.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Label, tag or otherwise mark metal fabrications supplied for installation by other Sections to indicate its function, location in building and *Shop Drawing* designation.
- .2 Protect work from damage during delivery, storage and handling.
- .3 Deliver work to location at the *Place of the Work* designated by the *Contractor* and to meet requirements of the construction schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Design, fabricate, and install work of this Section in accordance with the Ontario Building Code and requirements of all other *Authorities Having Jurisdiction*.
- .2 Welding:
 - .1 Weld structural components in steel to conform to requirements of CSA W59-15, and by a fabricator fully certified by the Canadian Welding Bureau to conditions of CSA W47.1-

- 09(2014) and CSA W55.3-08 (R2013) as applicable or equivalent certification acceptable to the *Consultant*.
- .3 Design assemblies and connections to withstand own dead load, live loads, super-imposed dead loads, and fabrication forces, without permanent distortions or deformation, to maximum allowable deflection of $L/360$, within the following construction tolerances:
- .1 Maximum variation from plumb in vertical lines:
- .1 3.2 mm (1/8") in 3 m (10 ft)
- .2 Maximum variation from level:
- .1 3.2 mm (1/8") in 9 m (30 ft).
- .3 Maximum variation from straight:
- .1 3.2 mm (1/8") in 3 m (10 ft) under a 3 m (10 ft) straight edge.
- .4 Maximum variation from angle indicated:
- .1 10 seconds.
- .5 Tolerances shall be non-cumulative.
- .4 Design of metal fabrications to be by a *Professional Engineer*, except work designed on the structural *Drawings*. The *Contractor* shall ensure that the *Professional Engineer* is experienced in this type of engineering work and in accordance with Section 01 33 00 – Submittal Procedures.

2.2 MATERIALS

- .1 General:
- .1 Unless detailed or specified otherwise, standard *Products* will be acceptable if construction details and installation meet intent of the *Contract Documents*.
- .2 Include materials, *Products*, accessories, and supplementary parts necessary to complete assembly and installation of work of this Section.
- .3 Incorporate only metals that are free from defects that are visible, or that impair strength or durability. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharply defined profiles.
- .4 The *Contractor's Professional Engineer* responsible for the production of the *Shop Drawings* is responsible for structural design, member sizes, arrangement, connections and anchoring of work of this Section. Coordinate and maintain materials, dimensions, layout and appearance to meet intent of the *Contract Documents*.
- .2 Metals:
- .1 Steel, structural shapes, plate, bars: hot-rolled, CSA G40.21-04, Grade 300W.
- .2 Steel, hollow structural sections: hot-formed, seamless, CSA G40.21-04, Grade 350W, Class H.
- .3 Steel (mild), sheet and strip, hot rolled, ASTM A1011/A1011M-10.
- .4 Steel, sheet: cold rolled, stretcher levelled, fully pickled, ASTM A1008/A1008M- 11, Grade CS Type A exposed, matte finish, dry, unless otherwise indicated on the Contract drawings.

- .5 Steel pipe: ASTM A53 / A53M - 10, Type E or S, Grade A or B, standard weight, Schedule 40 seamless black or AISI MT 1010/1015, or *Equivalent*.

2.3 ACCESSORIES

.1 Fasteners:

- .1 Fasteners: Exposed fasteners to match the material surface on which they occur.
- .2 Fasteners for stainless steel to be stainless steel 300 Series or stainless steel 400 Series.
- .3 Fasteners in contact with aluminum to be stainless steel 300 Series, stainless steel 400 Series, cadmium plated or aluminum.
- .4 Bolts and anchor bolts: in accordance with ASTM A307-14.
- .5 High strength bolts: in accordance with ASTM A325-14.
- .6 Use embedded epoxy set anchors for anchorage to concrete at exterior locations exposed to weather, unless otherwise indicated; installation and embedment depth shall be as per manufacturer's instructions, embedment depth shall not be greater than 80% of concrete thickness.
- .7 Other types of fasteners as appropriate to meet design requirements.

.2 Welding materials:

- .1 Steel: in accordance with CSA W59-15.

.3 Grout:

- .1 Epoxy grout; non-shrink, non-expanding:

- .1 Hilti 'HY-150'.
- .2 Sika Group 'Sika AnchorFix 3001'.
- .3 W.R. Meadows of Canada 'REZI-WELD 3/2 EPOXY GROUT/PATCH'.
- .4 Or *Equivalent*.

- .2 Cementitious grout: non-shrink, non-expanding to ASTM C1107/C1107M-14a:

- .1 Sika 'Sika Grout 212' or 'Sika M-Bed Standard'.
- .2 W.R. Meadows 'Sealtight CG-86 Construction Grout'.
- .3 Or *Equivalent*.

- .4 Dielectric separator: Best grade, quick drying non-staining alkali resistant bituminous paint in accordance with CAN/CGSB 1.108-M89, or membrane type to acceptance of the *Consultant*.

2.4 FINISHES

- .1 Shop primer; steel: CISC/CPMA 2-75 or SSPC-Paint 20, Paint Specification No. 20: Zinc-Rich Primers (Type I "Inorganic" and Type II "Organic").
- .2 Shop primer; galvanized steel in pool or arena environments: in accordance with Section 09 91 00 - Painting.

- .3 Zinc rich paint; steel: Two-component zinc-rich coating, zinc powder to ASTM D520 Type III, SSPC-Paint 20, Type 1 Inorganic or single-component zinc-rich coating to SSPC-Paint, Type 2 Organic, CAN/CGSB 1.181-M99, VOC content <100 g/l to ASTM- D1475.
 - .1 Acceptable Products:
 - .1 Aervoe Industries, Inc. 'Low VOC Cold Galvanize Coating 93% Zinc'.
 - .2 ZRC Worldwide 'ZRC Zero-VOC Galvanizing Compound'.
 - .3 Or *Equivalent*.
 - .4 Hot dip galvanizing: for irregular sections, conforming to CAN/CSA G164-M92, minimum zinc coating of 600 g/m². Use air cooling method (no water or chromate dipping treatment permitted).

2.5 FABRICATION

- .1 General:
 - .1 Fabricate metal fabrications with machinery and tools specifically designed for the intended manufacturing processes and by skilled tradesmen.
 - .2 Fit and assemble metal fabrications in shop. When this is not possible, make a trial shop assembly.
 - .3 Incorporate anchors at 610 mm (24") on centre or as otherwise required for secure attachment for metal fabrications located in cast-in-place concrete and concrete masonry units.
 - .4 Incorporate means for fastenings of other work secured to work of this Section.
 - .5 Do welding work in accordance with CSA W59-15 as applicable, unless specified otherwise.
- .2 Construction:
 - .1 Fabricate with materials, component sizes, metal gauges, reinforcing, anchors, and fasteners of adequate strength to withstand intended use, and within allowable design factors imposed by the *Authorities Having Jurisdiction*. Fabricate items from steel unless otherwise noted.
 - .2 Ensure that metal fabrications will remain free of warping, buckling, opening of joints and seams, distortion, and permanent deformation.
 - .3 Construct items that are part of floor construction, such as gratings and trench covers, to support the same live loads for which surrounding floors are designed unless indicated otherwise.
 - .4 Drill drainage holes at exterior exposed tubular fabrications to permit drainage of moisture to exterior of metal fabrications.
- .3 Assembly:
 - .1 Accurately cut, machine and fit joints, corners, copes and mitres so that junctions between components fit together tightly and in true planes.
 - .2 *Provide* smooth welds with splatter removed where exposed to view.
 - .3 Allow for differential movements within assemblies and at junctions of assemblies with surrounding work.

- .4 Field welding of hot dipped galvanized members permitted only when other fastening methods are not possible. Locations of field welds to be clearly identified on reviewed *Shop Drawings*.
- .5 Incorporate holes and connections for work installed under other Sections.
- .6 Cleanly and smoothly finish exposed edges of materials including holes.
- .7 Cap open ends of sections exposed to view, such as pipes, channels, angles, and other similar work.
- .4 Shop prime painting:
 - .1 Clean loose mill scale, rust, dirt, weld flux and spatter from the work after fabrication.
 - .2 Prepare and prime paint in accordance with manufacturer's installation instructions. Prepare steel by methods specified in CISC/CPMA 2-75 or SSPC SP3.
- .5 Galvanizing:
 - .1 Galvanize metal fabrications following fabrication.
 - .2 Paint damage galvanized surfaces with zinc rich paint, immediately following damage to galvanized protection. Prepare substrate to remove oil and grease to SSPC-SP1, rust scale to SSPC-SP3, mill scale to SSPC-SP6.
 - .3 Fill vent and drain holes that are exposed in the finished work, unless indicated on the Contract drawings to remain as weep holes in exterior fabrications, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Take measurements at the *Place of the Work* to ensure that metal fabrications are fabricated to fit surrounding construction, around obstructions and projections in place, or as indicated on the Contract drawings and to suit service locations. The *Contractor* shall be responsible for confirming all *Site* dimensions.

3.2 INSTALLATION

- .1 *Install* metal fabrications plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding work.
- .2 Include in work of this Section anchor bolts, high tensile bolts, washers and nuts, expansion bolts, toggles, straps, sleeves, brackets, clips, and other items necessary for secure installation as required by loading and by the *Authorities Having Jurisdiction*. Weld in accordance with CSA-S16-09.
- .3 Attach metal fabrications to interior concrete and masonry with corrosion resistant expansion bolts to support load with a safety factor of 3.
- .4 Attach metal fabrications to exterior concrete and masonry with non-shrink epoxy cement to support load with a safety factor of 3.
- .5 Insulate between dissimilar metals or between metal, and masonry or concrete with bituminous paint to prevent electrolytic action.

- .6 Where indicated, grout metal posts, pickets, balusters, and the like, in metal sleeves cast into concrete, with non-shrink quick setting epoxy anchor cement, unless detailed otherwise. Fabricate sleeves of 75 mm (3") minimum in depth.
- .7 Hand items over for casting into concrete or building into masonry to appropriate *Subcontractors* together with setting templates.

3.3 FIELD QUALITY CONTROL

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

3.4 ADJUSTING AND CLEANING

- .1 After erection, touch up primed surfaces that are burned, scratched or otherwise damaged with prime paint to match shop paint.
- .2 Clean and repair areas of bare metal and welds on galvanized surfaces with zinc rich paint. Welded area of members to be masked to minimize overpainting of adjacent undamaged surfaces. Prepare substrate to remove oil and grease to SSPC-SP1, rust scale to SSPC-SP3, mill scale to SSPC-SP6.
- .3 Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new, at the *Contractor's* expense.

3.5 PROTECTION

- .1 Maintain protection of work of this Section from time of installation until final finishes are applied or to final cleanup.
- .2 Protect finished surfaces from damage.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 System Description
- .5 1.5 Delivery, Storage & Handling
- .6 2.1 Bollard Sleeves
- .7 2.2 Materials
- .8 3.1 Examination
- .9 3.2 Installation

1.3 SUMMARY

- .1 Post Guard polyethylene plastic pipe sleeves for steel pipe bollards.

1.4 SYSTEM DESCRIPTION

- .1 Performance Requirements
 - .1 High molecular weight material. Designed for optimum balance of density, molecular weight and molecular weight distribution demonstrating maximum property advantages for large products that require high impact resistance.
 - .2 Ultraviolet Protection Additive. Five Year UV stabilizer package. Warranty Five Years.
 - .3 Thickness Nominal wall thickness will be 0.125 inch
 - .4 Abrasion Resistant
 - .5 Environmental Stress Cracks Resistant
 - .6 Reflective Tape: Each Post Guard has two strips of 3M Series or *Equivalent* Reflective tape recessed on the part 5.875 inches apart
 - .7 Flexural Modulus: 200,000 psi
 - .8 Tensile Strength: 4,000psi

1.5 DELIVERY, STORAGE & HANDLING

- .1 The *Contractor* shall place order in a timely fashion to ensure construction schedule is not adversely impacted.
- .2 Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

PART 2 - PRODUCTS

2.1 BOLLARD SLEEVES

- .1 Manufacturer:
 - .1 Encore Commercial Products Inc. - Sure Guard
 - .2 Contact information: 5 Shirley Ave. Kitchener Ontario N2B 2E6.
 - .3 Tel: 519-772-1976, Toll Free: 1-800-756-3537, Fax: 519-570-4333
 - .4 Email: info@sureguard.ca
 - .5 website: www.sureguard.ca;
 - .6 Or *Equivalent*.

2.2 MATERIALS

- .1 High-density polyethylene (HDPE) and High-density polyethylene (LDPE)
 - .1 Size: as required for all bollards.
 - .2 Colours: to be selected from manufacturer's full range.
 - .3 Tape colors: to be selected from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify the steel pipe cores are set true, correctly aligned and well anchored in below grade concrete encasement.
- .2 Fill cores with concrete and strike level across the top of pipe.

3.2 INSTALLATION

- .1 Centre two foam strips (included) over bollard. Slide the Post Guard over the bollard and foam will expand for a snug fit.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Delivery, Storage, and Handling
- .6 2.1 Wood Materials
- .7 2.2 Wood Treatment
- .8 2.3 Panel Materials
- .9 2.4 Sheathing Materials
- .10 2.5 Fastenings and Hardware
- .11 2.6 Source Quality Control
- .12 3.1 General
- .13 3.2 Curbs, Supports, and Blocking at Roofing Assemblies
- .14 3.3 Equipment Backboard
- .15 3.4 Miscellaneous Plywood Blocking

1.3 SUMMARY

- .1 The work of this Section includes, but is not necessarily limited to, the following:
 - .1 Plywood backing panels and wood studs.
 - .2 Wood grounds, nailers, blocking and sleepers.
 - .3 Wood roof blocking.
 - .4 Wood panel sheathing.

1.4 SUBMITTALS

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

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

- .1 General requirements:
 - .1 Except as indicated or specified otherwise in the *Contract Documents*, lumber must be softwood, S4S, moisture content not greater than 19% at time of installation, in accordance with following standards:
 - .1 Canadian Standards Association (CSA) O141-05.
 - .2 National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber.
 - .2 Furring, blocking, nailing strips, grounds:
 - .1 Use S2S material.
 - .2 Dimension lumber sizes: in compliance with Section 12 of the NLGA.
 - .3 Dimension lumber species and grades:
 - .1 Spruce-Pine-Fir.
 - .2 Light framing to NLGA Construction grade, S-Dry.
 - .3 Planks to NLGA No. 2 grade, S-Dry.
 - .4 Boards to NLGA No. 4 Common grade, S-Dry.
 - .3 Curbs, nailers, plywood for roofing: Spruce species, NLGA construction grade, sound and free of imperfections or deficiencies making unsuitable for use. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
 - .1 Pressure treat with wood preservative.
 - .4 Studs and framing: Spruce, Pine, Fir (S-P-F) species group, S-Dry or kiln dried, Stud Grade or No. 2 Grade unless otherwise indicated in the Contract documents

2.2 WOOD TREATMENT

- .1 Wood preservative pressure treatment:
 - .1 Wood shall be pressure impregnated with fire-retardant chemicals in accordance with CAN/CSA O80 and have flame-spread rating of not more than 25 to CAN/ULC-S102-10 after wood has been subjected to an accelerated weathering test as specified in ASTM D2898-07 for exterior applications.

2.3 PANEL MATERIALS

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

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

2.4 SHEATHING MATERIALS

- .1 Exterior sheathing:
 - .1 Exterior grade plywood, thicknesses as follows:
 - .1 Walls: 12.7 mm (1/2") minimum, unless otherwise indicated in the Contract documents.
 - .2 Roofs: 15.9 mm (5/8") minimum, unless otherwise indicated in the Contract documents.

2.5 FASTENINGS AND HARDWARE

- .1 General:
 - .1 *Provide* fasteners of size and type indicated in the Contract documents, acceptable to the *Authorities Having Jurisdiction*, and that comply with requirements specified in this Section for material and manufacture. *Provide* nails or screws, in sufficient length, to penetrate not less than 38 mm (1-1/2") into wood substrate.
 - .2 Anchors to concrete and unit masonry: Capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M-15, conducted by a qualified independent testing and inspecting agency.
 - .3 Use surface fastenings of following types, except where specific type is indicated in the Contract documents.
 - .1 To hollow masonry, plaster and panel surfaces use 9 mm (11/32") expansion bolts.
 - .2 To solid masonry and concrete use expansion bolts.
 - .3 To structural steel use bolts through drilled hole, or welded stud-bolts or power driven self-drilling screws, or welded stud-bolts.
 - .4 To steel deck use bolts through drilled hole or power driven self-drilling screws.
 - .4 Fastener materials:
 - .1 Hot-dip galvanized fasteners: ASTM A153/A153M-09 Class A or B1 G185 (CAN/CSA G164-M92 minimum zinc coating of 600 g/m²) and connectors meeting ASTM A653/A653M-11 Class G-185 sheet (CAN/CSA G164-M92 minimum zinc coating of 600 g/m²) or better.
 - .2 For pressure-preservative-treated wood, use stainless-steel Type 304 fasteners.
 - .5 Hardware materials:
 - .1 Hot-dipped galvanized in accordance with CAN/CSA G164-M92 with minimum zinc coating of 600 g/m² or hot-dipped galvanized fasteners complying with ASTM A153/A153M-09, Class A or B1, and connectors complying with ASTM A653/A653M-11, Class G185.
- .2 Sheathing fasteners: Bugle head, corrosion resistant steel, power driven type, minimum length of 3 times thickness of sheathing.

- .3 Sill plate anchors: 15.9 mm (5/8") diameter bolts, spaced not more than 1.6 m (5'-1/4") on centre (o.c). Embed anchor bolts 150 mm (6") minimum into foundation wall so that they may be tightened without withdrawal from concrete. Washers: 2.5 times size of bolt and HEX nuts.

2.6 SOURCE QUALITY CONTROL

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board or equivalent certification acceptable to the *Consultant*.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Layout work carefully and to accommodate work of other Subcontractors. Cut and fit accurately. Erect in position indicated in the contract drawings. Align, level, square, plumb, and secure work permanently in place.
- .2 Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit and use plates or washers for bolt head and nut bearings. Turn up bolts and lag screws tightly when installed, and again just before concealed by other work or at completion of work.
- .3 Cooperate with work of other Sections to ensure that unity of actions will ensure orderly progress to meet construction schedule.
- .4 Include in work of this Section rough hardware such as nails, bolts, nuts, washers, screws, clips, and connectors required for complete and proper installations; and operating hardware required on the work of this Section for temporary use.
- .5 Do not attach work by wood plugs or blocking in concrete or masonry.
- .6 Do not regard nailers, blocking, and such other fastening provision indicated as exact or complete. Install required provisions for fastening, located and secured to suit *Place of the Work* conditions, and adequate for intended support.
- .7 Cut work into lengths as long as practical and with square ends. Erect work plumb, in true planes, and fastened rigidly in place.
- .8 Verify that grounds required for fastening of components and equipment are located correctly and sized for adequate support.
- .9 Secure wall sheathing horizontally perpendicular to studs, with ends staggered, over firm bearing.

3.2 CURBS, SUPPORTS, AND BLOCKING AT ROOFING ASSEMBLIES

- .1 Install wood curbs, upstands, supports and blocking and securely attach to structure, trimmed and levelled to receive flashings and applied roofing materials.
- .2 Slope solid wood caps at parapets to *Provide* positive moisture drainage toward roofing membrane unless otherwise indicated in the Contract documents.
- .3 *Provide* wood nailers of minimum 38 mm (1-1/2") thick solid wood members for anchorage of fasteners.
- .4 Securely attach wood members to substrate by anchoring and fastening as indicated in the contract drawings, complying with the following:
 - .1 Attach each item in the build-up with fasteners or anchors at spacing not exceeding the following:

- .1 Wood to wood:
 - .1 Screws: 450 mm (18").
 - .2 Nails: 300 mm (12").
- .2 Wood to metal:
 - .1 Screws: 450 mm (18").
 - .2 Bolts/washers: 1220 mm (48").
- .3 Wood to concrete/concrete block:
 - .1 Tapcon type screws: 450 mm (18").
 - .2 Expansion/toggle bolts/washers: 1220 mm (48").
- .2 Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces.
- .3 Size fasteners for embedment into substrate in accordance with manufacturer's installation instructions.
- .5 Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood.

3.3 EQUIPMENT BACKBOARD

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

3.4 MISCELLANEOUS PLYWOOD BLOCKING

- .1 *Provide* minimum 19 mm (3/4") softwood plywood blocking for attachment of miscellaneous fitments as indicated in the Contract drawings.
- .2 Complete wood blocking within gypsum board metal stud assemblies in accordance with work of Section 09 22 00 - Metal Supports for Gypsum and Cement Board.

END OF SECTION

PART 1 – GENERAL

1.1 General Instructions

- .1 Make a thorough examination of the drawings, the specifications and the site, to determine the intent, extent, materials and conditions of interfacing with other work and to be fully cognizant of requirements.

1.2 Related Work

- .1 Section 06 10 53..... Rough Carpentry
- .2 Section 06 17 19..... Cross-Laminated Timber
- .3 Section 06 18 00..... Glued-Laminated Structural Units

1.3 Reference Standards

- .1 Comply with The Building Code Act, as amended, the 2012 Ontario Building Code (OBC) as amended and Regulations and by-laws of other authorities having jurisdiction, including latest amendments thereto; all hereafter referred to as Building Code.
- .2 All codes, standard specifications and by-laws referred to in this Specification shall be current editions including all latest revisions, addenda and supplements, unless otherwise noted in the Building Code.
- .3 Conform to the appropriate Canadian Construction Materials Centre (CCMC) and the International Code Council Evaluation Service (ICC-ES) reports applicable to the products specified for:
 - .1 VENEERS (Ultrasonically graded).
 - .2 ADHESIVES (Waterproof Type to CSA O112.9-10 (R2014) and O112.10-08 (R2013)).
 - .3 Flange and Web members.
 - .4 ICC-ES Report No. ESR-1153 for I-Joists and ESR-1387 for LSL, PSL and LVL.
- .4 Conform to NLGA Standard Grading Rules for Canadian Lumber, 2014.
- .5 In the event of conflict between reference standards, codes, drawings and specifications, the Contractor shall request clarification by the Consultant. The Consultant's decision as to which requirements govern shall be final and binding. Generally the more stringent provision shall govern. No extras to the contract will be approved due to such clarification.
- .6 Conform to the Occupational Health and Safety Act, R.S.O. 1990, c. O.1, last amendment 2014, c. 10, Sched. 4.

1.4 Source Quality Assurance

- .1 These products shall be manufactured in a plant listed in the above referenced CCMC reports.
- .2 If requested provide certification by an approved third party inspection agency that the plant and fabrication process complies with the referenced CCMC reports.
- .3 Each of the LSL, PSL, LVL and I-Joists shall be identified by a stamp indicating the product type, CCMC report number, manufacturer's name, plant number and inspection agency's logo.

1.5 Design Criteria

- .1 The fabricated wood members specified on the contract drawings for this project are based upon the technical data for the following products as manufactured by Weyerhaeuser Canada Ltd.
 - .1 LSL (Laminated Strand Lumber) TIMBERSTRAND LSL RIM BOARD
 - .2 PSL (Parallel Strand Lumber)..... PARALLAM
 - .3 LVL (Laminated Veneer Lumber) MICROLLAM
 - .4 I-Joist TJI TRUS JOIST
- .2 See later in this section for alternatives and/or equals.
- .3 The fabricated wood members shall be custom designed to fit the dimensions and loads indicated on the contract drawings.
- .4 If requested, submit for review, design calculations prepared by a licensed Professional Engineer for each member and condition.
- .5 Erection is to be performed by a contractor or framer experienced in this type of construction. Provide references when requested.

1.6 Shop Drawings

- .1 If requested, submit for review, shop drawing showing layout and detail necessary for determining fit and placement in building.
- .2 The fabricator shall prepare, assist with and approve the production of the shop drawing prior to submission.
- .3 Fabrication shall not commence until shop drawings are reviewed.

- .4 Allow ten (10) working days for the review of drawings and supply as many copies for review and distribution as directed. Shop drawings shall be checked in detail by the Contractor and shall bear the checker's initials before submission.
- .5 Drawings which fail to meet these requirements shall be returned marked NOT REVIEWED and must be re-submitted after correction.
- .6 The review of shop drawings shall not relieve the Contractor of the responsibility for seeing that this work is complete, accurate and in conformity with the drawings and this specification.
- .7 Only shop drawing bearing the review stamps shall be kept at the site.

PART 2 – PRODUCTS

2.1 Materials

- .1 All materials used to fabricate the structural components, including but not limited to:
 - .1 VENEER
 - .2 ADHESIVE
 - .3 FLANGE & WEB MEMBERSShall comply with the CCMC report number as identified earlier in this section.
- .2 All members are to be free of finger or scarf joints or mechanical connections for the full-length of the members.
- .3 TOLERANCES:
 - .1 Finished length as specified $\pm 3\text{mm}$ [1/8"]
 - .2 Depth as specified $\pm 1.5\text{mm}$ [1/16"]
 - .3 Width as specified $\pm 1.5\text{mm}$ [1/16"]
- .4 HARDWARE:
 - .1 All hardware including but not limited to the following: Nails, spikes, framing anchors, bolts and washers shall conform to the notes and details on the contract documents.

PART 3 – EXECUTION

3.1 Delivery, Storage and Handling

- .1 Deliver, store and handle the fabricated structural wood products in strict conformance with the manufacturer's directions.

3.2 Erection

- .1 Erect the products in conformance with the contract drawings and approved shop drawings.
- .2 Brace and anchor members until permanently secured.
- .3 Connections and nailing to comply with details, notes and recommendations of the manufacturer.

3.3 Alternatives and/or Equals

- .1 BASE BID: Due to the customized detailing and engineering characteristics of the framing assembly, it is a requirement that the specified products are used as a base bid:
 - MICORLLAM LVL by Weyerhaeuser Canada Ltd.
 - PARALLAM PSL by Weyerhaeuser Canada Ltd.
 - TJI TRUS JOIST by Weyerhaeuser Canada Ltd.
 - TIMBERSTRAND LSL RIMBOARD by Weyerhaeuser Canada Ltd.
- .2 ALTERNATIVE MANUFACTURERS
 - .1 Contractors may propose alternative manufacturers to that shown on the Contract drawings, provided that they comply with the specified CCMC reports and LEED Requirements.
 - .2 Alternative products shall be accompanied by all pertinent design criteria and certifications.
 - .3 No element of an alternative scheme can interfere with or impede the construction of the Base Building Structure, except that if any aspect of the alternative components, proposed by the Contractor, varies from that shown and the variation requires re-design of the base building elements and/or the revision to or addition of materials to accommodate such variance and the Owner, the Architect and the Structural Consultant are in agreement with the proposed variation, then the Contractor requesting the variation shall pay for all costs, including re-design and re-drafting associated with the change.
 - .4 Submission of alternative products to those specified and review by the consulting team does not indicate acceptance. Acceptance shall be in writing and be issued solely by the Architect.

3.4 Field Quality Control

- .1 Notify the Structural Consultant for a review of preparations prior to installation of members and also for a review after installation and prior to closing in the work.
- .2 Notify the manufacturer's representative prior to closing in, to provide opportunity for review of the installation.

- .3 Additional Inspection and Testing may be carried out by a qualified Inspection and Testing Agency appointed by the Architect.
 - .1 The cost of this additional inspection shall be paid for out of the Cash Allowances for Inspection and Testing.
- .4 Any inspection or testing required because of an error by the Contractor or due to departure from the construction documents by the Contractor shall be paid for by the Contractor.
- .5 Inspections can include but not be limited to:
 - .1 Sampling fabrication and erection procedures for general conformity to the requirements of the specification.
 - .2 Checking fabricated members against specified member shapes.
 - .3 Sample checking of screwed and bolted joints.
 - .4 Submission of reports as directed.
- .6 The Contractor shall provide the necessary cooperation to ensure that the inspection can proceed.
- .7 Inspection does not relieve the Contractor of the responsibility for the performance of the Contract. The Contractor is solely responsible for quality control and shall implement appropriate supervisory and quality control procedures.
- .8 Materials or workmanship not conforming to the requirements of the contract documents may be rejected at any time during the progress of work.

3.5 Quality Control

- .1 Implement a system of quality control to ensure that the minimum standards specified herein are attained.
- .2 Bring to the attention of the Consultant any defects in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.
- .3 The Consultant 's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's aperformance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

3.6 Notification

- .1 Prior to commencing significant segments of the work, give the Consultant and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review the work. Failure to meet this requirement may be cause for the Consultant to classify the work as defective.

3.7 Inspection and Testing

- .1 The Owner will appoint an Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct. The representative of the Inspection and Testing Company shall NOT be required to supervise or instruct the Contractor.

3.8 Defective Materials and Work

- .1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength, made and the like, in order to help determine whether the work must be corrected or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the work may be acceptable.
- .2 All testing shall be conducted in accordance with the requirements of The Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- .3 Materials or work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 06 17 00

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Make a thorough examination of the drawings, the specifications and the site, to determine the intent, extent, materials, and conditions of interfacing with other work and to be fully cognizant of requirements.

1.1 RELATED WORK

- .1 Section 06 10 53 Rough Carpentry
- .2 Section 06 17 00 Shop-Fabricated Structural Wood
- .3 Section 06 18 00 Glued-Laminated Structural Units

1.2 REFERENCE STANDARDS

- .1 Comply with The Building Code Act, as amended, the 2012 Ontario Building Code (OBC) as amended and Regulations and by-laws of other authorities having jurisdiction, including latest amendments thereto; all hereafter referred to as Building Code.
- .2 All codes, standard specifications and by-laws referred to in this Specification shall be current editions including all latest revisions, addenda and supplements, unless otherwise noted in the Building Code.
- .3 Conform to the following CSA Standards:
 - .1 B111 Wire Nails, Spikes and Staples.
 - .2 G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel.
 - .3 G164 Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .4 O80 Series Wood Preservation.
 - .5 O86 Engineering Design in Wood.
 - .6 O112.9 Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
 - .7 O112.10 Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

- .8 O122 Structural Glued-Laminated Timber.
- .9 O177 Qualification Code for Manufacturers
of Structural Glued-Laminated
Timber.
- .10 S16 Design of Steel Structures.
- .11 W47.1 Certification of Companies for Fusion
Welding of Steel.
- .4 Conform to the following ASTM Standards:
 - .1 A307 Standard Specification for Carbon
Steel Bolts, Studs, and Threaded
Rod 60000 PSI Tensile Strength.
 - .2 A653/A653M..... Standard Specification for Steel
Sheet, Zinc Coated (Galvanized) or
Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip
Process.
 - .3 A36/A36M..... Standard Specification for Carbon
Structural Steel.
- .5 Conform to APA Standard for Performance Rated CLT ANSI/APA PRG 320
- .6 Conform to CGSB-1.40, Anti-Corrosive Structural Steel Alkyd Primer.
- .7 In the event of conflict between reference standards, codes, drawings and specifications, the Contractor shall request clarification by the Consultant. The Consultant's decision as to which requirements govern shall be final and binding. Generally the more stringent provision shall govern. No extras to the contract will be approved due to such clarification.
- .8 Conform to the Occupational Health and Safety Act, R.S.O. 1990, c. O.1, last amendment 2014, c. 10, Sched. 4.

1.3 SOURCE QUALITY ASSURANCE

- .1 Manufacturer to be certified by the American Plywood Association - Engineered Wood Systems (APA EWS) and bonded with polyurethane resin (white) adhesive meeting the requirements of ANSI A190.1-1992, DIN 68 141 and EN 301 and 302.
- .2 Cross-Laminated Timber manufacturer certified by CSA Administrative Board, Structural Glue Laminated Timber Division in accordance with CAN/CSA 0177 to manufacture;

- Class 1 interior softwood glued laminated members
 - Class X exterior softwood glued laminated members
- .3 If requested, submit a certificate in accordance with CSA O177, Appendix B, at completion of fabrication.
 - .4 If requested, provide certification that the protective sealer complies with the specified requirements.
 - .5 Place authorization labels on glued-laminated members indicating manufacture in a CSA certified plant.
 - .6 Fabricator of steel connections to be certified by the Canadian Welding Bureau to the requirements of CSA W47.1
 - .7 Erection to be performed by an organization experienced in Cross-Laminated timber construction. Provide references when requested.

1.4 DESIGN OF DETAILS AND CONNECTIONS

- .1 Design details and connections by a licenced Professional Engineer to resist forces, moments and shears indicated on or implied by the drawings.

1.5 SHOP DRAWINGS

- .1 Provide erection drawings having a scale no less than the structural framing plans and detail drawings of individual members and complete information necessary for fabrication and erection.
- .2 Copies of Structural Framing Plans and Sections utilized as erection drawings are not permitted unless permission is first sought from and granted by the Structural Consultant.
- .3 Clearly indicate stress grade, service grade, appearance grade, connection details, shop applied finishes, shop and erection details including cuts, holes, fastenings, camber and connection hardware.
- .4 Submit shop drawings for review as directed.
- .5 All shop drawings shall bear a Seal and Signature of a licenced Professional Engineer for items designed by the fabricator or manufacturer.
- .6 Fabrication shall not commence until shop drawings are reviewed.
- .7 Allow ten (10) working days for the review of drawings and supply as many copies for review and distribution as directed. Shop drawings shall be checked in detail by the Contractor and shall bear the checker's initials before submission.

- .8 Drawings which fail to meet these requirements shall be returned marked NOT REVIEWED and must be re-submitted after correction.
- .9 The review of shop drawings shall not relieve the Contractor of the responsibility of seeing that this work is complete, accurate and in conformity with the drawings and this specification.
- .10 Only shop drawings bearing the review stamps shall be kept at the site.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Laminating stock to comply with CSA O122:
 - .1 Douglas Fir – Larch
 - .2 Hem Fir and Douglas Fir – Larch
 - .3 Lodgepole Pine and/or Spruce
- .2 Adhesive to comply with CSA O112 Series: to suit grade of service required in accordance with CSA O122.
- .3 Sealer: Penetrating type, clear, non-yellowing liquid.
- .4 Fasteners/Connections:
 - .1 Split Ring Connectors in accordance with SAE 1010 and the SAE Handbook.
 - .2 Shear Plate Connectors in accordance with SAE 1010 and the SAE Handbook.
 - .3 Bolts: to ASTM A307.
 - .4 Lag Screws: to ASME B18.2.1.
 - .5 Side Plates: to CSA G40.21.
 - .6 Drift Pins: to ASTM A307 or CSA G40.21.
 - .7 Nails and Spikes: to CSA B111.
 - .8 Truss Plates: to ASTM A653.
 - .9 Glued-Laminated Rivets: to CSA G40.21 or ASTM A36.
- .5 Galvanizing: to CSA G164 minimum zinc coating 610 g/m² [18 oz/yd²].

Note: for connections specified to be galvanized, provide galvanized nuts, bolts, washers, nails and spikes as required.
- .6 Shop Coat Primer: to CAN/CGSB 1.40.

- .7 Other materials or products, which are not listed herein, shall comply with the latest CSA, ASTM, CGSB, or ACI standards appropriate to those materials. Submit brand names and manufacturer's data sheets for review, if requested.

PART 3 - EXECUTION

3.1 FABRICATION

- .1 Fabricate Cross-Laminated Timber panels in accordance with ANSI/APA PRG 320 except where specified otherwise and to the following classifications. Use multiple layers of 19mm (3/4 in) minimum to 38mm (1 1/2 in) maximum thick laminations.
- .2 Appearance Classification:
 - .1 Non-Exposed – Where panels are concealed.
 - .1 Shake and checks allowed, shall not exceed 915mm or 1/4 the length
 - .2 Heart or Blue Stain allowed, not limited
 - .3 Knots – firm and tight (NLGA #2)
 - .4 Pitch streaks not limited
 - .5 Minimal wane on face
 - .6 Side pressure on exposed face not required
 - .2 Exposed – Where panels are in view in final construction. Exposed face to utilize “J” grade SPF lumber or L3&Btr D. Fir.
 - .1 Shake and checks allowed up to 610mm (24 in) long, none through
 - .2 Up to a maximum of 5% Blue stain allowed, heart stain permitted
 - .3 Knots – firm and tight (NLGA #2)
 - .4 Pitch streaks not limited
 - .5 Wane on face not permitted
 - .6 Side pressure on exposed faces required
- .3 Visual grade Cross-Laminated Timber panels to be fabricated with chamfers, Non-Visual grade panels can be supplied without chamfers (90° corners)
- .4 Cross Laminated Timber (CLT) panels to be joined at edges using a continuous spline. All required fastener and spline geometry by manufacturer
- .5 Mark panels for identification during erection, ensure that marks will be concealed in final assembly for appearance grade panels. Clearly mark top surface
- .6 All structural steel connecting CLT panels to each other and to supporting panels shall be detailed, supplied and test fitted in the shop by the CLT supplier
- .7 Preservative Treatment:
 - .1 After fabrication, pressure treat indicated members with preservative and/or fire retardant in accordance with CSA O80 Series.

- .8 Prime Paint connections after fabrication.
- .9 Galvanize indicated connections after fabrication.
- .10 Mark members for identification during erection. Marks not to be visible in final assembly.

3.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store and protect materials of this section in accordance with directions.
- .2 Wrap members prior to leaving plant with a moisture resistant wrapping.
- .3 Use padded, non-marring slings for handling glued-laminated members.
- .4 Protect corners with wood blocking.
- .5 Slit underside of membrane covering during storage at site. Do not deface member.
- .6 Store glued-laminated units protected from weather, block off ground and separate with continuous blocking, so air may circulate around all faces of members.
- .7 Cover glued-laminated units with opaque moisture resistant membrane if stored outside.
- .8 Make adequate provisions for delivery and handling stresses.

3.3 ERECTION

- .1 Ensure protective sealer is not damaged before erection. If damaged, "touch-up" on site before erection.
- .2 Erect glued-laminated members in accordance with reviewed shop drawings.
- .3 Make adequate provision for possible erection stresses. Set panels level and plumb to correct positions.
- .4 Fit Cross-Laminated Timber panels closely and accurately, without trimming, cutting or other modifications, unless approved in writing by Engineer.
- .5 Brace and anchor members until permanently secured by structure
- .6 Make adequate provisions for erection stresses.
- .7 Do not field cut or alter members without Consultant's approval.

3.4 FIELD QUALITY CONTROL

- .1 Notify Structural Consultant for a review of preparations prior to installation of members and also for a review after installation prior to closing in work.
- .2 Additional inspection and testing may be carried out by a qualified Inspection and Testing Agency appointed by the Architect.
 - .1 The cost of this additional inspection shall be paid for out of the Cash Allowances for Inspection and Testing.
- .3 Any inspection or testing required because of an error by the Contractor or due to departure from the construction documents by the Contractor shall be paid for by the Contractor.
- .4 The Contractor shall provide the necessary cooperation to ensure that the inspection can proceed.
- .5 Inspection does not relieve the Contractor of the responsibility for the performance of the Contract. The Contractor is solely responsible for quality control and shall implement appropriate supervisory and quality control procedures.
- .6 Materials or workmanship not conforming to the requirements of the contract documents may be rejected at any time during the progress of work.

3.5 QUALITY CONTROL

- .1 Implement a system of quality control to ensure that the minimum standards specified herein are attained.
- .2 Bring to the attention of the Consultant any defects in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.
- .3 The Consultant 's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

3.6 NOTIFICATION

- .1 Prior to commencing significant segments of the work, give the [Consultant] and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review the work. Failure to meet this requirement may be cause for the [Consultant] to classify the work as defective.

3.7 INSPECTION AND TESTING

- .1 The Owner will appoint an Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct. The representative of the Inspection and Testing Company shall NOT be required to supervise or instruct the Contractor.

3.8 DEFECTIVE MATERIALS AND WORK

- .1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the [Consultant] may have tests, inspections or surveys performed, analytical calculations of structural strength, made and the like, in order to help determine whether the work must be corrected or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the [Consultant]'s opinion, the work may be acceptable.
- .2 All testing shall be conducted in accordance with the requirements of The Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- .3 Materials or work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 06 17 19

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Make a thorough examination of the drawings, the specifications and the site, to determine the intent, extent, materials, and conditions of interfacing with other work and to be fully cognizant of requirements.

1.1 RELATED WORK

- .1 Section 06 10 53 Rough Carpentry
- .2 Section 06 17 19 Cross-Laminated Timber
- .3 Section 06 17 00 Shop-Fabricated Structural Wood

1.2 REFERENCE STANDARDS

- .1 Comply with The Building Code Act, as amended, the 2012 Ontario Building Code (OBC) as amended and Regulations and by-laws of other authorities having jurisdiction, including latest amendments thereto; all hereafter referred to as Building Code.
- .2 All codes, standard specifications and by-laws referred to in this Specification shall be current editions including all latest revisions, addenda and supplements, unless otherwise noted in the Building Code.
- .3 Conform to the following CSA Standards:
 - .1 B111 Wire Nails, Spikes and Staples.
 - .2 G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel.
 - .3 G164 Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .4 O80 Series Wood Preservation.
 - .5 O86 Engineering Design in Wood.
 - .6 O112.9 Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
 - .7 O112.10 Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

- .8 O122 Structural Glued-Laminated Timber.
- .9 O177 Qualification Code for Manufacturers
of Structural Glued-Laminated
Timber.
- .10 S16 Design of Steel Structures.
- .11 W47.1 Certification of Companies for Fusion
Welding of Steel.
- .4 Conform to the following ASTM Standards:
 - .1 A307 Standard Specification for Carbon
Steel Bolts, Studs, and Threaded
Rod 60000 PSI Tensile Strength.
 - .2 A653/A653M..... Standard Specification for Steel
Sheet, Zinc Coated (Galvanized) or
Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip
Process.
 - .3 A36/A36M..... Standard Specification for Carbon
Structural Steel.
- .5 Conform to CGSB-1.40, Anti-Corrosive Structural Steel Alkyd Primer.
- .6 In the event of conflict between reference standards, codes, drawings and specifications, the Contractor shall request clarification by the Consultant. The Consultant's decision as to which requirements govern shall be final and binding. Generally the more stringent provision shall govern. No extras to the contract will be approved due to such clarification.
- .7 Conform to the Occupational Health and Safety Act, R.S.O. 1990, c. O.1, last amendment 2014, c. 10, Sched. 4.

1.3 SOURCE QUALITY ASSURANCE

- .1 Manufacture structural glued-laminated members in a plant certified as conforming to the requirements of CSA O177.
- .2 If requested, submit a certificate in accordance with CSA O177, Appendix B, at completion of fabrication.
- .3 If requested, provide certification that the protective sealer complies with the specified requirements.

- .4 Place authorization labels on glued-laminated members indicating manufacture in a CSA certified plant.
- .5 Fabricator of steel connections to be certified by the Canadian Welding Bureau to the requirements of CSA W47.1
- .6 Erection to be performed by an organization experienced in glued-laminated timber construction. Provide references when requested.

1.4 DESIGN OF DETAILS AND CONNECTIONS

- .1 Design details and connections by a licenced Professional Engineer to resist forces, moments and shears indicated on or implied by the drawings.

1.5 SHOP DRAWINGS

- .1 Provide erection drawings having a scale no less than the structural framing plans and detail drawings of individual members and complete information necessary for fabrication and erection.
- .2 Copies of Structural Framing Plans and Sections utilized as erection drawings are not permitted unless permission is first sought from and granted by the Structural Consultant.
- .3 Submit shop drawings for review as directed.
- .4 All shop drawings shall bear a Seal and Signature of a licenced Professional Engineer for items designed by the fabricator or manufacturer.
- .5 Fabrication shall not commence until shop drawings are reviewed.
- .6 Allow ten (10) working days for the review of drawings and supply as many copies for review and distribution as directed. Shop drawings shall be checked in detail by the Contractor and shall bear the checker's initials before submission.
- .7 Drawings which fail to meet these requirements shall be returned marked NOT REVIEWED and must be re-submitted after correction.
- .8 The review of shop drawings shall not relieve the Contractor of the responsibility of seeing that this work is complete, accurate and in conformity with the drawings and this specification.
- .9 Only shop drawings bearing the review stamps shall be kept at the site.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Laminating stock to comply with CSA O122:
 - .1 Douglas Fir – Larch
 - .2 Hem Fir and Douglas Fir – Larch
 - .3 Lodgepole Pine and/or Spruce
- .2 Adhesive to comply with CSA O112 Series: to suit grade of service required in accordance with CSA O122.
- .3 Sealer: Penetrating type, clear, non-yellowing liquid.
- .4 Fasteners/Connections:
 - .1 Split Ring Connectors in accordance with SAE 1010 and the SAE Handbook.
 - .2 Shear Plate Connectors in accordance with SAE 1010 and the SAE Handbook.
 - .3 Bolts: to ASTM A307.
 - .4 Lag Screws: to ASME B18.2.1.
 - .5 Side Plates: to CSA G40.21.
 - .6 Drift Pins: to ASTM A307 or CSA G40.21.
 - .7 Nails and Spikes: to CSA B111.
 - .8 Truss Plates: to ASTM A653.
 - .9 Glued-Laminated Rivets: to CSA G40.21 or ASTM A36.
- .5 Galvanizing: to CSA G164 minimum zinc coating 610 g/m² [18 oz/yd²].

Note: for connections specified to be galvanized, provide galvanized nuts, bolts, washers, nails and spikes as required.
- .6 Shop Coat Primer: to CAN/CGSB 1.40.
- .7 Other materials or products, which are not listed herein, shall comply with the latest CSA, ASTM, CGSB, or ACI standards appropriate to those materials. Submit brand names and manufacturer's data sheets for review, if requested.

PART 3 - EXECUTION

3.1 FABRICATION

- .1 Fabricate members to the following classifications:
 - .1 Stress Grades, Service Grades, and Appearance Grades: As noted on drawings.
- .2 Sealer:
 - .1 Apply protective sealer before shipping unless noted otherwise.
 - .2 Do not apply sealer to surfaces which are to receive a stained finish or preservative treatment.
- .3 Preservative Treatment:
 - .1 After fabrication, pressure treat indicated members with preservative and/or fire retardant in accordance with CSA O80 Series.
- .4 Prime Paint connections after fabrication.
- .5 Galvanize indicated connections after fabrication.
- .6 Mark members for identification during erection. Marks not to be visible in final assembly.

3.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store and protect materials of this section in accordance with directions.
- .2 Wrap members prior to leaving plant with a moisture resistant wrapping.
- .3 Use padded, non-marring slings for handling glued-laminated members.
- .4 Protect corners with wood blocking.
- .5 Slit underside of membrane covering during storage at site. Do not deface member.
- .6 Store glued-laminated units protected from weather, block off ground and separate with continuous blocking, so air may circulate around all faces of members.
- .7 Cover glued-laminated units with opaque moisture resistant membrane if stored outside.
- .8 Make adequate provisions for delivery and handling stresses.

3.3 ERECTION

- .1 Ensure protective sealer is not damaged before erection. If damaged, "touch-up" on site before erection.
- .2 Erect glued-laminated members in accordance with reviewed shop drawings.
- .3 Brace and anchor members until permanently secured by structure.
- .4 Make adequate provisions for erection stresses.
- .5 Do not field cut or alter members without Consultant's approval.

3.4 FIELD QUALITY CONTROL

- .1 Notify Structural Consultant for a review of preparations prior to installation of members and also for a review after installation prior to closing in work.
- .2 Additional inspection and testing may be carried out by a qualified Inspection and Testing Agency appointed by the Architect.
 - .1 The cost of this additional inspection shall be paid for out of the Cash Allowances for Inspection and Testing.
- .3 Any inspection or testing required because of an error by the Contractor or due to departure from the construction documents by the Contractor shall be paid for by the Contractor.
- .4 The Contractor shall provide the necessary cooperation to ensure that the inspection can proceed.
- .5 Inspection does not relieve the Contractor of the responsibility for the performance of the Contract. The Contractor is solely responsible for quality control and shall implement appropriate supervisory and quality control procedures.
- .6 Materials or workmanship not conforming to the requirements of the contract documents may be rejected at any time during the progress of work.

3.5 QUALITY CONTROL

- .1 Implement a system of quality control to ensure that the minimum standards specified herein are attained.
- .2 Bring to the attention of the Consultant any defects in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.

- .3 The Consultant 's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

3.6 NOTIFICATION

- .1 Prior to commencing significant segments of the work, give the [Consultant] and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review the work. Failure to meet this requirement may be cause for the [Consultant] to classify the work as defective.

3.7 INSPECTION AND TESTING

- .1 The Owner will appoint an Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct. The representative of the Inspection and Testing Company shall NOT be required to supervise or instruct the Contractor.

3.8 DEFECTIVE MATERIALS AND WORK

- .1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the [Consultant] may have tests, inspections or surveys performed, analytical calculations of structural strength, made and the like, in order to help determine whether the work must be corrected or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the [Consultant]'s opinion, the work may be acceptable.
- .2 All testing shall be conducted in accordance with the requirements of The Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- .3 Materials or work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

END OF SECTION 06 18 00

PART 1- GENERAL

1.1 GENERAL INSTRUCTIONS

Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Closeout Submittals
- .7 1.7 Quality Assurance
- .8 1.8 Delivery, Storage, and Handling
- .9 1.9 Field Conditions
- .10 2.1 Performance/Design Requirements
- .11 2.2 General
- .12 2.3 Wood Materials
- .13 2.4 Panel Materials
- .14 2.5 Fasteners and Adhesives
- .15 2.6 Hardware
- .16 2.7 Finishes – Interior Architectural Woodwork
- .17 2.8 Fabrication
- .18 3.1 Preparation
- .19 3.2 Installation
- .20 3.3 Installation – Tolerances
- .21 3.4 Adjusting and Cleaning
- .22 3.5 Protection

1.3 SUMMARY

The work of this Section includes architectural woodwork including, but not limited to, the following:

- .1 Standing and running trim.
- .2 Cabinetry and hardware.
- .3 Plastic wood benches and fabrications.
- .4 Solid surfacing countertops and fabrications.
- .5 Wood wall panels.
- .6 Factory and *Site* finishing of architectural woodwork.

1.4 ADMINISTRATIVE REQUIREMENTS

Coordination:

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

1.5 SUBMITTALS

Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.

Product data sheets:

- .1 Submit manufacturer's *Product* data for each type of *Product* and process proposed for use in the work of this Section and incorporated into items of architectural woodwork.

Shop drawings:

- .2 Submit *Shop Drawings* for the work of this Section complying with the Architectural Woodwork Standards, Edition 2, 2014 requirements.
- .3 Indicate quality standards and grades.
- .4 Include full scale drawings of all exposed-to-view edge conditions.
- .5 Include plans, sections and large scale details, and indicate components and methods of assembly, fastenings, and other fabrication information required for the work of this Section. Indicate assembly joint lines.
- .6 Include materials and their characteristics and finishes as applicable including the following:
 - Panel core and material types, thicknesses, compliance with specified standards, special treatments.
 - Adhesive types to be used and locations.
 - Finishing requirements including Architectural Woodwork Standard finish system number, sheen, and required application steps.
- .7 Submit coordination drawings indicating locations of concealed grounds, cut- outs, plates, and other required fabrications.
- .8 Show relation to adjoining construction, details of outside and inside corners and door openings.

Verification samples:

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

1.6 CLOSEOUT SUBMITTALS

Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.

Operation and maintenance data:

- .1 Submit maintenance and cleaning instructions for finishes requiring specific care, noting particularly those procedures or materials which will cause damage to finished surfaces to be included in maintenance manuals.

1.7 QUALITY ASSURANCE

Qualifications:

- .1 Manufacturers:

The *Contractor* shall ensure that architectural woodwork is manufactured by a firm having a minimum of five years' experience on work of similar size and quality.

The *Contractor* shall ensure that the manufacturer is a member in good standing of the Architectural Woodwork Institute or the Architectural Woodwork Manufacturers Association of Canada or the Woodwork Institute or equivalent membership acceptable to the Consultant.

Fabricator solid surfacing: Fabrication to be performed by a solid surface manufacturer's certified fabricator. The *Contractor* shall submit the manufacturer's certification letter prepared by the solid surfacing manufacturer.

- .2 Installers / applicators / erectors: Engage an installer who has successfully completed two architectural woodwork projects similar in scope, materials and design to this *Project* within the last five years.

Quality standard:

- .3 The work shall be in accordance with the Architectural Woodwork Standards, Edition 2, 2014, Premium Grade, or the highest grade available for performance and appearance characteristics of materials in Sections 3 – 5 used that apply to *Product* fabrication and installation requirements governed by Sections 6 – 12.

1.8 DELIVERY, STORAGE, AND HANDLING

Protect architectural woodwork during transit, delivery, storage and handling to prevent damage, spoilage, and deterioration.

Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate architectural woodwork have been completed in installation areas. If woodwork

must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified under subsection 1.10 - Field Conditions.

The *Contractor* shall be solely responsible to make certain that architectural woodwork is not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content. The *Contractor* shall coordinate the delivery of the woodwork with the architectural woodwork manufacturer.

1.9 FIELD CONDITIONS

Environmental conditions:

- .1 During storage and installation: Obtain and comply with Architectural Woodwork Standard's for optimum temperature and relative humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained. Woodwork shall be acclimatized for a minimum of 72 hours prior to commencing woodwork installation.
- .2 During finishing: Comply with Architectural Woodwork Standard's temperature and humidity requirements before, during, and after application of finishes.
- .3 During service life of woodwork: Obtain and comply with woodwork manufacturer's advice for optimum temperature and humidity conditions for woodwork. Note that building humidity control is not in operation 24 hours per *Day* or 365 *Days* per year and system is intermittent during winter and summer months. As a result, fabrication of wood components should anticipate major changes in humidity levels.

PART 2 – PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

Casework integrity shall meet the minimum acceptance levels in accordance with SEF 8- 1999 as outlined in the Architectural Woodwork Standards, Edition 2, 2014 and additional or greater loading capacities as specified throughout the Architectural Woodwork Standards.

Maximum allowable adjustable shelf lengths shall comply with shelves assembly rules per the Architectural Woodwork Standards, Edition 2, 2014.

Welding:

- .4 Weld components in steel to conform to requirements of CSA W59-15, and by a fabricator fully certified by the Canadian Welding Bureau or equivalent certification acceptable to the *Consultant* in accordance with the conditions of CSA W47.1-09(2014) and CSA W55.3-08 (R2013) as applicable.
- .5 Weld components in aluminum to conform to the requirements of CSA W59.2-M1991 (R2013), and by a fabricator certified by the Canadian Welding Bureau or equivalent certification acceptable to the *Consultant* in accordance with the conditions of CSA W47.2-12.
- .6 Weld stainless steel components to conform to requirements of CSA W59-15 and ANSI/AWS D1.6/D1.6M as applicable, and by a fabricator fully certified by the Canadian Welding Bureau or equivalent certification acceptable to the *Consultant* in accordance with the conditions of CSA W47.1-09(2014).

2.2 GENERAL

Single-source manufacturing and Installation responsibility: Engage a qualified manufacturer to assume undivided responsibility for woodwork specified in this Section, including fabrication, finishing, and installation.

2.3 WOOD MATERIALS

Lumber:

- .7 Hardwood for concealed blocking and framing: Economy grade, any species that, when painted, will not show any defects.
- .8 Moisture content: *Provide* kiln-dried (KD) lumber with moisture content range between 6% to 12% for interior architectural woodwork. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed 5% to 10%.
- .9 Solid hardwood painted finish.

Species:

White Birch.

Cut:

Rift.

Wood veneers:

- .10 Allowable wood veneer face grade characteristics shall comply with Architectural Woodwork Standards, Edition 2, 2014 referenced grade and referenced standards.

Species

White Birch.

Veneer cut:

Rotary.

Veneer leaf matching:

Random.

- .11 Edgeband exposed panel edges with 6 mm (1/4") thick solid hardwood trim, unless otherwise indicated in the Contract Documents.

Medium density fibreboard (MDF):

- .12 In accordance with ANSI A208.2-2009, 720 kg/m³ (45 lbs/ft³) minimum density and as follows:

Grade:

Grade 130.

Formaldehyde emission: F21 for panel thicknesses greater than 8mm 8 mm (5/16") and F13 for panels equal to or thinner than 8 mm (5/16").

Acceptable *Products*:

Uniboard Canada Inc.

Or Equivalent.

2.4 PANEL MATERIALS

Panel material schedule; except where indicated otherwise in the *Contract Documents*:

.13 Thickness: 19 mm (3/4") minimum.

.14 Core panels:

At veneered work: MDF, except at shelving use veneer core plywood.

Plywood backing; countertops, backsplashes, and where indicated in the contract drawings:
Veneer core plywood with Type II adhesive, sanded good one side or good two sides
(when both sides exposed or to receive applied finish materials) plywood, with no added
urea-formaldehyde used in composition.

.15 Maximum moisture content at time of installation: 10% to 12%.

Plywood:

.16 Veneer core plywood non telegraphing grain:

Softwood plywood: in accordance with ANSI/HPVA HP-1-2009.

Douglas Fir plywood: in accordance with US Plywood Standard APA PS-1-09.

Medium density fibreboard (MDF):

.17 In accordance with ANSI A208.2-2009, 720 kg/m³ (45 lbs/ft³) minimum density and as follows:

Grade:

Grade 130.

Formaldehyde emission: F21 for panel thicknesses greater than 8mm 8 mm (5/16") and F13
for panels equal to or thinner than 8 mm (5/16").

Acceptable *Products*:

Uniboard. Or Equivalent. Plastic Laminate Finish as specified on drawings.

HDPE Puckboard Sheet – a solid white highly durable High Density Polyethylene (HDPE) – 48" x
96" sheet size. Thicknesses: .500"

Engineered stone and porcelain tile surfacing.

.18 Composition for engineered stone: 93% crushed quartz aggregate combined with resins and
pigments and fabricated into slabs using a vacuum vibro-compaction process, and as follows:

Thickness, finish and colour: as indicated in the *Contract Documents*.

Flame Spread Value (FSV): Maximum 25.

Smoke Developed Value (SDV): Maximum 50.

Shower benches and boards for coat hooks:

Plastic wood; as manufactured by Trex Company Inc. or *Equivalent*, colour to later selection
by the *Consultant* from the manufacturer's full range.

2.5 FASTENERS AND ADHESIVES

Wood screws: FF-S-111D Amendment 1 (1989), type, size, material and finish as required for the condition of use.

Nails: FED FF-N-105, type, size material and finish as required for the condition of use.

Anchors: Type, size material and finish as required for the condition of use.

Fastening devices shall be set or countersunk flush with surface of framing member. No exposed fasteners permitted. Where accepted by the *Consultant*, exposed fasteners shall be flat head hex socket cap screws and matching joint connector sex bolts (also known as Chicago screws or post and screw) by Murakoshi, distributed by Richelieu or *Equivalent*, Spaenaur Joint Connector bolt with decorative head, hex drive series; finish as selected by the *Consultant*.

At butt joints in railing caps and counter surfaces, employ assembling bolts to ensure tight structural joint.

Adhesives: Type II water resistant, except use Type I waterproof in wet environments.

2.6 HARDWARE

Casework hardware; to be furnished and installed by the architectural woodwork manufacturer.

- .19 As far as practical, use one manufacturer's products for all Products in this section.
- .20 All costs associated with the *Products* of this Section will not be covered by a cash allowance and shall be included in the *Contract Price*.
- .21 Cabinet and auxiliary hardware: Where casework hardware is not specified or indicated on the *Drawings* or scheduled, casework hardware shall comply with ANSI/BHMA Standards, latest edition, minimum grades, loading and other basic rules per the Architectural Woodwork Standards, Edition 1, 2009.
- .22 Stainless steel hat and coat hook: Specified under Section 10 28 00 – Washroom Accessories and Janitor Accessories for installation as part of the work of this Section.

2.7 FINISHES – INTERIOR ARCHITECTURAL WOODWORK

Paint and stain finish, in accordance with Section 09 91 00 - Painting.

2.8 FABRICATION

Fabricate woodwork to dimensions, profiles, and details indicated in the Contract drawings with openings and mortises pre-cut, where possible, to receive hardware and other items of work.

Complete fabrication, assembly, finishing, hardware application, and other work before shipment to maximum extent possible. Trial fit in shop and disassemble components only as necessary for shipment and installation. Where necessary, *Provide* ample allowance for scribing, trimming, and fitting. Reassemble with concealed fasteners.

Provide woodwork, solid tops and other materials with pre-cut openings, where possible, for hardware, appliances, plumbing fixtures, electrical work, telephone cut-outs and similar items. Locate openings accurately and *Provide* proper size and shape. Smooth edges of cut-outs and, where located in countertops, seal edges of cut-outs with a water-resistant coating.

Provide lumber framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.

Reinforcing shown is minimum. *Provide* additional reinforcing as required to ensure a rigid assembly. Take responsibility for the stability of furniture and fitments.

Do fabrication from field measurements with provisions for scribing as required to meet built-in conditions.

Provide balancing sheets as required, and specified, complying with the Architectural Woodwork Standards, Edition 2, 2014.

Provide surface mount blocking and strapping necessary to support the work of this Section. Such blocking shall not be exposed upon completion of work.

Prefinish work at the factory, except where specified or indicated otherwise in the Contract documents.

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

PART 3 - EXECUTION

3.1 PREPARATION

Condition woodwork to average prevailing humidity conditions in installation areas before installing.

Ensure that environmental conditions have been provided as requested and specified.

Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

Provide all grounds, nailers and other required fabrications which are to be built into other work when required.

Ensure that wall and ceiling variations are not in excess of 6.4 mm (1/4") in 3658 mm (144") and that floors are not in excess of 12.7 mm (1/2") in 3658 mm (144") of being plumb, level, flat, straight, square, of the correct size. Variations shall be corrected prior to installation of work of this Section.

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

3.2 INSTALLATION

Install woodwork to comply with Architectural Woodwork Standards, Edition 2, 2014 for same grade specified in Part 1 of this Section for type of woodwork involved.

Install woodwork plumb, level, true, and straight with no distortions.

Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated in the shop drawings.

Complete the finishing work specified in this Section to whatever extent not completed at shop or before installation of woodwork.

Plastic wood:

.23 Install plastic wood in accordance with manufacturer's instructions and recommendations.

- .24 Install with the following minimum expansion/contraction gaps, wider as recommended by manufacturer:

Width-to-width: 9.5 mm (3/8").

End-to-end: 3.2 mm (1/8").

Perimeter and abutting solid objects: 6.4 mm (1/4").

- .25 Screw-down installation: Use manufacturer's recommended screws, exterior grade. Install screws at least 25 mm (1") in from board edges.

3.3 INSTALLATION – TOLERANCES

Install to a tolerance of 3 mm in 2400 mm (1/8" in 8'-0") for plumb and level (including tops) and with no variations in flushness of adjoining surfaces unless otherwise acceptable in accordance with the Architectural Woodwork Standards, Edition 1, 2009.

3.4 ADJUSTING AND CLEANING

Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork, at the *Contractor's* expense.

Clean, lubricate, and adjust hardware.

Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.5 PROTECTION

Protect architectural woodwork during remainder of construction period to ensure that work will be without damage or deterioration at time of acceptance.

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that woodwork is without damage or deterioration at time of *Substantial Performance of the Work*.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Field Conditions
- .8 1.8 Delivery, Storage, and Handling
- .9 2.1 Performance/Design Requirements
- .10 2.2 Materials
- .11 3.1 General
- .12 3.2 Preparation - Typical
- .13 3.3 Membrane Installation
- .14 3.4 Field Quality Control

1.3 SUMMARY

- .1 Section includes:
 - .1 Sheet waterproof membrane at locations as indicated and as follows:
 - .1 Throughwall membrane flashing: either Type 1 or Type 2 sheet membrane is acceptable.
 - .2 In shower compartments: only Type 1 sheet membrane is acceptable.
 - .3 Damp Proof Course (DPC): only Type 2 sheet membrane is acceptable.

1.4 ADMINISTRATIVE REQUIREMENTS

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

1.5 SUBMITTALS

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

1.6 QUALITY ASSURANCE

- .1 Execute the work of this Section only by a *Subcontractor* who has adequate plant, equipment and skilled workers to perform it expeditiously, is known to have been responsible for satisfactory

installations similar to that specified during a period of at least the immediate past 5 years, and has been approved in writing by the self-adhered waterproofing system manufacturer for the installation of their *Product*.

.2 Mock-Up:

.1 Construct area of typical waterproofing installation for approval. Locate at the *Place of the Work* as part of final installation.

.2 Do not proceed until mock-up has been reviewed and accepted by the *Consultant*.

1.7 FIELD CONDITIONS

.1 *Provide* forced air circulation during curing period for enclosed applications.

.2 Apply only when air and surface temperatures are maintained above 4°C, have been so for 48 hours, and are not likely to fall lower until the work of this Section is completed, unless otherwise approved.

.3 The work of this Section may proceed at temperatures below 4°C only with mutual documented agreement of inspection and testing company, manufacturer and applicator that, with materials and methods used, specified installation will be achieved.

.4 Ensure application temperature and humidity recommended by material manufacturer are maintained before, during and after installation.

.5 *Provide* forced air circulation or adequate natural ventilation during installation and curing periods for enclosed application.

.6 Do not expose materials vulnerable to water or sun damage in quantities greater than can be installed the same *Day*.

.7 *Install* waterproofing on dry surfaces, free of snow and ice and during weather that will not introduce moisture into waterproofing system.

1.8 DELIVERY, STORAGE, AND HANDLING

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

.2 Store solvent-base liquids and surface conditioner away from excessive heat and open flame. Post "NO SMOKING" signs in areas where solvent-base materials are used and stored.

.3 Store surface conditioner at temperature above 5°C.

.4 Pallets of waterproofing membrane shall not be double stacked.

PART 2 - PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

.1 Waterproofing system shall *Provide* watertight protection to prevent the passage of water under hydrostatic pressure.

2.2 MATERIALS

.1 Waterproofing membrane Type 1:

.1 Standard ethylene propylene diene monomer (EPDM sheet membrane), in accordance with CGSB 37-GP-52M-1984, Type 1, Class A, 1.6 mm (1/16") thick, non-reinforced.

- .2 Waterproofing membrane Type 2:
 - .1 Self adhering polymeric waterproofing membrane.
 - .2 Thickness:
 - .1 Film: 4 mils.
 - .2 Polymeric membrane: 56 mils.
 - .3 Tensile strength: in accordance with ASTM D412-06a (2013).
 - .4 Film: 40.71 MPa (5,900 psi) minimum.
 - .5 Polymeric membrane: 4.07 MPa (590 psi) minimum.
 - .6 Elongation: in accordance with ASTM D412-06a (2013).
 - .7 Polymeric membrane: 455 percent minimum.
 - .8 Water vapour transmission: in accordance with ASTM E96/E96M-10, Method B: 0.05 grains/ft²/ hour.
 - .9 Water absorption: in accordance with ASTM D570-98(2010) e1, 0.1%, 72 hours maximum.
 - .10 Resistance to hydrostatic head: equivalent to 45.72 m (150 ft) of water.
 - .11 Puncture resistance: in accordance with ASTM E154/E154M-08a (2013) e1, 67 pounds.
 - .12 Acceptable *Products*:
 - .1 Bakor 'WP 200'.
 - .2 Colloid Environmental Technologies Company (CETCO) 'Envirosheet', as distributed by DRE Industries Inc.
 - .3 Tremco 'Permaquik PQ 7100'.
 - .4 Soprema 'Colphene 3000'.
 - .5 W.R. Meadows 'Mel-Roll'.
 - .6 Or Equivalent.
 - .3 Primer/surface conditioner: In accordance with membrane manufacturer's printed installation instructions.
 - .4 Adhesives: In accordance with membrane manufacturer's printed installation instructions.
 - .5 Mastic; self-adhered membrane systems: Single component, utility grade, rubber based sealant. Use manufacturer's proprietary mastic.
 - .6 Sealers:
 - .1 For sheet membrane Type 1: use sealant Type 6 in accordance with Section 07 92 00 – Joint Sealants in accordance with manufacturer's recommendations.
 - .2 For sheet membrane Type 2:
 - .1 With Blueskin WP200, use Polybitume 570-05, as manufactured by Bakor or *Equivalent*.

- .2 With Per-A-Barrier Wall Membrane, use Bituthene Mastic, as manufactured by Grace Construction Products or *Equivalent*.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Comply with manufacturer's *Product* data, including *Product* application and installation instructions, as well as manufacturer's shipping and storage recommendations.
- .2 Examine conditions of substrates and other conditions under which the work of this Section is to be performed and notify the *Consultant*, in writing, of circumstances detrimental to the proper completion of the *Work*. Do not proceed with the work of this Section until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's written recommendations.

3.2 PREPARATION - TYPICAL

- .1 Protect adjacent work areas and finish surfaces from damage or contamination from waterproofing *Products* during installation operations.
- .2 Concrete surfaces shall be smooth, clean, dry and free of any foreign matter that would otherwise hinder either adhesion or regularity of waterproofing membrane installation.
- .3 Remove fins, ridges, and other protrusions levelled and smoothly finished to match monolithic concrete surface. Completely fill honeycomb, aggregate pockets, holes and other voids with non-shrink cementitious grout levelled and smoothly finished to match monolithic concrete surface.
- .4 Priming:
 - .1 Condition surfaces to receive waterproofing membrane using primer/surface conditioner applied by spray or roller in accordance with manufacturer's mixing and application instructions.
 - .2 Allow primer/surface conditioner to dry adequately before proceeding with waterproofing membrane. Avoid pooling and excess of primer/surface conditioner. Primed surfaces not covered by waterproofing membrane on the same *Day* must be re-primed.
 - .3 Metal surfaces need not be primed, but should be free of grease, oil, dirt, loose paint, rust or any other contaminants.

3.3 MEMBRANE INSTALLATION

- .1 Apply waterproofing membrane system in accordance with manufacturer's instructions.
- .2 *Provide* a chalk line or alternate means of establishing a square start location. Align first sheet of membrane with straight edge and after removing first few feet of release paper from roll lay membrane into place. Continue to pull release paper from roll thereby adhering the membrane onto the substrate. Proceed at a rate that allows opportunity to prohibit air from becoming entrapped between membrane and substrate.
- .3 Continue with subsequent rolls aligning each with previous along lap lines provided on membrane. Maintain a minimum overlap of 64 mm (2-1/2").
- .4 End laps as encountered at roll ends and splices should overlap the previous membrane a minimum of 150 mm (6"). Stagger end laps. Point exposed edges and terminations with pointing mastic to prevent water from travelling under membrane. Lap to shed water.

- .5 Lay membrane carefully to ensure a uniform application and to minimize fishmouths (wrinkles extending to membrane's edge).
- .6 Horizontal to vertical inside corner transition areas are to be pre-treated with manufacturer's proprietary fillet extending 19 mm (3/4") vertically and horizontally from the corner. Apply a minimum 225 mm (9") strip of membrane centred at the joint.
- .7 Immediately following placement, roll membrane in its entirety to ensure continuous adhesion to the substrate. For verticals, use membrane roller as recommended by manufacturer.
- .8 On vertical and horizontal applications membrane terminations shall receive an edge dressing of waterproofing mastic to protect against undermining effects of ponded water or vertical drainage.
- .9 *Install* DPC across the width of the foundation wall and *Install* throughwall membrane flashing in masonry in accordance with the manufacturer's recommendations and as follows:
 - .1 *Install* membranes under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. *Install* membranes under weep hole courses as indicated.
 - .2 In cavity and veneered walls, carry throughwall membrane flashing from front edge of masonry, under outer wythe, then up backing not less than 250 mm (10") and as follows:
 - .1 For masonry backing, embed membrane a minimum of 25 mm (1") in joint of backing masonry.
 - .2 For frame backing, bond to plywood sheathing using manufacturer's recommended adhesive.
- .10 Detail work:
 - .1 Over non-working joints or cracks up to a maximum of 5 mm (3/16"), apply a reinforcing strip of waterproofing membrane, not less than 225 mm (9") in width centered over the joint/crack.
 - .2 Non-working joints or cracks greater than 5 mm (3/16") in width, notify the *Consultant*. Joints shall be filled flush to the level of the surrounding deck surface prior to the placement of a 225 mm (9") reinforcing strip of waterproofing membrane. Waterproofing liquid membrane should be used to fill voids of this nature.
 - .3 Cold pour joints: Grind or chip as required to smooth joint/crack prior to field membrane application. Treat in same manner as non-working joints/cracks less than 5 mm (3/16") wide.
 - .4 Inspect vertical and horizontal inside/outside corner locations to ensure smoothness and regularity. Outside corners should be continuous and free of sharp edges. Inside corners should be free of rough edges resulting from formwork placement. Repair as required.
 - .5 *Install* a reinforcing ply of waterproofing membrane over outside corners. Use a width of membrane not less than 225 mm (9") centred over the corner and press into full contact with the substrate. Reinforcing strips shall be installed prior to field membrane application.

3.4 FIELD QUALITY CONTROL

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 2.1 Insulation Materials
- .7 2.2 Accessory Materials
- .8 3.1 General Installation Requirements
- .9 3.2 Examination
- .10 3.3 Installation – General
- .11 3.4 Installation – Batt Insulation
- .12 3.5 Installation – Semi-Rigid Insulation
- .13 3.6 Installation – Rigid Insulation Application
- .14 3.7 Installation – Foamed-in-Place Insulation
- .15 3.8 Field Quality Control
- .16 3.9 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 Semi-rigid insulation; cavity walls.
 - .2 Rigid insulation; cavity wall insulation.
 - .3 Rigid insulation; below grade insulation at vertical conditions.
 - .4 Rigid insulation; below grade insulation at horizontal conditions.
 - .5 Foamed-in-place (gap filler) insulation.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
 - .2 Submit data and installation instructions for materials and prefabricated devices, providing descriptions sufficient for identification at the *Place of the Work*.

- .3 Submit data from the manufacturer's or independent laboratory indicating compatibility and adhesive results of proposed materials.
- .3 Samples: Submit representative samples of each specified insulation material, insulation clips, adhesives, fasteners, tapes and other material for review.

1.5 QUALITY ASSURANCE

- .1 Qualifications: Execute work of this Section using a *Subcontractor* who has adequate plant, equipment and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- .1 Batt insulation; except where acoustic batt is indicated in the Contract Drawings.:
 - .1 Unfaced, mineral-fibre batts, in accordance with CAN/ULC S702-09, Type 1.
 - .2 Acceptable manufacturers:
 - .1 Fibrex.
 - .2 Johns Manville.
 - .3 Owens Corning Canada.
 - .4 Roxul Inc.
 - .5 Or *Equivalent*.
 - .2 Batt insulation; except where acoustic batt is indicated or scheduled:
 - .1 Unfaced, mineral-fibre batts, formaldehyde-free, in accordance with CAN/ULC S702-09, Type 1.
 - .2 Acceptable manufacturers:
 - .1 Johns Manville.
 - .2 Or *Equivalent*.
 - .3 Insulation Type 2: semi-rigid insulation, within cavity walls:
 - .1 Mineral-fibre in accordance with CAN/ULC S702-09, Type 1, 72 kg/m³ (4.5 lb/ft³) minimum density in accordance with ASTM C612-10 for basalt rock and steel slag mineral-fibre insulation.
 - .2 Acceptable Products:
 - .1 Roxul 'CavityRock MD'.
 - .2 Or *Equivalent*.
 - .4 Insulation Type 3; rigid, below grade insulation at vertical conditions:
 - .1 Extruded polystyrene, closed-cell, smooth skin, in accordance with CAN/ULC S701-11, Type 4, 30 psi compressive strength.

- .2 Acceptable Products:
 - .1 'Styrofoam SM' as manufactured by Dow Chemical.
 - .2 'Celfort 300' as manufactured by Owens Corning.
 - .3 Or *Equivalent*.
- .5 Rigid insulation; below grade insulation at horizontal conditions:
 - .1 Extruded polystyrene, closed-cell, smooth skin, in accordance with CAN/ULC S701-11, Type 4.
 - .2 Compressive Strength, ASTM D1621-10, 275 kPa (40 psi) minimum (measured at 5% deformation or at yield, whichever occurs first).
 - .3 Acceptable *Products*:
 - .1 'Styrofoam Highload 40' as manufactured by Dow Chemical.
 - .2 'Foamular 400' as manufactured by Owens Corning Canada.
 - .3 Or *Equivalent*.
- .6 Foamed-in-place (gap filler) insulation:
 - .1 One-component CFC-free polyurethane foam in accordance with CAN/ULC S710.1-05.
 - .2 Two-component CFC-free polyurethane foam in accordance with CAN/ULC S711.1-05.

2.2 ACCESSORY MATERIALS

- .1 Adhesive: solvent based polymer modified liquid applied membrane, compatible with insulation to be applied, type as manufactured for the attachment of insulation. Acceptable *Product*: Bakor Airbloc 21 or 230-21 or *Equivalent*.
- .2 Insulation fasteners: Impaling clip of galvanized steel with washer retainer, to be adhered to surface to receive board insulation with adhesive, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- .3 Batt insulation restraint: Zinc coated woven wire and mechanical fasteners.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- .1 Comply with requirements of Section 01 45 00 – Quality Control.
- .2 *Install* materials in accordance with manufacturer's installation instructions.

3.2 EXAMINATION

- .1 Take measurements at the *Place of the Work* to ensure that work is fabricated to fit structure; surrounding construction; around obstructions and projections in place, or as indicated in the Contract drawings; and to suit locations of services.
- .2 Verify that backup construction is aligned for proper installation of work before commencing erection.

3.3 INSTALLATION – GENERAL

- .1 Surfaces to receive insulation shall be dry and free of dew, frost, voids, loose material, oil, grease, asphalt curing compounds and other matter detrimental to bond of adhesive. Adhesive shall be compatible with waterproofing on walls.
- .2 Apply adhesives, and *Install* insulation in accordance with manufacturer's printed recommendations. Apply at rate as required to prevent displacement of insulation boards during construction operations.
- .3 Butt joints tightly and offset vertical joints to form an unbroken thermal envelope. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .4 Apply insulation to ensure total and complete coverage of surfaces indicated in the Contract drawings to be insulated, and in direct contact with such surfaces. Unless otherwise specified, apply insulation in single layer of thickness indicated.
- .5 Ensure integrity and continuity of insulation at juncture with different types of materials and seal in an acceptable manner.
- .6 Do not enclose insulation until it has been reviewed and accepted by the *Consultant*.

3.4 INSTALLATION – BATT INSULATION

- .1 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .2 Do not over compress insulation to fit into spaces.
- .3 *Install* continuous woven wire restraint mechanically fastened to steel studs to hold insulation against exterior sheathing materials.
- .4 Insulation equal to that specified shall be placed in jamb and header assemblies that will be inaccessible after their installation into wall. Ensure that insulation is kept dry and not compressed.
 - .1 Where applicable, fasten insulation using masonry tie securement plates provided under Section 04 05 19 – Masonry Reinforcements and Connectors.
 - .2 In locations where insulation clips are not practical or available with masonry connectors, mechanically fasten insulation at maximum spacing of 400 mm (16") on centre, using fasteners to suit substrate condition.

3.5 INSTALLATION – SEMI-RIGID INSULATION

- .1 *Install* at masonry assembly locations in accordance with Section 04 05 00 – Masonry Procedures.
 - .1 Where applicable, fasten insulation using masonry tie securement plates provided under Section 04 05 19 - Masonry Reinforcements and Connectors.
 - .2 In locations where insulation clips are not practical or available with masonry connectors, mechanically fasten insulation at maximum spacing of 400 mm (16") on centre, using fasteners to suit substrate condition.

3.6 INSTALLATION – RIGID INSULATION APPLICATION

- .1 Edge butter rigid insulation joints with adhesive and trowel flush with insulation face at wall cavity insulation locations to *Provide* a full and continuous seal.

- .2 Butter masonry tie penetrations with adhesive at wall cavity insulation locations.
- .3 Secure rigid insulation boards to substrate at rate of 6 each 610 x 1220 mm (24" x 48") board minimum, with corrosion resistant mechanical fasteners complete with 25 mm (1") plastic washers.
- .4 Below grade insulation:
 - .1 Adhere rigid insulation to face of below grade perimeter walls with adhesive.
 - .2 Perimeter below grade application: extend boards minimum 600 mm (24") vertically below bottom of finish floor slab, installed on face of perimeter foundation walls.
- .5 Below grade insulation; underslab:
 - .1 *Install* in accordance with the insulation manufacturer's written specifications and in accordance with requirements of subsection 3.3 – General Installations of this Section.

3.7 INSTALLATION – FOAMED-IN-PLACE INSULATION

- .1 *Install* one-component foam in accordance with CAN/ULC S710.2-05 application standard.
- .2 *Install* two-component foam in accordance with CAN/ULC S711.2-05 application standard.
- .3 *Install* at exterior building envelope assemblies to locations as indicated in the Contract drawings, to cavity and gaps surrounding metal frames.
- .4 Refer also to foamed-in-place insulation as specified in Section 08 41 00 – Aluminum Framed Glazing Systems.

3.8 FIELD QUALITY CONTROL

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

3.9 PROTECTION

- .1 Comply with the manufacturer's printed recommendations respecting protection.
- .2 Protect polystyrene insulation from extended exposure to sunlight.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 2.1 Sheet Vapour Barrier
- .7 2.2 Accessories
- .8 3.1 Installation
- .9 3.2 Attachment
- .10 3.3 Exterior Surface Openings
- .11 3.4 Perimeter Seals
- .12 3.5 Lap Joint Seals
- .13 3.6 Electrical Boxes
- .14 3.7 Field Quality Control

1.3 SUMMARY

- .1 Section includes:
 - .1 Above-grade vapour barrier.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 Samples:
 - .1 Submit sample of proposed *Products* for review by the *Consultant*.

1.5 QUALITY ASSURANCE

- .1 Qualifications: *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .2 Mock-up:
 - .1 Construct 10 m² (100 ft²) area of typical installation for each type of *Product*.

- .1 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
- .2 Locate at the *Place of the Work* as part of final installation. Space installation to include exterior wall panel incorporating window and insulation.
- .3 Do not proceed until mock-up has been reviewed by the *Consultant*.
- .4 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

PART 2 - PRODUCTS

2.1 SHEET VAPOUR BARRIER

- .1 Polyethylene film: CAN/CGSB 51.34-M86 (amended 1988), Type 1, 0.15 mm (6 mil) thick, with a water vapour permeance of not greater than 45 ng/(P•s•m²), flame spread rating of less than 150 in accordance with CAN/ULC-S102-10.

2.2 ACCESSORIES

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 75 mm (3") wide.
- .2 Lap sealant; butyl sealant: CGSB 19.21-M87.
 - .1 Acceptable *Products*:
 - .1 Pecora 'BA98'- Pecora Corporation
 - .2 Tremco 'Acoustical Sealant'.
 - .3 QuietSeal 'Acoustic Sealant QS-350'.
 - .4 Or *Equivalent*.
- .3 Staples and fasteners: minimum 6.4 mm (1/4") leg.
- .4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Ensure services are installed and inspected prior to installation of sheet vapour barrier.
- .2 *Install* sheet vapour barrier on interior side of insulation at exterior wall and ceiling assemblies prior to installation of gypsum board to form continuous application.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Inspect sheets for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 ATTACHMENT

- .1 Seal vertical joints in sheet vapour barrier over framing by lapping no fewer than two studs.
- .2 Fasten sheet vapour barrier to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 400 mm (16") o.c.

3.3 EXTERIOR SURFACE OPENINGS

- .1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.4 PERIMETER SEALS

- .1 Seal perimeter of sheet vapour barrier as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.
 - .3 *Install* staples through lapped sheets at sealant bead into wood substrate.
 - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 LAP JOINT SEALS

- .1 Seal lap joints of sheet vapour barrier as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150 mm (6") and press into sealant bead.
 - .4 *Install* fasteners through lapped sheets at sealant bead into wood substrate.
 - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 ELECTRICAL BOXES

- .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
 - .1 *Install* moulded box vapour barrier or double wrap boxes with film sheet providing minimum 305 mm (12") perimeter lap flange.
 - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.7 FIELD QUALITY CONTROL

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 2.1 Materials
- .7 3.1 Installation
- .8 3.2 Field Quality Control

1.3 SUMMARY

- .1 Section includes:
 - .1 Below grade vapour barrier; located beneath concrete slabs.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 -Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* to be for used in the work of this Section.
- .3 Samples:
 - .1 Submit sample of proposed *Products* for review by the *Consultant*.

1.5 QUALITY ASSURANCE

- .1 Qualifications: *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Vapour barrier membrane:
 - .1 Performance criteria:
 - .1 Permeance, as tested after conditioning: not greater than 0.5700 ng/ (Pa*s *m²) [0.010 perms (gm/ft²/in-Hg)] in accordance with ASTM E1745-11 paragraphs 7.1.2 through 7.1.5.
 - .2 Strength: Class A in accordance with ASTM E1745-11.

- .3 Thickness of plastic:
 - .1 0.38 mm (15 mils) minimum.
- .2 Acceptable *Products*:
 - .1 Stego Industries 'Stego Wrap Vapor Barrier', thickness specified above.
 - .2 W.R. Meadows 'PERMINATOR', thickness specified above.
 - .3 Or *Equivalent*.
- .2 Vapour barrier membrane joint tape:
 - .1 Description: High density polyethylene tape, pressure sensitive, 100 mm (4") wide, *Product* as per vapour barrier membrane manufacturer's installation instructions.
- .3 Penetration flashing:
 - .1 Vapour barrier membrane material and vapour barrier joint tape in accordance with the manufacturer's instructions.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 *Install* vapour barrier membrane in accordance with the manufacturer's instructions and ASTM E1643-11.
- .2 Extend vapour barrier to the perimeter of the slab and seal to perimeter and penetration conditions. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at the slab perimeter.
- .3 *Install* vapour barrier membrane using largest practicable sheet size to minimize joints over compacted fill.
- .4 Inspect vapour barrier membrane sheets for continuity. Repair punctures and tears in vapour barrier membrane with sealing tape before work is concealed.
- .5 Vapour barrier membrane installation shall be continuous and vapour tight.
- .6 Overlaps vapour barrier membrane joints 150 mm (6") minimum and tape seal with vapour barrier joint tape.
- .7 Unroll vapour barrier membrane with longest dimension parallel with direction of concrete placement.
- .8 Lap vapour barrier membrane up foundation walls a minimum of 100 mm (4") and tape seal with vapour barrier joint tape.
- .9 Centre vapour barrier joint tape over vapour barrier membrane laps and joints. Keep area of tape adhesion free of dust, dirt, and moisture.
- .10 Cut slit around pipes, ductwork, rebar, and wire penetrations to place the initial layer of vapour barrier membrane.

- .1 Cut a piece of vapour barrier membrane minimum width of 300 mm (12"). The length should be 1 1/2 times the pipe circumference. With a roofer's knife or scissors, cut "fingers" half the width of the film.
- .2 Wrap vapour barrier membrane around and tape the collar onto the pipe and completely tape fingers to the bottom layer of vapour barrier membrane with vapour barrier joint tape.
- .11 In the event that vapour barrier membrane is damaged during or after installation, repairs shall be made. Cut a piece of vapour barrier membrane large enough to cover damage by minimum overlap of 150 mm (6"). Clean adhesion areas of dust, dirt, and moisture. Tape down edges using vapour barrier joint tape.

3.2 FIELD QUALITY CONTROL

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 References
- .5 1.5 Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage, and Handling
- .8 1.8 Field Conditions
- .9 1.9 Extended Warranty
- .10 2.1 Performance/Design Requirements
- .11 2.2 Materials – General
- .12 2.3 Sheet-Applied, Vapour Impermeable Self-Adhesive Air / Vapour Barrier Membrane System
- .13 2.4 Sheet-Applied, Vapour Permeable Sheathing Membrane Air Barrier System
- .14 3.1 Installation – General
- .15 3.2 Installation – Sheet Applied, Vapour Impermeable, Self-Adhesive Membrane
- .16 3.3 Field Quality Control

1.3 SUMMARY

- .1 Section includes:
 - .1 Air barrier membrane for masonry wall assemblies and for frame construction.
 - .2 Sheet-Applied Self-Adhesive Air / Vapour Barrier Membrane.

1.4 REFERENCES

- .1 Definitions:
 - .1 Air barrier material: A building material that is designed and constructed to *Provide* primary resistance to airflow through air barrier system.
 - .2 Air barrier system: The collection of air barrier materials and auxiliary materials applied to substrate, including joints and junctions to abutting construction, to control air movement through the building envelope.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:

- .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 Compatibility statement:
 - .1 Submit manufacturer's compatibility statement validating compatibility of air barrier system materials with substrates and adjacent materials.

1.6 QUALITY ASSURANCE

- .1 Qualifications: *Provide* the work of this Section, executed by competent installers with a minimum of five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .2 Mock-up:
 - .1 Construct minimum 10 m2 (100 ft2) area of each typical wall assembly installation for each type of *Product*.
 - .2 Locate at the *Place of the Work* as part of final installation. Space installation to include exterior wall panel incorporating window, glazing system and insulation.
 - .3 Do not proceed until mock-up has been reviewed by the *Consultant*.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Package materials and identify on attached labels the manufacturer, contents and material specification number.
- .2 Store flammable solvent-base liquids away from excessive heat and open flame. Primer contains solvent. Do not use near open flame.
- .3 Store surface conditioner at temperature above 5°C to facilitate handling.
- .4 Store roll materials on end.

1.8 FIELD CONDITIONS

- .1 *Provide* forced air circulation during curing period for enclosed applications.
- .2 Low temperature application:
 - .1 Perform adhesion test for membrane when ambient temperature is below -5°C.
 - .2 Proceed with work when temperature is (or predicted) to fall below -5°C ambient temperature only with the mutual documented agreement of the inspection and testing company, the manufacturer and the applicator.
- .3 Do not perform installation during rainy or inclement weather or on wet or frost covered surfaces.
- .4 *Provide* temporary protection of the applied membrane to prevent mechanical damage or damage from spillage of oil or solvents.

1.9 EXTENDED WARRANTY

- .1 The work of this Section shall meet the specified building envelope performance requirements during the warranty period.

PART 2 – PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Air barrier system shall perform as continuous air barrier and as liquid-water drainage plane flashed to discharge to exterior of building envelope incidental condensation or water penetration.
- .2 At wall and roof cladding transitions, air barrier system shall perform as continuous air barrier and as liquid-water drainage plane flashed to discharge to exterior of building envelope incidental condensation or water penetration by creation of unobstructed drainage plane that extends across the cladding transition or by flashing to discharge to exterior of building envelope incidental condensation or water penetration.
- .3 Air barrier system shall accommodate substrate movement, construction material changes, and transitions at perimeter conditions without deterioration which permits air and water leakage exceeding the following specified limits and requirements, or interruption of the drainage plane:
 - .1 Air permeance of air barrier material: Maximum 0.02 L/s.m² at 75 Pa (0.004 cfm/ft² at 1.57 psf) in accordance with ASTM E2178-13.
 - .2 Rate of air leakage of air barrier system: Maximum 0.15 L/s.m² at 75 Pa (0.030 cfm/ft² at 1.57 psf) in accordance with ASTM E283-04 (2012).
 - .3 Water vapour transmission for air / vapour barriers: Maximum 5.7 ng/Pa.s.m² (0.1 perms).
 - .4 Water vapour transmission for vapour permeable air vapour barriers: Minimum 570 ng/Pa.m² s. (10 perms).
 - .5 Air barrier membrane system structural performance while maintaining air barrier performance for air leakage: Air barrier system shall transfer wind loads to structure and shall resist 100% of design wind load in accordance with the Ontario Building Code.
 - .6 Low temperature performance: Minimum -30°C (-22°F).
 - .7 Compatibility: Air barrier system materials shall be compatible with substrate and adjacent materials with material manufacturers and show no performance deterioration during service conditions.
 - .8 Self-sealability: in accordance with ASTM D1970/D1970M-15.
- .4 Air barrier system shall be joined in an airtight and flexible manner to air barrier material of adjacent building envelope air barrier systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between the following unless otherwise applicable:
 - .1 Foundation and walls.
 - .2 Walls and openings (windows, doors, louvres, and other wall penetrations).
 - .3 Wall and roof systems.
 - .4 Wall and roof over unconditioned space.
 - .5 Walls, floor and roof across construction, control, and movement joints.
 - .6 Walls, floors and roof to utility, pipe and duct penetrations.

2.2 MATERIALS – GENERAL

- .1 Single source responsibility: Materials shall be sourced from one manufacturer including sheet membranes, air barrier sealants, primers, mastics and adhesives.

2.3 SHEET-APPLIED, VAPOUR IMPERMEABLE SELF-ADHESIVE AIR / VAPOUR BARRIER MEMBRANE SYSTEM

- .1 Description: Composite preformed modified bituminous membrane system consisting of Styrene-Butadiene-Styrene (SBS) modified asphalt for low temperature flexibility and polyethylene scrim reinforcing, with physical properties as follows:
 - .1 Single source responsibility: Components required for complete air barrier system and through wall flashing membrane behind the opaque wall assemblies to be obtained from single manufacturer.
 - .2 Thickness: 1.0 mm (40 mils)
 - .3 Application temperature: in accordance with *Product* installation instructions.
 - .4 Primer: in accordance with *Product* installation instructions.
 - .5 Termination and penetration sealing mastic: in accordance with *Product* installation instructions.
 - .6 Acceptable *Product* systems:
 - .1 Henry Company 'Bakor Blueskin SA' and 'Blueskin SA LT'.
 - .2 Carlisle Coatings & Waterproofing 'CCW 705'.
 - .3 Grace Construction Products 'Perm-A-Barrier Wall Membrane'.
 - .4 IKO 'AquaBarrier AVB' and AquaBarrier AVB Low Temp'.
 - .5 Soprema 'Sopraseal Stick 1100 Summer Grade' and Sopraseal Stick 1100 Winter Grade'.
 - .6 Tremco 'ExoAir 110 and 110LT'.
 - .7 W.R. Meadows 'Air Shield' and 'Low Temperature Air Shield'.
 - .8 Or *Equivalent*.

2.4 SHEET-APPLIED, VAPOUR PERMEABLE SHEATHING MEMBRANE AIR BARRIER SYSTEM

- .1 Description: Flexible sheet material with high vapour permeability in accordance with CAN/CGSB 51.32- M77, for breather type sheathing membranes.
- .2 Air barrier tape: as per manufacturer's printed installation instructions.
- .3 Fasteners:
 - .1 For steel frame construction: as per manufacturer's printed installation instructions, rust resistant screws with 50 mm (2") diameter plastic cap.
 - .2 For wood frame construction: as per manufacturer's printed installation instructions, nails with large heads or plastic washers. Wide staples with a 25 mm (1") minimum crown may be used if applied on wood sheathing.
- .4 Acceptable *Products*:
 - .1 Dupont 'Tyvek CommercialWrap'.
 - .2 Fabrene Inc. 'Air-Gard XL'.

- .3 Dow 'Styrofoam WeatherMate Plus'.
- .4 Fiberweb 'Tygar Metrowrap'.
- .5 Or *Equivalent*.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- .1 Surfaces to receive air barrier systems shall be smooth, dry and free from conditions that will adversely affect execution, permanence, or quality of the work of this Section.
- .2 Air barrier system shall be continuous in the building envelope. Lap and seal air barrier systems in accordance with *Product* manufacturer's installation instructions to construction, control, and expansion joints, across junctions between different building assemblies, and around penetrations through the building assembly.
- .3 Wrap into jamb, head and sill of building envelope window openings, door openings, and other openings with air barrier system membrane by returning membrane to inside face of opening unless otherwise indicated.
- .1 Coordinate air / vapour barrier terminations of the work of this Section with air / vapour barrier membrane in Section 08 41 00 – Aluminum Framed Glazing Systems Door Hardware.

3.2 INSTALLATION – SHEET APPLIED, VAPOUR IMPERMEABLE, SELF-ADHESIVE MEMBRANE

- .1 Apply self-adhering membrane continuous to prepared and primed substrate in an overlapping shingle fashion to shed moisture towards exterior and in accordance with the manufacturer's recommendations. Stagger vertical joints 200 mm (8").
- .2 Align and position self-adhering membrane, remove protective film and press firmly into place. Ensure minimum 50 mm (2") overlap at end and side laps. Promptly roll laps and membrane with a counter top roller to affect the seal.
- .3 At the end of each *Day's* work seal the top edge of the membrane where it meets the substrate using liquid air seal mastic. Trowel apply a feathered edge to seal termination and shed water.
- .4 Seal projections with application of liquid air seal mastic.
- .5 Apply self-adhering membrane continuous across junctions between different building assemblies, and around penetrations through the building assembly. *Provide* 100 mm (4") overlap unless otherwise indicated in the Contract Drawings, or required by the manufacturer's installation instructions.
- .6 Inspect membrane for punctures, misaligned seams and fishmouths, apply additional layer of membrane over affected area, extending minimum of 150 mm (6") beyond damaged area in all directions.

3.3 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00 – Quality Control.
- .1 Perform pull adhesion tests for project substrates in accordance with ASTM D4541-09e1.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage, and Handling
- .8 1.8 Field Conditions
- .9 1.9 Extended Warranty
- .10 2.1 Performance/Design Requirements
- .11 2.2 Materials – Panel System
- .12 2.3 Accessories
- .13 2.4 Finishes
- .14 2.5 Fabrication
- .15 2.6 Fabrication Tolerances
- .16 3.1 Examination
- .17 3.2 Air Barrier Membrane Application
- .18 3.3 Insulation
- .19 3.4 Installation
- .20 3.5 Installation Tolerances
- .21 3.6 Field Quality Control
- .22 3.7 Adjusting and Cleaning
- .23 3.8 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 Aluminum panel cladding.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with installers of wall mounted items, equipment, and mechanical and electrical work so that installation will not subvert the integrity of the cladding system.

- .2 Coordinate interface, transition, lapping, flashings and compatibility of membranes with work of Section 07 27 00 – Air Barrier Systems.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 *Shop Drawings*:
 - .1 Submit engineered *Shop Drawings*.
 - .2 Indicate panel layout, elevations, dimensions, attachment and anchoring materials and methods, trim and closure pieces, detail and location of joints, sealants and gaskets; include joints necessary to accommodate thermal movement, flashing, accessories and related work of this Section.
 - .3 Indicate methods to achieve watertight assembly, including sealants, penetration seals, drainage path of moisture from within assembly to exterior of envelope.
 - .4 Indicate materials, finishes, and colours.
- .4 Samples:
 - .1 Submit 2 - 610 x 610 mm (24" x 24") size samples of panel material, of each colour specified.
- .5 Certificates:
 - .1 Submit certification from composite aluminum cladding system manufacturer that the manufacturing process and field installation procedure have been both carried out under an independent quality assurance program designed to confirm that the *Product* and its application are consistent with the system as tested and listed in accordance with CAN/ULC S134-92.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors: Execute the work of this Section only by a *Subcontractor* who has adequate plant, roll forming machinery, equipment, and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.
- .2 Execute work in accordance with manufacturing process and field installation procedures under an independent quality assurance program design to confirm that the *Product* and its application are consistent with the system as tested and listed in accordance with CAN/ULC S134-92.
- .3 Mock-up:
 - .1 Construct panels 10 m² (100 ft²) of typical wall cladding installation for acceptance as specified in Section 01 33 00 – Submittal Procedures. Locate on *Site* as part of final installation.
 - .2 Do not proceed until mock-up has been accepted by the *Owner*, the *Consultant* and cladding inspection company.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Store materials at temperatures recommended by the manufacturer.
- .2 Store roll materials on end.
- .3 Package materials and identify on attached labels the manufacturer, contents and material specification number.
- .4 Store flammable solvent-base liquids away from excessive heat and open flame. Primer contains solvent. Do not use near open flame.

1.8 FIELD CONDITIONS

- .1 Comply with the manufacturer's instructions.

1.9 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Article A-15 Warranty Period of the Agreement between *Owner* and *Contractor*.
- .2 *Provide* special *Product* warranty; aluminum finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - .1 Failures to paint finish include, but are not limited to, the following:
 - .1 Color fading more than 5 Hunter units when tested according to ASTM D2244-15.
 - .2 Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - .3 Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - .2 Warranty period: 20 years from the date of Substantial Performance.
- .3 The warranty is a total system warranty. The cladding system shall meet both the specified system and the building envelope performance requirements during the warranty period.

PART 2 – PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Design:
 - .1 System shall be engineered by the *Contractor's Professional Engineer*.
 - .2 Design for expansion and contraction of component materials of the *Work* produced by an exterior surface temperature range of -35°C to +60°C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
 - .3 Design cladding system to accommodate and withstand the following without permanent deformation or damage to, or failure of, cladding system or building structure:
 - .1 Deflection of cladding system due to uniformly distributed specified loads shall not exceed L/90 of the span for walls.
 - .2 Movement within cladding system, and between cladding system and building structure.
 - .3 Cladding system dead loads, snow loads, ice loads, and wind loads, and combinations thereof, in accordance with the Ontario Building Code.

- .1 Design wind loads shall be based on at least 1/50 hourly wind pressure values as indicated in Ontario Building Code and greater values as required, to maximum allowable deflection without permanent deformation.
- .4 Design to allow positive drainage of condensation occurring within cladding system to exterior of building envelope or drainage outlet.
- .5 Design to allow positive drainage of water to exterior of building envelope or drainage outlet.
- .6 Design wall system and secondary support structure as required to accommodate specified erection tolerances of the structure.
- .7 Design system to meet tolerances specified.
- .8 Panel joinery:
 - .1 Dry-seal, rainscreen joints.
- .9 No visible fasteners, telegraphing or fastening on panel faces or any other compromise of neat and flat appearance.
- .2 Performance:
 - .1 Comply with the following performance requirements:
 - .1 Components for combustible cladding shall be tested and listed for CAN/ULC S134-92 standard and satisfy requirements of paragraph 3.1.5.5 (c) of the Ontario Building Code.
 - .2 Metal fasteners shall be corrosion resistant.
 - .3 *Provide* drip detail over windows and door heads, copings, at edges of overhangs, to direct moisture to exterior.
 - .4 Wall system to utilize drain systems to positively drain water from within wall system to exterior.

2.2 MATERIALS – PANEL SYSTEM

- .1 System types:
 - .1 Concealed fastener with dry joints.
- .2 Aluminum panels; composite sheet type with thermosetting core:
 - .1 Acceptable *Products*:
 - .1 3A Composites USA 'Alucobond Plus'.
 - .2 Mitsubishi Chemical Functional Products Inc. 'Alpolic FR'.
 - .3 Ontario Panelization 'Alcotex ACM Panel System 3'
 - .4 Or *Equivalent*.
 - .2 Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material. Panel system shall be listed for fire resistance rating.
 - .1 Bond integrity testing to adhere: ASTM D1781-98(2012).

- .2 Fire test of exterior wall assemblies: CAN/ULC S134-92.
- .3 Aluminum sheet: tempered, flattened aluminum sheet, 0.5 mm (0.019") face sheet thickness, 4 mm (0.157") thick panels in the following alloy:
 - .1 Painting quality: 3003-H14 to ANSI H35.1/H35.1M-2013.
 - .2 Anodizing quality: 5005-H34 to ANSI H35.1/H35.1M-2013.

2.3 ACCESSORIES

- .1 Extruded aluminum accessory components:
 - .1 Aluminum extrusions in accordance with ASTM B221-14, to the following minimum wall thickness and alloy:
 - .1 Thickness:
 - .1 2.28 mm (0.090").
 - .2 Support brackets: Steel brackets to be hot dipped galvanized with zinc coating (0.09 g/m (3.4 mil)) in accordance with CAN/CSA G164-M92.
 - .3 Fasteners: Self-tapping, purpose made stainless steel screws.
 - .4 Insulation:
 - .1 Semi-rigid insulation: rock wool type, in accordance with Section 07 21 00 – Thermal Insulation.
 - .5 Air barrier membrane:
 - .1 Composite preformed 1.1 mm (43 mil) thick modified membrane system consisting of Styrene-Butadiene-Styrene (SBS) modified asphalt for low temperature flexibility and glass scrim or polyethylene reinforcing.
 - .2 Acceptable *Products*:
 - .1 Bakor 'Blueskin PE 200 HT'.
 - .2 W.R. Grace 'Ice & Water Shield'.
 - .3 Acceptable alternates by W.R. Meadows or Soprema or Vicshield.
 - .4 Or *Equivalent*.
 - .6 Sub-girts (z-girts): minimum 1.2mm (18 gauge) zinc-coated steel in accordance with ASTM A653/A653M-11 with Grade A coating Z275.
 - .7 Isolation coating: Bituminuous paint.
 - .8 Trim, coping, closures, and cap pieces:
 - .1 3.18 mm (0.125") aluminum, to match cladding system.
 - .2 Factory fabricate components, ready for installation.
 - .9 Sealant: in accordance with Section 07 92 00 – Joint Sealants.

2.4 FINISHES

- .1 Exposed aluminum surfaces: 70% Kynar 500 or Hylar 5000 fluoropolymer or equivalent resin systems, ceramic pigments and other select inorganic pigments in accordance with AAMA Specification 2605.
 - .1 Acceptable Products:
 - .1 PPG 'Duranar XL'.
 - .2 Valspar 'Fluoropon Classic'.
 - .3 Or *Equivalent*.
 - .2 Colour:
 - .1 Colour to later selection by the *Consultant* from the manufacturer's full range. Colour shall be:
 - .1 Solid.
 - .2 Pearlescent.
 - .3 Metallic.

2.5 FABRICATION

- .1 Form to profiles indicated on the *Drawings* and to conform with reviewed *Shop Drawings*.
- .2 Construct panel lines, breaks, and angles sharp and true, and surfaces free from warp and buckle.
- .3 Allow for structural movements within the systems, and to accommodate thermal expansion and contraction between panels and structural members.
- .4 Factory form panels with welded corners.
- .5 Fabricate systems to prevent entry of water into building and from collection within system assembly.
- .6 Join intersecting parts together to achieve tight, accurately fitted joints with adjoining surfaces in true planes.
- .7 Fabricate system to conform to requirements of reference standards specified.
- .8 Co-operate with applicable sections to ensure all co-ordination required for proper installation of work of this Section in conjunction with and incorporated with other work.
- .9 Lay out panels to obtain uniform metal and paint grain finish. Mark direction of metal grain and paint application on back of panels.

2.6 FABRICATION TOLERANCES

- .1 Comply with the following maximum tolerances:
 - .1 Plumb:
 - .1 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").
 - .2 Level:
 - .1 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").

.3 Alignment:

- .1 Where surfaces abut in line or are separated by reveal or protruding element up to 12.7 mm (1/2") wide, limit offset from true alignment to 1.6 mm (1/16").
- .2 Where surfaces are separated by reveal or protruding element from 12.7 to 25.4 mm (1/2 to 1") wide, limit offset from true alignment to 3.2 mm (1/8").
- .3 Where surfaces are separated by reveal or protruding element of 25.4 mm (1") wide or more, limit offset from true alignment to 6.4 mm (1/4").

.4 Variation from plane:

- .1 3.2 mm in 3.6 m (1/8" in 12'-0"); 12.7 mm (1/2") over total length.

.5 Panels:

- .1 Bow: 0.2% of panel dimensions up to 3.2 mm (1/8") maximum.
- .2 Indicated size:
 - .1 Up to 1220 mm (4'-0"): plus/minus 0.76 mm (0.030").
 - .2 1220 mm to 3050 mm (4'-0" to 10'-0"): plus/minus 1.52 mm (0.060").

.6 Square or rectangular:

- .1 Maximum 3.2 mm (1/8") difference between diagonal measurements.

.7 Variation from indicated position in Fabrication Tolerances: plus/minus 3 mm (1/8").

.2 Tolerances shall not be cumulative.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Take *Site* measurements to ensure that work of this Section is fabricated to fit structure; surrounding construction; around obstructions and projections in place, or as shown on the *Drawings*; and to suit locations of services.
- .2 Verify that backup construction is aligned for proper installation of work of this Section before commencing erection.
- .3 Notify the *Consultant* in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 AIR BARRIER MEMBRANE APPLICATION

- .1 *Install* in accordance with manufacturer's installation instructions.
- .2 Surfaces must be smooth, clean dry and free from loose contaminants. Brushing and/or scraping of block and concrete surfaces may be required to adequately prepare surface.
- .3 Apply primer for membrane work.
- .4 Wrap openings with membrane returning to inside face of openings.
- .5 Ensure air barrier seals into adjacent systems for complete air barrier to building envelope.

3.3 INSULATION

- .1 Carefully cut and fit insulation in pieces to fit surfaces of members to which insulation bears contact.
- .2 Cut backs of pieces as required to fit over projecting anchors, fastenings or similar protrusions. Fit boards neatly with tight joints around pipes, ducts, obstructions, openings, corners, and structural members.
- .3 Apply insulation to ensure total and complete coverage of surfaces indicated in the Contract drawings to be insulated, and in direct contact with such surfaces.
- .4 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

3.4 INSTALLATION

- .1 Erect systems complete with flashings forming part of the system, clips, fasteners, closures and caulking to meet same design criteria as specified for fabrication.
- .2 Erect panels in straight lines that are true, level, square, and plumb.
- .3 Attachment system: Allow for free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -28.9°C to 82.2 °C (-20 °F to 180 °F). Buckling of panels, opening of joints, undue stress on fasteners, failure to sealants or any other detrimental effects due to thermal movement is not permitted. Allow for ambient temperature at time of fabrication, assembly and erection procedures.
- .4 Anchor cladding securely as per recommendations of the *Contractor's Professional Engineer* and in accordance with reviewed *Shop Drawings* to allow for necessary thermal movement, wind loading and structural support.
- .5 Seal between work of this Section and work of other Sections to meet specified requirements of Section 07 92 00 – Joint Sealants and to achieve a watertight installation.
- .6 Cut, flash, and apply sealant to system penetrations. Seal around materials penetrating metal cladding watertight.
- .7 *Install* various components within cladding assembly to *Provide* positive controlled drainage of moisture to exterior of building envelope or drainage outlet.
- .8 Conceal fasteners.
- .9 Do not *install* component parts that are observed to be defective, including warped, bowed, dented, and broken members.
- .10 Obtain panel symmetry whenever possible relative to openings in both vertical and horizontal plane.
- .11 Brake form metal flashings to profile required, in maximum lengths.
- .12 *Install* head and sill flashings, edge trim, cap pieces and other formed profiles as applicable and/or detailed.
- .13 Do not cut, trim, weld or braze component parts during erection in manner that would damage finish, decrease strength or result in a visual imperfection or failure in performance. Return

component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

- .14 Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.
- .15 Protect surface of metals in contact with concrete, mortar, plaster or other cementitious surface with isolation coating.

3.5 INSTALLATION TOLERANCES

- .1 Comply with the following maximum tolerances:
 - .1 Plumb:
 - .1 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").
 - .2 Level:
 - .1 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").
 - .3 Alignment:
 - .1 Where surfaces abut in line or are separated by reveal or protruding element up to 12.7 mm (1/2") wide, limit offset from true alignment to 1.6 mm (1/16").
 - .2 Where surfaces are separated by reveal or protruding element from 12.7 to 25.4 mm (1/2 to 1") wide, limit offset from true alignment to 3.2 mm (1/8").
 - .3 Where surfaces are separated by reveal or protruding element of 25.4 mm (1") wide or more, limit offset from true alignment to 6.4 mm (1/4").
 - .4 Variation from plane:
 - .1 3.2 mm in 3.6 m (1/8" in 12'-0"); 12.7 mm (1/2") over total length.
 - .5 Panels:
 - .1 Bow: 0.2% of panel dimensions up to 3.2 mm (1/8") maximum.
 - .2 Indicated size:
 - .1 Up to 1220 mm (4'-0"): plus/minus 0.76 mm (0.030").
 - .2 1220 mm to 3050 mm (4'-0" to 10'-0"): plus/minus 1.52 mm (0.060").
 - .6 Square or rectangular:
 - .1 Maximum 3.2 mm (1/8") difference between diagonal measurements.
 - .7 Variation from indicated position in Installation tolerances: plus/minus 3 mm (1/8").
 - .1 Tolerances shall not be cumulative.

3.6 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00 – Quality Control.
 - .1 Inspection and testing company shall perform inspection for completed *Work*.

- .1 Confirm that composite aluminum cladding system and its application are consistent with the system as tested and listed in accordance with CAN/ULC S134-92

3.7 ADJUSTING AND CLEANING

- .1 After erection, touch up coatings removed or damaged during erection.
- .2 Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new, at the *Contractor's* expense.
- .3 Wash down exposed interior and exterior surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths. Wipe interior surfaces clean as part of final clean-up.
- .4 Remove excess sealant with recommended solvent.

3.8 PROTECTION

- .1 Protect panels during fabrication, transportation, storage at the *Place of the Work* and erection.

END OF SECTION

PART 1 – GENERAL**1.1 GENERAL INSTRUCTIONS**

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Closeout Submittals
- .7 1.7 Quality Assurance
- .8 1.8 Delivery, Storage, and Handling
- .9 1.9 Field Conditions
- .10 1.10 Extended Warranty
- .11 2.1 Roofing System Manufacturer
- .12 2.2 Performance/Design Requirements – General
- .13 2.3 Performance/Design Requirements – Fire Protection
- .14 2.4 Roofing Membrane and Flashing Sheets
- .15 2.5 Auxiliary Roofing Membrane Materials
- .16 2.6 Asphalt Materials
- .17 2.7 Substrate Boards
- .18 2.8 Air and Vapour Barriers
- .19 2.9 Roof Insulation
- .20 2.10 Insulation Accessories
- .21 2.11 Fasteners and Restraints
- .22 2.12 Walkway Pavers
- .23 2.13 Expansion Joints
- .24 2.14 Flashings and Penetration Flashings
- .25 3.1 Examination
- .26 3.2 Preparation
- .27 3.3 Method of Installation
- .28 3.4 Substrate Board (Sheathing/Underlay)
- .29 3.5 Application of Primer
- .30 3.6 Air and Vapour Barrier
- .31 3.7 Asphalt Application
- .32 3.8 Insulation Application – Conventional Roofing
- .33 3.9 Cover Board

- .34 3.10 Installation of Reinforced Gussets
- .35 3.11 Roofing Details
- .36 3.12 Installation of Torch-Applied Cap Sheet Membrane
- .37 3.13 Installation of Torch-Applied Cap Sheet Flashing Membrane
- .38 3.14 Waterproof Expansion Joint Installation
- .39 3.15 Roof Drains
- .40 3.16 Roof Penetrations
- .41 3.17 Metal Flashings
- .42 3.18 Paver Installation
- .43 3.19 Field Quality Control
- .44 3.20 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - .1 Two-ply styrene-butadiene-styrene (SBS) modified bituminous membrane roofing; as follows:
 - .1 Exposed membrane roofing system.
 - .2 Roofing insulation.
 - .3 Air and vapour barrier.
 - .4 Associated roofing accessories and *Products*.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with Divisions 21, 22 and 23 to ensure that roof drains are suitable for roofing system design.
 - .2 Coordinate with *Subcontractors* of roof mounted items, equipment, and mechanical and electrical work at roof so that installation will not subvert the integrity of the roofing system.
 - .3 Coordinate with installation of air barrier at walls to ensure complete continuity of air barrier system for building. Roofing air barrier membrane to lap by 75 mm (3") minimum and terminate with wall system air barrier membrane.
 - .4 The *Contractor* shall ensure that the manufacturer meets with the necessary parties at the *Site* to review and discuss *Project* conditions as it relates to the integrity of the roofing assembly.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for each type of *Product* indicated in the Shop Drawings.

.3 *Shop Drawings*; general details:

.1 Include plans, elevations, sections, details, and attachments to other work for the following:

- .1 Base flashings, cants, and membrane terminations.
- .2 Tapered insulation, including slopes.
- .3 Crickets, saddles, and tapered edge strips, including slopes.
- .4 Insulation fastening patterns.

.4 Certificates:

.1 Installer certificates: The *Contractor* shall *Provide* installer certificates signed by the roofing system manufacturer certifying that installer is approved, authorized, or licensed by manufacturer to *Install* roofing system.

.2 Manufacturer certificates: The *Contractor* shall *Provide* manufacturer certificates signed by the roofing manufacturer certifying that roofing system complies with requirements specified in subsection 2.2 - Performance/Design Requirements– of this Section.

- .1 Submit evidence of compliance with performance requirements.

.5 Roofing manufacturer's warranty and design criteria:

- .1 Submit copy of completed roofing manufacturer's pre-installation notification form at least 10 *Working Days* prior to commencement of roofing installation.
- .2 Submit copy of roofing manufacturer's warranty specimen and warranty design criteria for roofing system prior to commencement of roofing installation.

.6 Samples:

- .1 Submit samples complete with the manufacturer's labels intact, of materials to be used for work of this Section prior to commencement of work. Allowing 5 working days for review and acceptance by the *Consultant* and roofing inspection company. Do not proceed with work until samples are accepted.

1.6 CLOSEOUT SUBMITTALS

.1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.

.2 Operation and maintenance data:

- .1 Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals.

1.7 QUALITY ASSURANCE

.1 Qualifications:

- .1 Manufacturers: Company specializing in manufacturing the *Products* specified in this Section, with a minimum of 10 years' experience.
- .2 Installers / applicators / erectors: The *Contractor* shall *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

- .1 The *Work* of this Section shall be installed by a *Subcontractor* that is a member in good standing of the Canadian Roofing Contractors Association (CRCA) and Ontario Industrial Roofing Contractors Association (OIRCA) or equivalent certificate acceptable to the *Consultant*, who has been a member for at least five years.
- .2 The roofing *Subcontractor* must be approved by the membrane manufacturer for the warranty program specified. Submit *Subcontractor's* certification letter prepared by the membrane manufacturer.
- .2 Execute work of this Section only under full time supervision of qualified *Subcontractor's Site* supervisor.
- .3 Mock-up:
 - .1 Prepare a 10 m² (100 ft²) mock-up of the work of this Section. Incorporate materials and methods of fabrication and installation identical with project requirements.
 - .2 Install mock-up at roof area location directed by the *Consultant*. Retain accepted mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and workmanship.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver roofing materials to the *Site* in original containers with seals unbroken and labelled with the manufacturer's name, *Product* brand name and type, date of manufacture, and directions for storage.
- .2 Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- .3 Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- .4 Handle materials carefully to preclude damage. Follow manufacturer's written recommendations.
- .5 Package materials and identify on attached labels the manufacturer, brand, contents, weight as applicable, and *Product* and specification numbers.
- .6 Protect edges of roll goods from damage during handling, and store rolls on end to prevent flattening.
- .7 Do not store roofing materials on roof. Store them in a dry area protected from inclement weather while roofing installation is not in progress. Store above materials under opaque, breathable and waterproof tarpaulins or in sheds.
- .8 Prevent compression of insulation panels at any point and breakage of edges and corners. Discard wet, cupped, bowed, or otherwise damaged insulation from *Place of the Work*.
- .9 Protect edges and corners of precast concrete paving slabs to prevent damage.

1.9 FIELD CONDITIONS

- .1 Weather limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 EXTENDED WARRANTY

- .1 *Provide* Ontario Industrial Roofing Contractors Association (OIRCA) two-year warranty for labour, materials, and workmanship.
- .2 Warrant work of this Section in accordance with Section 01 78 36 - Warranties for a period of two years from the date of Substantial Performance.
- .3 In addition, roofing manufacturer shall *Provide* total system warranty including the following:
 - .1 Roofing membrane manufacturer will issue a written document in the *Owner's* name, valid for warranty duration, for the repair of leaks in the roofing membrane to restore the roofing system to dry and watertight condition, to the extent that membrane manufacturing or installation defects caused water infiltration. Include copy of required warranty with close out documentation.
 - .2 Warranty shall cover entire cost of the repair(s) required to maintain dry and watertight roofing system during the full warranty duration.
 - .3 Warranty shall include for labour, materials, and workmanship.
 - .4 Warranty shall be non-prorated with no dollar limit (NDL) for duration of warranty.
 - .5 10-year warranty duration from the date of Substantial Performance.

PART 2- PRODUCTS

2.1 ROOFING SYSTEM MANUFACTURER

- .1 General:
 - .1 Single source responsibility: each roofing component to be by one manufacturer.
- .2 Acceptable roof system manufacturers: Subject to compliance with requirements, *Provide Products* by one of the following:
 - .1 Firestone Building Products.
 - .2 GAF Materials Corporation.
 - .3 IKO Industries.
 - .4 Siplast.
 - .5 Soprema.
 - .6 Or *Equivalent*.

2.2 PERFORMANCE/DESIGN REQUIREMENTS – GENERAL

- .1 Roofing system: The roofing system shall include roofing system materials required to achieve roofing membrane manufacturer's warranty.
- .2 Roofing materials, components, and assemblies shall resist environmental and wind (uplift) loads, and effects of those loads in accordance with the Ontario Building Code.
- .3 General performance: Installed roofing system and base flashings shall withstand wind uplift pressures, thermally induced movement, and exposure to weather without failure due to defective

manufacture, fabrication, installation, or other defects in construction. Roofing system and base flashings shall remain watertight.

- .4 Material compatibility: *Provide* roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- .5 Roofing system: Prevent water from entering building and roofing assembly through roofing membrane.
- .6 Roofing system design:
 - .1 Roofing system assemblies shall have been successfully tested by a qualified testing agency to resist project roofing uplift pressures in accordance with the Ontario Building Code.
 - .2 Roofing system shall meet roofing system manufacturer's 145 kph (90 mph) wind speed requirements or equivalent FM Class 60 Windstorm Classification for wind uplift pressures, and to cladding design wind loads indicated in wind study report, as applicable.
- .7 Roof covering classification: Roof assembly shall have a Class C classification as determined in conformance with CAN/ULC S107-10 "Standard Methods of Fire Tests of Roof Coverings".
- .8 Air barrier system shall accommodate substrate movement, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding the following specified limits and requirements:
 - .1 Air permeance of air barrier material: Maximum 0.02 L/s m² at 75 Pa (0.004 cfm/ft² at 1.57 psf) in accordance with ASTM E2178-13.
 - .2 Rate of air leakage of air barrier system: Maximum 0.15 L/s m² at 75 Pa (0.030 cfm/ft² at 1.57 psf) in accordance with ASTM E283-04 (2012).
 - .3 Water vapour transmission for air / vapour barriers: Maximum 5.7 ng/Pa.m².s. (0.1 perms).
 - .4 Pull-off strength of liquid or sheet applied membrane and laps: Cohesive or substrate failure permitted when tested to specified wind load. Air barrier system shall transfer wind load to structure and shall resist 100% of design wind load or minimum of 2.15 kPa (45 psf), whichever is greater.
 - .5 Low temperature flexibility: to -30°C (-22°F) in accordance with CGSB 37-GP-56M-1985.
- .9 Air barrier system shall be joined in an airtight and flexible manner to air barrier material of adjacent building envelope air barrier systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between the following unless otherwise applicable:
 - .1 Walls and openings.
 - .2 Across construction, control, and expansion joints.
 - .3 Penetrations.
- .10 Solar Reflectance: roof shall have a minimum Solar Reflectance Index (SRI) of 78.

2.3 PERFORMANCE/DESIGN REQUIREMENTS – FIRE PROTECTION

- .1 At the end of each *Working Day*, use a heat detector gun or equipment as recommended by the membrane manufacturer to spot smouldering or concealed fire. Schedule the work to ensure workers are still on location at least two hours after torch application.
- .2 Never apply the torch directly to any wood surfaces. Conform with fire safety recommendations of the manufacturer and the CRCA.
- .3 Throughout roofing installation, maintain the *Place of the Work* in a clean condition and have one approved ABC fire extinguisher within 6 m of each roofing torch. Torches must never be placed near combustible or flammable *Products*.

2.4 ROOFING MEMBRANE AND FLASHING SHEETS

- .1 Roof membrane base sheet and base sheet flashing: CGSB 37.56, SBS-modified asphalt membrane sheet.
 - .1 Reinforcement:
 - .1 180 gm/m² non-woven polyester.
 - .2 Thickness:
 - .1 3 mm (0.160") minimum.
- .2 Roofing membrane cap sheet and cap sheet flashing: CGSB 37.56, SBS-modified asphalt membrane sheet with non-woven polyester reinforced elastomeric bitumen, protected by coloured granules.
 - .1 Reinforcement:
 - .1 180 gm/m² non-woven polyester.
 - .2 Thickness:
 - .1 4 mm (0.140") minimum.

2.5 AUXILIARY ROOFING MEMBRANE MATERIALS

- .1 General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing system.
- .2 Mastic sealant: Polyisobutylene, plain or modified bitumen, non-hardening, non-migrating, non-skinning, and non-drying.
- .3 Metal flashing sheet: Metal flashing sheet is specified in Section 07 62 00 – Metal Flashing.
- .4 Miscellaneous accessories: *Provide* miscellaneous accessories recommended by roofing manufacturer.
- .5 Aggregate surfacing: gravel with no foreign material, ASTM D1863/D1863M- 05(2011) e1, water washed, dry, free of dirt and dust, hard, dry, clean, and graded in sizes from 9 mm to 12 mm.

2.6 ASPHALT MATERIALS

- .1 Asphalt primer: CGSB 37-GP-9Ma-1983.
- .2 Roofing asphalt: CAN/CSA A123.4-04, Type 2 or Type 3.

2.7 SUBSTRATE BOARDS

- .1 Substrate board: ASTM C1177/C1177M-08, glass-mat, water-resistant gypsum substrate, factory primed.
 - .1 Thickness:
 - .1 12.7 mm (1/2").
 - .2 Acceptable *Products*:
 - .1 Georgia Pacific 'Dens Deck Prime'.
 - .2 Or *Equivalent*.

2.8 AIR AND VAPOUR BARRIERS

- .1 Glass fibre sheet: ASTM D2178/D2178M-15, Type IV, asphalt-impregnated, glass-fibre felt (to be used in conjunction with asphalt).
- .2 Aluminized bitumen sheet: Air / vapour barrier membrane shall be manufactured by coating an aluminum foil with oxidized bitumen. Water vapour resistance: 16 ng/Pa.s.m². Both surfaces lightly sanded.
- .3 SBS modified bitumen membrane, reinforced with a fibreglass mat in conformance with Prefabricated membrane, complying with CGSB 37-GP-56M-1985.

2.9 ROOF INSULATION

- .1 General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- .2 Rigid polyisocyanurate insulation board, inorganic felt faced:
 - .1 Description: Closed-cell polyisocyanurate foam core integrally laminated to heavy, durable and dimensionally stable inorganic coated-glass facers, CAN/ULC S704-03 Type 2 and Class 3, HCFC free, 138 kPa (20 psi) minimum compressive strength (at 10% deformation), CAN/ULC-S126-06, LTTR value in accordance with CAN/ULC S770-00.
 - .2 Board size:
 - .1 1220 mm x 1220 mm (4 ft x 4 ft).
 - .3 Tapered insulation: *Provide* factory-tapered insulation boards fabricated to slope of 1:48 (1/4 inch per 12 inches) unless otherwise indicated.
 - .4 *Provide* preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated in the shop drawings for sloping to drain. Fabricate to slopes indicated, and no less than 1:48 (1/4 inch per 12 inches) in addition to roof structure slope or to tapered insulation slope as applicable.

2.10 INSULATION ACCESSORIES

- .1 General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with roofing assembly.

- .2 Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.
- .3 Insulation adhesive:
 - .1 Modified asphaltic insulation adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- .4 Cant strips:
 - .1 Insulation cant strips; perlite: ASTM C728-13, perlite insulation board, cut to *Provide* 45 degree transition from horizontal to vertical surfaces.
- .5 Cover board:
 - .1 Cover board; cellulose fibreboard: Asphalt treated and coated fiberboard in accordance with CAN/ULC S706-02, 12.7 mm (1/2") thick.
 - .1 Thickness: 12.7 mm (1/2").
- .6 Substrate joint tape: 150 mm (6") wide, coated, glass fibre.

2.11 FASTENERS AND RESTRAINTS

- .1 General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing system.
- .2 Factory-coated steel fasteners and plates complying with corrosion-resistance provisions in FM 4470, designed for fastening roofing components to substrate, tested by manufacturer for required pullout strength and wind uplift resistance, and acceptable to roofing manufacturer.
- .3 Termination bars: Pre-punched aluminum bar 25 mm (1") wide x 1.5 mm (1/16") thick x 3048 mm (10 ft) long with 6.4 mm (1/4") x 9.5 mm (3/8") slotted holes on 200 mm (8") centres.

2.12 WALKWAY PAVERS

- .1 Precast paver slabs: CSA A231.1-14/A231.2-14, 610 mm (24") square x 45 mm (1-3/4") height, slip resistant textured finish, minimum 45 MPa (6526 psi) compressive strength, minimum 4.5 MPa (653 psi) (mean) flexural strength, minimum 4.5% (by mass) water absorption, maximum allowable average loss of mass of not greater than 50 g/m² (0.16 oz/ft²) after 28 cycles.
- .2 Precast support pads: 25 mm (1") thick, extruded expanded polystyrene insulation, in accordance with CAN/ULC S701-11, Type 4, Class B, self-extinguishing, 35 psi at 5% deflection compressive strength, thermal conductivity (k) factor of 0.029 at 23.8 °C.

2.13 EXPANSION JOINTS

- .1 Description:
 - .1 Manufactured from a proprietary copolymer with internal polyester reinforcement, monolithic seam vulcanization.
 - .2 Movement and fabrication: Tri-directional movement capability, joint waterproofing system shall be factory fabricated in one piece for the entire contiguous expansion joint or where length of joint exceeds manufacturer's shipping and handling guidelines shall be lapped and

- vulcanized by manufacturer's mechanics on *Site*, repair of damaged materials shall be performed by manufacturer's mechanics.
- .3 Compatible with adhesives and membranes associated with expansion joint construction in accordance with manufacturer's installation instructions.
 - .4 Warranted by manufacturer to cover full warranty duration specified in this Section.
 - .5 Hydrostatic pressure limit: Working pressure in column of water shall perform under static limit not to exceed 10 m (33 ft).
- .2 Acceptable *Products*; to suit type of roofing assembly and movement design requirements:
- .1 Situra Inc. 'RedLINE'.
 - .2 Situra Inc. 'FlamLINE'.
 - .3 Or *Equivalent*.

2.14 FLASHINGS AND PENETRATION FLASHINGS

- .1 Prefinished metal flashings in accordance with Section 07 62 00 – Metal Flashing.
- .2 Roof drains; Stainless steel bolts, leader diameter size maximized to suit existing drain outflow pipe, deck clamps, stainless steel control flow insert, ballast guard, bitumen coated flanges, vandalproof hinged access gate (Allen-key operable) complete with drain seals:
 - .4 Drain body construction:
 - .1 Aluminum.
 - .5 Lexcor 'Flash-Tite Superdrains-FSD-FLAT',
 - .6 Thaler Metal Industries 'RD-FLAT'.
 - .7 Or *Equivalent*.
- .3 Prefabricated plastic pans; insulation filler and sealer; designed and provided for roof penetrating component in each case and for specified roofing system. Use gooseneck types for wiring and conduit.
 - .1 Lexcor 'Roof Protrusion Flashing'.
 - .2 Thaler Roofing Specialties 'Stack Jack Flashing'.
 - .3 Or *Equivalent*.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, areas, and conditions, with roofing installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - .1 Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - .2 Verify that blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

- .3 Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 23 – Steel Roof Decking.
- .4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.
- .2 Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 METHOD OF INSTALLATION

- .1 Prepare surfaces and complete waterproofing work in conformance with roofing manufacturer's printed installation instructions.
- .2 Install roofing elements on clean and dry surfaces, in conformance with manufacturer's instructions and recommendations.
- .3 Roofing work must be completed in a continuous fashion as surfaces are readied and weather conditions permit.
- .4 Seal seams that are not covered by a cap sheet membrane in the same *Day*. Do not install cap sheet when moisture is present at/in the base sheet seams.
- .5 Whenever membranes are torch-applied, a continuous and even bead of molten bitumen must be visible as the membrane is unrolled and torched.
- .6 Lay roofing membrane free from wrinkles, air pockets, fishmouths, tears, and prominent lap joints. Full bond cap sheet to base sheet. Seams shall be lapped and fully bonded.
- .7 Prior to installation of base sheet and cap sheet, allow sheet to relax after unrolling. Relax time to be as recommended by manufacturer based on concurrent ambient temperature.
- .8 Extend roofing to outer edges of roof and up vertical surfaces at least 200 mm (8") above horizontal roofing, and full height beneath counter flashing and top of curb flashing.
- .9 Complete roofing up to line of termination for each *Working Day*.

3.4 SUBSTRATE BOARD (SHEATHING/UNDERLAY)

- .1 Lay substrate board with tightly butted joints. Longitudinal joints must be at right angles to flute direction. Joints occurring along widths of board to be continuously supported on top flange of metal deck. Stagger end joints of adjacent board by 1/2 the board width.
- .2 Ensure substrate board is immediately protected with membrane.
- .3 Mechanical fasteners to penetrate top flutes only; by no less than 19 mm (3/4") and by no more than 25.4 mm (1"). Check underside of deck before installation to eliminate damaging existing conditions below deck.
- .4 Tape all seams in substrate board prior to the installation of the air / vapour barrier. Use 150 mm (6") wide strips of self-adhering base sheet to prevent leakage into the building.

3.5 APPLICATION OF PRIMER

- .1 Roofing substrates surfaces shall receive a coat of primer at a rate required by roofing manufacturer's printed installation instructions.
- .2 Surfaces to be primed must be free of rust, dust or any residue that may hinder adherence.
- .3 Cover primed surfaces with roofing membrane as soon as possible (same *Day* coverage for self-adhesive membranes).

3.6 AIR AND VAPOUR BARRIER

- .1 Built-up two-ply asphalt and fibreglass felt: Install two glass-fibre felt plies lapping each felt 483 mm (19 inches) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 14°C (25°F) of equiviscous temperature.
- .2 Completely seal air and vapour barrier at terminations, obstructions, and penetrations to prevent air movement into roofing.

3.7 ASPHALT APPLICATION

- .1 Asphalt Heating: Heat roofing asphalt and apply within plus or minus 14°C (25°F) of equiviscous temperature unless otherwise required by roofing system manufacturer. Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 14°C (25°F) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
- .2 Apply asphalt at Equiviscous Temperature (EVT) and do not spread more than 1830 mm (6 ft) of hot asphalt in front of each roll and reduce distance accordingly during cold weather. Ensure hot asphalt in kettle is in constant use and circulation to avoid distillation.
- .3 Apply asphalt at minimum rate of 1.2 kg/m² (25 lb/100 ft²) and as specified herein for aggregate surfacing flood coat.

3.8 INSULATION APPLICATION – CONVENTIONAL ROOFING

- .1 Comply with up roofing manufacturer's written instructions for installing roof insulation.
- .2 Adhesively applied insulation: Install insulation adhesive in accordance with roofing manufacturer's installation instructions.
- .3 Mechanically fastened insulation: Fasteners must be attached to steel deck's upper flutes and at spacing to meet performance requirements, in accordance with roofing manufacturer's installation instructions
- .4 Nailer strips: Mechanically fasten 90 mm (3-1/2") width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
 - .1 4877 mm (16 ft) apart for roof slopes greater than 1:12 (1 inch per 12 inches) but less than 3:12 (3 inches per 12 inches).
 - .2 1220 mm (48") apart for roof slopes greater 3:12 (3 inches per 12 inches).
- .5 Stagger and offset vertical joints from preceding insulation boards, 305 mm (12").

- .6 Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- .7 Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- .8 Install only as much insulation as can be covered with membrane roofing in the same *Day*.
- .9 Install insulation boards with edges in moderate contact without forcing and fill gaps greater than 6 mm (1/4") with insulation.
- .10 Cut insulation to fit to blocking, upstands, and penetrations through roof; fill gaps greater than 6 mm (1/4") with insulation.
- .11 Reduce thickness of insulation at roof drains by 13 mm (1/2") for a distance of 610 mm (24") from centre drain.
- .12 Install tapered insulation under area of roofing to conform to slopes indicated.
 - .1 Apply insulation adhesive to underside and immediately bond tapered insulation to substrate.
 - .2 Apply hot roofing asphalt to underside and immediately bond tapered insulation to substrate.
- .13 Protect and keep insulation dry (in new condition). Do not install insulation which is not in dry condition.

3.9 COVER BOARD

- .1 Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 300 mm (12") in each direction. Loosely butt cover boards together. Tape joints if required by roofing manufacturer.
 - .1 Apply insulation adhesive to underside and immediately bond cover board to substrate.
 - .2 Apply hot roofing asphalt to underside and immediately bond cover board to substrate.

3.10 INSTALLATION OF REINFORCED GUSSETS

- .1 Install reinforcing gussets on inside and outside corners of base sheet flashing membrane.
 - .1 *Provide* self-adhesive base sheet flashing membrane gussets, adhered over base sheet membrane flashing into intersecting corner, with edges of gusset sealed with a bead of compatible mastic.

3.11 ROOFING DETAILS

- .1 *Install* as indicated on the *Drawings* and with various roofing details illustrated in roofing manufacturer's printed installation instructions.

3.12 INSTALLATION OF TORCH-APPLIED CAP SHEET MEMBRANE

- .1 Once base sheet, base sheet flashing, and stripping are applied and do not show defects, and installation has been reviewed by the roofing system manufacturer and the inspection and testing company, cap sheet can then be laid.
- .2 Cap sheet shall be unrolled starting from lowest point of roof. Cap sheet shall be rerolled from both ends prior to torching. Care must be taken to ensure alignment of first roll (parallel with edge of roof).

- .3 Cap sheet shall be torch welded on to base sheet membrane. During this application, both surfaces shall be simultaneously melted, forming an asphalt bead that shall be pushed out in front of cap sheet. Maintain a consistent 3 mm (1/8") wide asphalt bead at seams.
- .4 Avoid overheating.
- .5 Base sheet and cap sheet seams shall be staggered a minimum of 305 mm (12").
- .6 Overlap side laps by 75 mm (3") and end laps by 150 mm (6").
- .7 Make sure 2 membranes are properly welded without unwelded areas. Torch welding speed varies depending on weather. In cold conditions, it slows down, in warm and dry conditions, it speeds up.
- .8 After installation of cap sheet, check lap seams on cap sheet.

3.13 INSTALLATION OF TORCH-APPLIED CAP SHEET FLASHING MEMBRANE

- .1 Cap sheet flashing shall be laid in strips one metre wide. Side laps shall be 75 mm (3") and shall be staggered a minimum of 100 mm (4") from cap sheet laps and base sheet laps, in order to avoid excessive thickness.
- .2 Draw parallel chalkline at termination line of cap sheet flashing at horizontal roof deck surface. Sink surface granules into bed of hot bitumen with torch and round-nosed trowel in area between chalk line and base of upstand or parapet, as well as over any granulated vertical surfaces to be overlapped.
- .3 Cap sheet flashing shall be torch welded directly on its base sheet, proceeding from bottom to top. Torching shall soften the two membranes and ensure a uniform weld, as described under "Cap Sheet Installation". When allowed by support, cap sheet top edge shall be nailed on 305 mm (12") centres.

3.14 WATERPROOF EXPANSION JOINT INSTALLATION

- .1 *Install* all components of the system in accordance with the manufacturer's printed instructions.
- .2 The system is to be wholly encapsulated between the plies of the modified bitumen membrane in a roofing system.

3.15 ROOF DRAINS

- .1 Ensure that roof drains are set to permit drainage, located at lowest possible location, and properly secured. Cut and slope insulation at each drain to form a sump and to accommodate flashing immediately surrounding drain. Review final locations with the *Consultant* prior to installation of drains.
- .2 Drain sumps to be *Provided* by the tapered insulation manufacturer.
- .3 Temporarily block drain pipes during application of membrane. Remove blocking when work is not in progress and after work of this Section is completed.
- .4 Carry membrane and insulation to edge of drain base and trim around drain opening. Top ply to be granulated cap sheet flashing to minimum 200 mm (8") from edge of drains.
- .5 Ensure that installation of drain and membrane is performed in accordance with recommendations of drain manufacturer.

- .6 Prime drain flange and allow to dry.
- .7 Embed first felt ply in a coat of waterproofing mastic and extend plies of felt into the drain opening of drains, and trim as required.
- .8 Fill void between drain body and roof insulation board/base structure support with two- component polyurethane foam insulation.

3.16 ROOF PENETRATIONS

- .1 *Install* curb flashings around ducts, pipes, structural steel, and other projections through membrane systems in conformance with manufacturer's written instruction and as detailed.
- .2 Install penetration flashing supplied under work of mechanical and under the work of this Section, in accordance with roofing manufacturer's installation instructions.
- .3 Prime metal flanges with primer and allow solvents to flash off prior to installation.
- .4 Remove poly film on areas to receive metal flashing. Set metal flange in full layer of waterproofing mastic to *Provide* positive bond and seal.
- .5 *Install* base ply to the base of the metal flashing staying short of curved metal section.
- .6 *Install* cap ply to the base ply flashing ensuring a full bond to the base ply and apply bead of waterproofing sealer at the termination point.

3.17 METAL FLASHINGS

- .1 *Install* metal flashings in accordance with Section 07 62 00 – Metal Flashing.

3.18 PAVER INSTALLATION

- .1 Public area pavers:
 - .1 *Install* paver pedestals in accordance with manufacturer's recommended installation instructions.
- .2 Paver installation:
 - .1 *Install* pavers in accordance with paver manufacturer's written instructions. Align the top cap joint spacers with paver edges. Level pavers in succeeding rows.
 - .2 *Install* pavers tightly butted into pedestals. Form minimum joint widths.
 - .3 Shim or adjust to level and as necessary to prevent rocking of pavers.
 - .4 Installation tolerances:
 - .1 Step in face alignment between paver faces: Plus or minus 1.5 mm (1/16").
 - .2 Jog in joint alignment between paver sections: Maximum 1.5 mm (1/16").
 - .5 Do not use pavers with chips, cracks, voids, stains, or other defects which might be exposed to view in the finished work.
 - .6 Machine cut pavers as necessary to fit the conditions indicated. Joints shall be no wider than the typical paver to paver joint.

3.19 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00 – Quality Control and as follows:
 - .1 Inspection and testing:
 - .1 Prior to installation of cap sheet membrane, base sheet membrane installation shall be reviewed by manufacturer and inspection and testing company, who shall each submit field review reports to the *Consultant*.
 - .2 Independent inspection and testing company shall perform:
 - .1 Inspections and *Provide* inspection reports.
 - .2 Tests and *Provide* test reports:
 - .3 Core cuts (if requested).
 - .2 Manufacturer's field review to be in accordance with Section 01 45 00 – Quality Control.

3.20 ADJUSTING AND CLEANING

- .1 Remove applicator's equipment and debris as work progresses, and at completion of the work of this Section in accordance with Sections 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Remove bituminous markings from finished surfaces.
- .3 Repair or replace defaced or disfigured finishes caused as a result of the work of this Section.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Preliminary requirements
 - .1 Comply with the General Conditions, the Supplementary Conditions, and all of Division 1 General Requirements.
 - .2 Requests for substitutions for *Products* specified or indicated will not be considered unless the request is in strict accordance with Section 01630 Product Substitution Procedures.
- .2 related sections
 - .1 Section 05123 Structural Steel and Open Web Steel Joists
 - .2 Section 06100 Rough Carpentry
 - .3 Section 07212 Rigid Insulation
 - .4 Section 07465 Preformed Metal Cladding
 - .5 Section 07620 Metal Flashing and Trim
 - .6 Section 07900 Joint Sealers
- .3 submittals
 - .1 Submit all required submittals in accordance with Section 01330 Submittals.
 - .2 Samples: submit duplicate 300 mm x 300 mm samples of each sheet metal material specified in order to verify colour match.
 - .3 Shop drawings: indicate arrangement of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame. Include location and configuration of snow fences and ridge vents.
- .4 qualifications
 - .1 The work of this section shall be performed by a member in good standing of the Canadian Roofing Contractors Association who shall also:
 - .1 Have a minimum of five (5) years' proven satisfactory experience.
 - .2 Have adequate equipment and skilled personnel to complete the work in an efficient and workmanlike manner.
- .5 guarantee / warranty
 - .1 The *Subcontractor* for the work of this section shall, and hereby does, warrant, and the *Contractor* does guarantee, that the sheet metal panels, related closures, fixings, and the like, *Provided* as part of the work of this section shall be free from defects for a period of two (2) years from the date of *Substantial Performance of the Work*.
 - .2 Furnish said guarantee/warranty in writing in a form acceptable to the *Consultant* and the *Owner*, signed and counter-signed by the *Contractor* and the *Subcontractor*.
- .6 inspection

- .1 All roofing and sheet metal work shall be done under the supervision of the Independent Inspection and Testing Company. The *Work* shall not be considered complete until a certificate is issued by the Independent Inspection and Testing Company.
- .2 Notify the Independent Inspection and Testing Company at least 48 hours prior to commencement of roofing work.
- .3 The cost for this inspection shall be paid for as part of the cash allowance for Independent Inspection and Testing in accordance with Section 01210 Allowances.

1.2 PRODUCTS

- .1 prefinished sheet metal
 - .1 Prefinished sheet steel to CSSBI Bulletin B16-94 Prefinished Sheet Steel for Building Construction.
 - .2 Base metal: continuous hot-dipped galvanized sheet steel conforming to the requirements of ASTM A-653M, nominal thickness of 0.76 mm.
 - .3 Profile: Tradition 150 in 500 mm coverage, full-length of roof slope without transverse seams, as manufactured by VicWest Steel.
 - .4 Finish: to be selected from VicWest Signature - SMP Coated Metal Line
- .2 accessories
 - .1 Ice and water shield as recommended by the sheet metal manufacturer.
 - .2 Sealant: Type 1 in accordance with Section 07900 Joint Sealers with primer and backer rods as recommended by the sheet metal manufacturer.
 - .3 Fasteners: concealed type.
 - .4 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
 - .5 Ridge vents: as recommended by roofing manufacturer in locations indicated.
 - .6 Snow guards/fences: Blizzard II (S-5! DualGard) as manufactured by Rocky Mountain Snow Guards Inc. System to be engineered to integrate with standing seam roof system. Colour to match colour of standing seam roof system, or approved equivalent.
- .3 fabrication
 - .1 Hem exposed edges on underside 12 mm, mitre and seal.
 - .2 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

1.3 EXECUTION

- .1 installation
 - .1 Install in accordance with manufacturer's recommendations.
 - .2 Work shall be done to provide a neat, plumb, and square installation.
 - .3 Ice and water shield to be applied over entire extend of low roof areas, installed shingle style.
 - .4 Apply sheet metal roofing beginning at eaves.

- .5 Form side laps with stitch fastening using a continuous bead of sealant or butyl tape.
- .6 Flash roof penetrations with material matching roof panels and make watertight using a continuous bead of sealant or butyl tape.
- .7 Form valleys of sheets not exceeding 3000 mm in length. Lap joints 150 mm in direction of water flow. Extend valley sheet a minimum of 150 mm under roofing sheets. At valley line, double-fold valley and roofing sheets and make watertight using a continuous bead of sealant or butyl tape.
- .8 Panel ends to be folded and hooked into metal flashing in accordance with manufacturer's standard details and recommendations.
- .9 Attach components in a manner not restricting thermal movement.
- .10 No face fasteners are to be used at ridges, valleys, hips, eaves, or valley starter strips.
- .11 Additional blocking is required between joists or trusses in locations where snow fences are to be installed.
- .12 Fix purpose made closures to bottom edge of sheet metal roof.
- .2 cleaning of the work
 - .1 On completion of the work, remove all bitumen or foreign matter from metal roofing, and wash with soap and hot water, or a suitable washing powder, rinse with cold water and wipe dry with a clean cloth. Leave work in a first class condition to the satisfaction of the *Consultant*.
 - .2 Remove excess materials from the *Place of the Work*.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Delivery, Storage, and Handling
- .7 2.1 Prefinished Aluminum Flashing
- .8 2.2 Prefinished Metal Finishes
- .9 2.3 Accessories
- .10 2.4 Fabrication
- .11 3.1 Flexible Flashing Underlayment Installation
- .12 3.2 Roof Flashing Installation
- .13 3.3 Installation of Roof Accessories
- .14 3.4 Installation Tolerances
- .15 3.5 Field Quality Control
- .16 3.6 Adjusting and Cleaning
- .17 3.7 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 *Supply* and installation of prefinished metal (aluminum) flashings.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Shop Drawings*:
 - .1 Submit *Shop Drawings* including the following:
 - .1 Plans, elevations, sections, and attachment details.
 - .2 Detail fabrication and installation layouts, expansion-joint locations, and key details. Distinguish between shop and field assembled work.
 - .3 Include identification of material, thickness, weight, and finish for each item and location in the *Work*.
 - .4 Include details for forming, including profiles, shapes, seams, and dimensions.

- .5 Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - .6 Include details of termination points and assemblies.
 - .7 Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contracting from fixed points.
 - .8 Include details of roof penetrations flashing.
 - .9 Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings as applicable.
 - .10 Include details of special conditions.
 - .11 Include details of connections to adjoining work.
- .3 Samples:
- .1 Submit full-size samples of each specified flashing material formed to detailed profile including corner, curb, cap, and parapet flashing, and coping including lock-joints and hold-down clips.
 - .2 Submit 2 - 50 mm x 50 mm (2" x 2") samples of each type of sheet metal material, colour and finish.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
- .1 Installers / applicators / erectors: *Provide* work of this Section, executed by competent installers with a minimum of five years' experience in application of *Products*, systems and assemblies specified and with approval of *Product* manufacturers.
 - .1 The *Work* of this Section shall be installed by a *Subcontractor* that is a member in good standing of the Canadian Roofing Contractors Association (CRCA), Ontario Industrial Roofing Contractors Association (OIRCA) or equivalent association acceptable to the *Consultant*, who has been a member for at least five years.
 - .2 Sealant shall be applied by a *Subcontractor* of recognized standing, having - not less than five years of proven experience in this type of work, and who has the necessary equipment and skilled mechanics to carry out the work of this Section satisfactorily and can substantiate this to satisfaction of the *Consultant*.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Keep materials and equipment free from debris, ice, snow and contaminants. Allow air to circulate around metal components, sheets and break shapes.
- .2 Protect holes, and reglets from water and ice during freezing weather.

PART 2- PRODUCTS

2.1 PREFINISHED ALUMINUM FLASHING

- .1 Aluminum flat sheet: Flat aluminum sheet in accordance with ASTM B209-14, to the following minimum thickness and alloy:
 - .1 Painting quality: 3003H14 or 3105H14 to ANSI H35.1/H35.1M-2013.

- .2 Minimum thickness:
 - .1 0.81 mm (0.032").

2.2 PREFINISHED METAL FINISHES

- .1 *Provide* the following finish to exposed prefinished metal (steel/aluminum as applicable):
 - .1 Type 1; Finish: factory prefinished CSSBI 10000 Series.
 - .1 10000 Series (Polyvinylidene Fluoride - PVDF) will not visibly (within 10 metres to the unaided naked eye) crack, chip, or peel (lose adhesion) for 35 years from date of application. This does not include minute fracturing that may occur during the normal fabrication process. 10000 Series (Polyvinylidene Fluoride - PVDF) will not chalk in excess of a number eight rating, in accordance with ASTM D4214-07(2015) method D659 at any time for 35 years from date of installation (35.5 yrs from application); will not change colour more than five (5.0) Hunter ΔE units as determined by ASTM D2244-15.
 - .2 Colour to later selection by the *Consultant* from the manufacturer's full range.

2.3 ACCESSORIES

- .1 Isolation coating: in accordance with CAN/CGSB-1.108, bituminous type.
- .2 Sealants: in accordance with Section 07 92 00 – Joint Sealants, colour as selected by the *Consultant* from the manufacturer's full range.
- .3 Cleats: of matching metal to flashing material, continuous, and of greater thickness than flashing material. Joints in cleats shall not coincide with joints in perimeter edge metal. Allow a 12.7 mm (1/2") gap between pieces.
- .4 Fasteners:
 - .1 Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - .2 General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head:
 - .1 Exposed screws: 38 mm (1-1/2") long minimum at 450 mm (18") on centre maximum. Heads matching colour of sheet metal using plastic caps or factory-applied coating. *Provide* metal-backed EPDM washer under heads of exposed fasteners.
 - .2 Blind fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - .3 Cleat fasteners: Corrosion-resistant barbed angular ring or screw shank nail; length to achieve approximately 32 mm (1-1/4") penetration into nailer; fasten at 150 mm (6") on centre.
 - .3 Fasteners for prefinished aluminum sheet: Aluminum or Series 300 stainless steel.
 - .4 Fasteners and plates to meet the requirements of Factory Mutual 4470 Standard for wind uplift and corrosion resistance.
- .5 Flexible flashing membrane; standard temperature grade for use at locations where membrane is protected by material with insulating properties:
 - .1 Description:

- .1 Thickness: 1 mm (40 mils) minimum.
- .2 Self-adhesive grade rubberized membrane backed by high density polyethylene.
- .3 Primer for substrate.
- .2 Acceptable *Products*:
 - .1 Bakor 'Blueskin Roof RF200'.
 - .2 Grace 'Ice & Water Shield'.
 - .3 Soprema 'LASTOBOND SHIELD'.
 - .4 Or *Equivalent*.

2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) "Architectural Sheet Metal Manual (Seventh Edition) details and as indicated.
- .2 Form pieces in 3048 mm (10 ft) maximum lengths. Make allowance for expansion at joints.
- .3 Sealed joints: Form non-expansion but movable joints in metal to accommodate sealant.
- .4 Expansion provisions: Form expansion joints of intermeshing hooked flanges, not less than 25.4 mm (1") deep, filled with sealant concealed within joints.
 - .1 Joints that *Provide* expansion and contraction capabilities should be located near the corners within approximately 610 mm (24") from each direction of the corner measured from the interior side.
- .5 Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, and of greater thickness of metal being secured.
- .6 Hem exposed edges on underside 12.7 mm (1/2"). Mitre and seal corners with sealant.
- .7 At parapets, *Provide* 25.4 mm (1") minimum overlap between bottom of wood blocking or flashing anchorage support and edge of drip or termination of flashing.
- .8 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .9 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- .10 *Provide* 25.4 mm (1") minimum overlap between bottom of wood blocking or flashing anchorage support and edge of drip or termination of flashing.

PART 3 - EXECUTION

3.1 FLEXIBLE FLASHING UNDERLAYMENT INSTALLATION

- .1 Apply primer to concrete masonry and precast concrete substrates.
- .2 *Install* in a consecutive weatherboard method starting at bottom or base of wall and working up.
- .3 *Provide* minimum of 50 mm (2") side laps and 75 mm (3") end laps.

- .4 Cut to manageable lengths, position membrane for alignment, remove protective poly- film and firmly apply pressure to assure adhesion.
- .5 Eliminate wrinkles or gaps, roll entire membrane surface (including seams) with a counter top or "J-roller" to ensure full contact and adhesion.
- .6 Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the air barrier membrane and around the perimeter edge of membrane terminations.
- .7 Flashing membrane shall be applied in weatherboard fashion starting at bottom of base of wall and working up, in and around the full perimeter of openings, to *Provide* watertight protection and according to the following procedures:
 - .1 Apply the first strip horizontally immediately below the sill, cut it sufficiently long to extend past each side of the window, so that it projects even with the vertical jamb flashing to be applied later. Turn sill flashing up 50 mm (2") at ends of sill.
 - .2 Sill flashing shall overlap wall membrane. Overlap jamb at head flashing membrane in the same manner.

3.2 ROOF FLASHING INSTALLATION

- .1 *Install* sheet metal work in accordance with SMACNA's "Architectural Sheet Metal Manual (Seventh Edition)".
- .2 *Provide* watertight flashing installing capable of resisting specified uplift pressures in accordance with roofing specifications, thermally induced movement and exposure to weather.
- .3 *Provide* minimum 10% slope for drainage towards roof at parapet locations, with minimum 2% sloped to drain at remaining flashing locations.
- .4 *Provide* continuous cleats for attachment of flashings at exterior face of wall and cleats for interior face of wall.
- .5 *Provide* radius (3-piece) copings for curved wall condition unless otherwise indicated.
- .6 Prefabricate corner copings in 610 mm (24") x 610 mm (24") sections.
- .7 Concealed fastenings and cleats, from view except where exposed flashings are accepted by the *Consultant* prior to installation.
- .8 Flash joints using S-lock forming tight fit over hook strips/cleats; unless otherwise indicated.
- .9 *Install* surface mounted flared joint true and level, and caulk top of reglet with sealant at reglets.
- .10 Insert metal flashings to other materials and flashings to form weather-tight junction.
- .11 *Provide* prefinished metal flashing over equipment curbs which are covered with roofing membrane.
- .12 Turn top edge of flashing into recessed reglet or mortar joint where indicated, to minimum depth of 25 mm (1"). Wedge flashing securely into joint. Seal flashing at reglet and cap flashing with sealant.
- .13 Expansion provisions: *Provide* for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3048 mm (10 ft) and *Provide* uniform joint spacing with no joints allowed within 610 mm (24") of corner or intersection. Where lapped expansion provisions cannot

be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25.4 mm (1") deep, filled with sealant concealed within joints.

- .14 *Provide* vapour permeable synthetic building paper separation between galvanized steel and treated wood where applicable.
- .15 *Install* flexible flashing membrane in accordance with the manufacturer's printed installation instructions.

3.3 INSTALLATION OF ROOF ACCESSORIES

- .1 Incorporate devices to which roofing and flashing may be secured.
- .2 *Install* work to ensure that roofing and flashings will be properly applied to maintain building envelope weather-tight.

3.4 INSTALLATION TOLERANCES

- .1 Installation tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 6 mm in 6 m (1/4 inch in 20 feet) on slope and location lines as indicated and within 3.2 mm (1/8") offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00 – Quality Control.
 - .1 The work of this Section will be inspected and tested in conjunction with inspection and testing of roofing work.

3.6 ADJUSTING AND CLEANING

- .1 Remove deposits, stains or protections and wash metals left unpainted and exposed to view as recommended by manufacturer of metal or paint finish.

3.7 PROTECTION

- .1 The *Consultant* will advise the *Contractor* of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Delivery, Storage, and Handling
- .7 2.1 Materials
- .8 2.2 Cementitious Fireproofing (Wet-Mix)
- .9 3.1 Preparation
- .10 3.2 Application
- .11 3.3 Field Quality Control
- .12 3.4 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 Sprayed fire-resistive materials.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Underwriters Laboratories of Canada Inc. (ULC) design number, brand names and descriptive catalogue data of *Products* to be used in the work of this Section.
 - .2 Include complete test report in cases where references are not published by testing laboratories, and where the *Authority Having Jurisdiction* has approved significant changes from tested assembly on basis of an engineering study; study calculations shall accompany report.

1.5 QUALITY ASSURANCE

- .1 Qualifications: The *Contractor* shall *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .2 Materials and applied systems shall have full acceptance by the *Authority Having Jurisdiction*.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Store fireproofing materials in weathertight enclosure raised clear of the ground so they are protected from moisture.
- .2 Store materials in original undamaged sealed container with manufacturer's labels and seals intact to show the approval of Underwriters' Laboratories of Canada (ULC).
- .3 Discard any material which has come into contact with moisture prior to actual use.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Materials shall be listed in accordance with CAN/ULC S101-07 achieve required fire protection rating.
- .2 *Products* shall be asbestos free.
- .3 Water, bonding agents, binders, accessories, cleaning solvents, aggregates and sealers shall be in accordance with base material manufacturer's recommendation.
- .4 Metal lath or non-metallic fibre mesh: as recommended by applied fireproofing manufacturer for application to painted surfaces.

2.2 CEMENTITIOUS FIREPROOFING (WET-MIX)

- .1 Description: Wet-mix spray-applied fire resistive materials (SFRM) consisting factory mixed dry formulation of gypsum or Portland cement binders and lightweight mineral or synthetic aggregates mixed with water to form slurry for conveyance and application.
- .2 Acrylic fireproofing adhesive and sealer: Vinyl acrylic copolymer emulsion of fine particle size, films retain high degree of flexibility and elongation.
- .3 Acceptable *Products*; standard density:
 - .1 AD Fire Protection Systems 'Southwest Fireproofing Type 5GP'.
 - .2 Grace Construction Products 'Monokote MK-6'.
 - .3 Isolatek International 'Cafco 300'.
 - .4 Or *Equivalent*.
- .4 Acceptable *Products*; medium density:
 - .1 A/D Fire Protection Systems Inc. 'Southwest Fireproofing Type 5MD'.
 - .2 Grace Construction Products 'Z-106 G'.
 - .3 Isolatek International 'Cafco 400'.
 - .4 Or *Equivalent*.

PART 3- EXECUTION

3.1 PREPARATION

- .1 Review locations of exposed/non-exposed fireproofed surfaces with the *Consultant* prior to application.

- .2 Prepare substrate in accordance with the printed instructions of the manufacturer of the sprayed fireproofing material to achieve required fire protection.
- .3 Mechanically fasten metal lath or non-metallic fibre mesh to painted surfaces to receive applied fireproofing in accordance with manufacturer's recommendations.
- .4 Apply medium coat of sealer to fireproofing in surfaces of indicated SFRM to prevent dust particles from becoming airborne.

3.2 APPLICATION

- .1 Apply sprayed-applied fireproofing in accordance with the printed instructions of the manufacturer of the sprayed fireproofing material, and as specified herein and in accordance with ULC or cUL design number.
- .2 Apply by the contour method in one or more coats of sufficient thickness to achieve the fire ratings as required in the Contract Documents.
- .3 Repair sprayed-applied fireproofing damaged by others after completion of the work of this Section. Costs for damage shall be borne by the responsible party. Coordinate work with other Sections.
- .4 *Install* the sprayed-applied fireproofing so that any movement of building structure acting alone or together does not tear, rupture, delaminate, puncture or perforate spray-applied fireproofing.

3.3 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00 – Quality Control.
- .2 Manufacturer's field review to be in accordance with Section 01 45 00 – Quality Control.

3.4 PROTECTION

- .1 Protect during installation any adjacent finished surfaces from contamination and damage due to the work under this Section.
- .2 Protect completed work, vulnerable corners, edges and surfaces liable to be damaged due to construction activities. *Provide* wood cover strips and sheet material as required to prevent damage.
- .3 Method and materials to effect protection are subject to review by the *Consultant*.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery Storage, and Handling
- .8 1.8 Field Conditions
- .9 2.1 Manufacturers
- .10 2.2 Performance/Design Requirements
- .11 2.3 Materials
- .12 3.1 Manufacturer's Instructions
- .13 3.2 Preparation
- .14 3.3 Installation
- .15 3.4 Identification
- .16 3.5 Field Quality Control

1.3 SUMMARY

- .1 Section includes:
 - .1 Materials installed in cavities, joints, around penetrations, and openings in floors, walls, partitions, and other building components to restrict the spread of fire and smoke.
- .2 Section excludes:
 - .1 Firestopping and smoke seals, for mechanical, electrical and communications penetrations of fire resistant assemblies, and firestopping and smoke seals within their respective assemblies.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract* and sections of Division 01.
- .2 Coordination:
 - .1 Coordinate with other Sections to assure that pipes, conduit, cable, and other items that penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
 - .2 Schedule the *Work* to assure that penetrations and other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data: Submit data and installation instructions for *Products* and prefabricated devices, providing descriptions sufficient for identification at the *Place of the Work*.
 - .1 Materials list of *Products* proposed for use in the work of this Section;
 - .2 Listing agency's detailed drawing showing opening, penetrating items, and firestopping materials, identified with listing agency's name and number or designation, fire rating achieved, and date of listing.
 - .3 Manufacturer's specifications, detail sheets, and other data needed to prove compliance with the specified requirements;
 - .4 Certificates: Submit manufacturer's certification that installed firestopping and smoke seal *Products* are suitable for the use indicated and comply with specified requirements.
 - .5 Submit fire resistance rating test listings for firestopping and smoke seal systems.
 - .6 Manufacturer's engineering judgment identification number and *Shop Drawing* details when no Underwriters Laboratories of Canada (ULC) or other Canadian listed assembly or equivalent assembly acceptable to the *Consultant*, is available for an application. Engineered judgment must include both *Project* name and the *Subcontractor's* name who will install firestop system as described in *Shop Drawing*.
- .3 *Shop Drawings*:
 - .1 Submit *Shop Drawings* indicating fire resistance rated assembly number, required temperature, hose stream, and flame rating, material thicknesses, installation methods and materials of firestopping and smoke seals, primers, supports, damming materials as applicable, reinforcements, anchorages, fastenings and methods of installation for each condition to be encountered.
 - .2 Designate on *Shop Drawings* static through penetrations and dynamic joint systems, relative positions, expansion and control joints in rated slabs and walls, firestopping details at receptacles and similar poke-through devices and surrounding permanent materials. Identify re-entry locations.
- .4 Manufacturers' instructions:
 - .1 The *Contractor* shall ensure that the manufacturer of the *Products* proposed for use in the work of this Section prepares a firestopping manual scheduling the *Products* to be used for each assembly and installation required in the *Work*.
 - .2 The manual must include the manufacturer's *Product* data sheets
 - .3 Firestopping manual must be submitted within 20 working Days from the *Contract* award.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified and with approval, training and certification of *Product* manufacturers.

- .1 Submit proof of the manufacturer's installer certification for each installer of firestopping and smoke sealant systems.
- .2 Manufacturer's willingness to sell its firestopping *Products* to the *Contractor* or to a *Subcontractor* or installer engaged by the *Contractor* does not in itself confer qualification on the buyer.
- .2 The *Contractor* shall ensure that the installer *Subcontractor* designates a single individual as *Project* foreperson and shall also ensure this foreperson is present at the *Place of the Work* at all times when the work of this Section is being performed.
- .2 Regulatory requirements:
 - .1 Firestop systems shall be listed in accordance with CAN/ULC-S115-05 and tested assemblies shall achieve a fire resistance rating in accordance with the Ontario Building Code.
 - .2 Proposed firestopping and smoke seal materials and methods shall conform to City of Markham Fire requirements.

1.7 DELIVERY STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- .1 General: Manufacturers of firestopping and smoke seal system *Products* and installation specialists for the work of this Section are limited to applicable assemblies as required for the *Work* and having listing mark on packaging.
- .2 Acceptable manufacturers for work of this Section:
 - .1 3M Canada Inc.
 - .2 A/D Fire Protection Systems Inc.
 - .3 Dow Corning.
 - .4 Hilti Canada Corp.
 - .5 Nuco – Self-Seal Firestopping Products.
 - .6 Tremco Canada Ltd.
 - .7 Or *Equivalent*.

2.2 PERFORMANCE/DESIGN REQUIREMENTS

- .1 *Provide* firestop and smoke seal systems consisting of a material, or combination of materials installed to retain the integrity of fire-rated construction by effectively impeding the spread of flame, smoke, and/or hot gasses through penetrations, blank openings or gaps, membrane penetrations, construction joints, or at perimeter fire containment in or adjacent to fire-rated barriers.
- .2 *Provide* also smoke sealants applied over firestopping materials or combination smoke seal/firestop seal material to form air tight barriers to retard the passage of gas and smoke.
- .3 *Provide* fire-resistance rating equivalent to the rating of the adjacent floor, wall or other fire separation assembly.
- .4 *Provide* firestopping and smoke sealant system assemblies as practical and as required to coordinate with the schedule and sequencing of the *Work*.
- .5 Confirm locations of exposed/non-exposed firestopping/smoke seal surfaces with the *Consultant* prior to application.
- .6 *Provide* movement capability at movement joints in accordance with design requirements for movement joint.

2.3 MATERIALS

- .1 Single source responsibility for firestopping and smoke seal materials:
 - .1 Obtain firestopping and smoke seal materials from single manufacturer for each different *Product* required.
 - .2 The *Contractor* shall ensure that the manufacturer instructs the applicator *Subcontractor* in procedures for each material.
- .2 Firestopping and smoke seal systems shall conform to the following:
 - .1 Volatile Organic Compounds (VOC) content not to exceed 250 grams per litre minus water.
 - .2 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gasses in compliance with requirements of CAN/ULC- S115-05 and not to exceed opening sizes for which they are intended.
 - .3 *Provide* firestopping materials and systems with fire-resistance rating not less than the fire-resistance rating of applicable adjacent assembly.
 - .4 Listed in accordance with CAN/ULC-S115-05.
 - .5 For services that penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating, *Provide* firestop system with "F" rating as required by the Ontario Building Code.
 - .6 For combustible pipe penetrations through a fire separation required to have a fire-resistance rating, *Provide* firestop system with "F" rating as required by the Ontario Building Code.
 - .7 For services that penetrate a fire wall or a horizontal fire separation that is required to have a fire-resistance rating, *Provide* firestop system with "FT" rating as required by the Ontario Building Code.
 - .8 For joints in fire-separations, *Provide* firestop system as required by the Ontario Building Code.

- .9 *Products* shall be compatible with abutting dissimilar membranes, architectural coatings, finishes at floors, walls and ceilings. Check with requirements of the *Contract Documents* and manufacturer of selected materials being installed.
- .3 Smoke sealants for overhead and vertical joints shall be non-sagging; sealants for floors shall be self-levelling.
- .4 Smoke sealants at vertical through penetrations in areas with floor drains shall be waterproof type.
- .5 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems).
- .6 Metal deck/wall penetration conditions with sprayed fireproofing: spray-on fire-rated firestop mastic.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written *Product* data including *Product* technical bulletins, *Product* installation instructions and *Product* packaging instructions.

3.2 PREPARATION

- .1 Examine sizes, anticipated movement and conditions to establish correct thickness and installation of back-up materials.
- .2 Clean bonding surfaces to remove deleterious substances including dust, paint, rust, oil, grease, moisture, frost and other foreign matter which may otherwise impair effective bonding.
- .3 Prime and mask adjacent surfaces. Mask areas adjacent to sprayed firestopping to limit firestopping overspray to area not greater than 25 mm (1") of minimum required.
- .4 Remove insulation from insulated pipe and duct where such pipes or ducts penetrate a fire separation unless listed assembly permits such insulation to remain within assembly, or where mechanical trades have installed special fire rated insulated sleeves.
- .5 Secure pipe, conduit, cable, and other items that penetrate firestopping and smoke seal systems.

3.3 INSTALLATION

- .1 Mix and apply firestopping, gas and smoke seals in accordance with manufacturer's written instructions and tested designs to achieve required flame rated seal, to prevent the passage of gas and smoke and, where specifically designated, the passage of fluids.
- .2 *Provide* temporary forming and packing as required and other accessories in accordance with manufacturers' written instructions. Apply materials with sufficient pressure to properly fill and consolidate the mass to seal openings.
- .3 *Provide* fill materials for through-penetration firestop systems by techniques to achieve the following results:
 - .1 Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - .2 Install materials so that they contact and adhere to substrates formed by openings and penetrating items.

- .4 *Provide* joint fillers to *Provide* support of firestop materials during application and at the position required to produce the cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance required.
- .5 For materials that will remain exposed after completing the *Work*, finish to *Provide* smooth, uniform surfaces. Tool or trowel exposed surfaces.
- .6 Seal joints to ensure an air and water resistant seal, capable of withstanding compressions and extensions due to thermal, wind or seismic joint movement.
- .7 Notify the *Consultant* when random completed installations are ready for review, as directed by the *Consultant*, prior to concealing or enclosing firestopping and as applicable, smoke seals.
- .8 Remove temporary forming and dams only after materials have gained sufficient strength.

3.4 IDENTIFICATION

- .1 Identify through-penetration firestopping and smoke seal systems with pressure- sensitive, self-adhesive, printed vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestopping system installation where labels will be visible to anyone seeking to remove penetrating items or firestopping and smoke seal systems. Include the following information on labels:
 - .1 The words: "Warning: Through-Penetration Firestopping system – Do Not Disturb";
 - .2 Applicator's name, address and phone number;
 - .3 Designation of applicable testing and inspection agency;
 - .4 Date of installation;
 - .5 Manufacturer's name for firestopping and smoke seal system materials.

3.5 FIELD QUALITY CONTROL

- .1 Quality control to be in accordance with Section 01 45 00 – Quality Control.
- .2 Field tests and inspections:
 - .1 The *Consultant* will review installation of the work of this Section and will perform random tests to verify its completion in accordance with the requirements of the *Contract Documents*.
 - .2 Give at least 48 hours' notice before operations commence, and arrange for a pre-job conference with the *Contractor*, the *Subcontractor*, the inspection and testing company, the manufacturer, and the *Consultant* present.
 - .3 Inspection and testing company shall examine penetration firestopping in accordance with ASTM E2174-09 and ASTM E2393-10a as applicable. Inspection and testing company shall examine firestopping and shall determine, in general, that firestopping has been installed in accordance with the requirements of the *Contract Documents* and the tested and listed firestop system.
 - .4 The *Contractor* shall ensure that the representatives of the manufacturer(s) have access to the *Work*. The *Contractor* shall *Provide* assistance and facilities for such access in order that the manufacturer(s) representative(s) may properly perform its function.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Field Conditions
- .7 1.7 Extended Warranty
- .8 2.1 Sealants
- .9 2.2 Accessories
- .10 3.1 Manufacturer's Recommendations
- .11 3.2 Preparation
- .12 3.3 Masking
- .13 3.4 Installation
- .14 3.5 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - .1 Exterior building sealants.
 - .2 Interior building sealants.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit the manufacturer's and *Product* name for each sealant which will be used in the *Work* prior to commencing the *Work*.
- .3 *Product* data sheets:
 - .1 Submit the manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .4 Test sealant in contact with samples of materials to be sealed to verify adhesion will be achieved and no staining of the material will result. Prepare sample joints at the *Place of the Work* of each type of sealant for each joint condition.
 - .1 Submit test results to the *Consultant* prior to application of sealants.
- .5 Test sealant in contact with samples of porous materials to be sealed to ensure that no staining of the material will result in accordance with ASTM C1248-08 (2012).

- .1 Submit test results to the *Consultant* prior to application of sealants.
- .6 Submit 2440 mm (96") long sealant joint mock-up.
- .7 Submit "wet sample" sealant colour samples for each sealant *Product* and colour.

1.5 QUALITY ASSURANCE

- .1 Qualifications: *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers. The *Contractor* shall ensure that the installer *Subcontractor* complies with quality assurance articles referenced in ASTM C1193-13 for installation of joint sealants.
- .2 Conduct quality control in accordance with Section 01 45 00 – Quality Control.

1.6 FIELD CONDITIONS

- .1 Verify substrates and ambient air temperature at the *Place of the Work* before, during and after application to ensure compliance with the manufacturer's recommendations. Surfaces shall be frost-free, dust-free, clean and completely dry at time of installation.
- .2 Weather Conditions: In accordance with the manufacturer's instructions, do not apply silicone joint sealants in snow, rain, fog or mist, or when such conditions are expected. Allow joint surfaces to attain dry conditions as recommended by the manufacturer before sealant application.
- .3 Sealant and substrate materials: Conform to the sealant manufacturer's specifications and recommendations. Keep organic sealant materials heated to at least 16°C when working at temperatures below 10°C.

1.7 EXTENDED WARRANTY

- .1 Warranty work of this Section for a period of two years from the date of Substantial performance, in accordance with Section 01 78 36 - Warranties.
- .2 Repair or replace joint sealants which fail to perform as air tight and water-tight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, or general durability; or appear to deteriorate or become unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship or in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.
- .3 Defects shall include, but are not limited to:
 - .1 Staining from abutting materials or filler.
 - .2 Migrating, bleeding into, or staining abutting materials.
 - .3 Unsightly surface deformation by causes other than movement.
 - .4 Excessive colour change, chalking, or dust pick-up.
 - .5 Failing adhesively or cohesively where maximum elongation is less than 25% of designed width of exposed joints.
 - .6 Hardening to more than 25% over specified hardness.

PART 2 - PRODUCTS

2.1 SEALANTS

.1 General:

- .1 Colours: Sealant colours shall match colours of adjacent materials, as selected and approved by the *Consultant*:
 - .1 Colours shall be selected from the manufacture's full range of colours, generally to match adjacent finished colours
- .2 Comply with ASTM C920-11 and other requirements indicated for each liquid- applied chemically curing sealant, including those referencing ASTM C920-11 classifications for type, grade, class, and uses.
- .3 *Provide* joint sealants, primer(s) and backings that are compatible with one another and with joint substrates under conditions of service and application as demonstrated by joint sealant manufacturer based on proven test results and field experience.
- .4 For sealants to be applied to porous substrates: *Provide Products* that have undergone testing according to ASTM D1248-12 and have not stained porous joint substrates indicated for *Work*.
- .5 Sealant supplied shall not exude any material(s) which travels into adjacent materials, or travels onto surfaces of adjacent materials; causing damage, or attracting soiling, which becomes apparent during the service life of the building.

.2 Interior sealants shall have Volatile Organic Compound (VOC) limit of less than 250 g/L.

.3 Sealant designations:

.1 Type 1 – Urethanes Two Part.

- .1 Non-sag, multi-component, epoxidized polyurethane sealant in accordance with CAN/CGSB 19.24-M90, Type 2, Class B.
- .2 Location: use at all locations except where noted otherwise.
- .3 Acceptable *Product*: Dymeric, as manufactured by Tremco Ltd. or *Equivalent*.

.2 Type 2 – Silicones One Part.

- .1 One-part, acetoxysilicone sealant, mildew resistant, in accordance with CAN/CGSB 19.22- M89.
- .2 Location: for washroom fixtures and vanity tops.
- .3 Acceptable *Product*: Tremsil 200, as manufactured by Tremco Ltd. or *Equivalent*.

.3 Type 3 – Acrylics One Part.

- .1 Acrylic terpolymer sealant, solvent release, in accordance with CGSB 19-GP-5M-1984.
- .2 Location: at interior joints between windows, door frames, and screen frames.
- .3 Acceptable *Product*: Mono 555, as manufactured by Tremco Ltd. or *Equivalent*.

.4 Type 4 – Acoustical Sealant.

- .1 Siliconized acrylic latex sealant, in accordance with CGSB 19.21-M87.
- .2 Location: at all perimeter joints and openings in gypsum board systems.
- .3 Acceptable *Product*: Tremflex 834, as manufactured by Tremco Ltd. or *Equivalent*.
- .5 Type 5 – Urethanes Two Part.
 - .1 Non-sag, multi-component, chemically cured, polyurethane sealant in accordance with CAN/CGSB 19.24-M90, Type 2, Class B.
 - .2 Location: at control joints in masonry assemblies.
 - .3 Acceptable *Product*: Dymeric511, as manufactured by Tremco Ltd. or *Equivalent*.
- .6 Type 6 – Urethanes Two Part.
 - .1 Non-sag, multi-component, chemically cured, polyurethane sealant in accordance with CAN/CGSB 19.24.
 - .2 Location: at all locations calling for Ethylene Propylene Diene Terpolymer (EPDM) membrane.
 - .3 Acceptable *Product*: Lexcan pourable sealer or *Equivalent*.
- .7 Type 7 – Urethanes One Part.
 - .1 Non-sag, single component, polyurethane sealant in accordance with CAN/CGSB 19.13-M87.
 - .2 Location: at metal flashing and trim.
 - .3 Acceptable *Product*: RC-1 Sealant as manufactured by Lexsuco or *Equivalent*.
- .8 Type 8 – Polyurethane One Part
 - .1 Non-sag, single component, moisture curing, modified polyurethane sealant in accordance with CGSB 19.12, class MC-2-25-B-N.
 - .2 Location: as toe bead filling void beneath glazing strip in Window Wall in accordance with Section 08 41 00 - Aluminum Framed Glazing Systems.
 - .3 Acceptable *Product*: DyMonic, as manufactured by Tremco Ltd. or *Equivalent*.
- .9 Type 9 – Structural Silicone.
 - .1 Non-sag, single component, elastomeric, chemical curing, neutral core, medium modulus silicone sealant in accordance with CAN/CGSB 19.13-M87, MCG-2-25-A-L.
 - .2 Location: as structural silicone sealant in window wall in accordance with Section 08 41 00 - Aluminum Framed Glazing Systems.
 - .3 Acceptable *Product*: Spectrum 2, as manufactured by Tremco Ltd. or *Equivalent*.
- .10 Type 10 – Acrylics One Part.
 - .1 Single component, elastomeric, water based, acrylic firestop sealant in accordance with CAN/ULC-S115-11.
 - .2 Location: fire rated joints and penetrations in fire rated systems.

- .3 Acceptable *Product*: TREMstop Acrylic, as manufactured by Tremco Ltd. or *Equivalent*.
- .11 Interior sealant, mildew resistant one part silicone sealant in accordance with the following:
 - .1 Comply with:
 - .1 ASTM C920-11, Type S, Grade NT, Class 25
 - .2 CAN/CGSB 19.22-M89.
 - .2 Acceptable *Products*:
 - .1 GE Silicones "Sanitary SCS1700 Sealant";
 - .2 BASF Building Systems "OmniPlus";
 - .3 Dow Corning "786";
 - .4 Tremco, Inc. "Tremsil 200";
 - .5 Or *Equivalent*.

2.2 ACCESSORIES

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

- .1 *Provide* cleaner conditioner required for glass and glazed surfaces as recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

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

3.2 PREPARATION

- .1 Prior to installation, clean substrates of substances that could impair the bond of joint sealants. Clean and prepare joint surfaces immediately before installing joint sealants. Protect adjacent work areas and finished surfaces from damage during joint sealant installation.
- .2 Clean porous joint surfaces by using heavy-duty brushing, light abrasive, mechanical abrading or combination of these methods to produce a clean, sound surface for optimum bond with joint sealants per manufacturer's recommendations. *Provide* a dry, dust-free and cleaned substrate for optimum results.
- .3 Non-porous surfaces should be cleaned using the two-cloth solvent wipe method as referenced in ASTM C1193-13 and outlined by joint sealant manufacturer's instruction. IPA (isopropyl alcohol) is not a degreasing solvent yet may be used in new construction for non-porous joint cleaning and preparation. Use xylene, toluene or Methyl Ethyl Ketone (MEK) for degreasing solvent and general cleaning of non-porous surfaces.
- .4 Rusting or scaling surfaces must be prepared using abrasive cleaning methods as recommended by joint sealant manufacturer prior to joint sealant installation. Efflorescence, mould, mildew and algae must be removed and neutralized prior to joint sealant installation.
- .5 Coordinate cleaning, priming and installation to avoid contamination of wet, freshly coated or adjacent finished surfaces. Prepare finish-coated surfaces per joint sealant manufacturer's specific recommendations.
- .6 Test materials for indications of staining or poor adhesion before any sealing is commenced. Submit results reports in writing to the *Consultant*.

3.3 MASKING

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

3.4 INSTALLATION

- .1 Review the complete *Contract Documents* for extent of sealant work required.
- .2 Comply with joint sealant manufacturer's installation instructions for *Products*, primers and applications indicated unless more stringent *Project*-specific instructions or requirements apply.
- .3 Apply joint sealants for continuous waterproof sealant joint protection. Vertical joints should be lapped over horizontal joints as recommended by the sealant manufacturer. Comply with installation recommendations in ASTM C1193-13 for use of joint sealants as applicable to each specific sealant installation.
- .4 *Install* sealant primers only when recommended by the sealant manufacturer and demonstrated at pre-construction tests after joint surface preparation has been completed and when surfaces are

verified as clean and dry. Allow any primer installation to completely dry or cure prior to installation of backing or joint sealants.

- .5 *Install* joint sealants in accordance with the joint sealant manufacturer's instructions using proven techniques that comply with the following and in proper sequence with installation of primers and backings.
 - .1 Using proper joint sealant dispensing equipment, place sealants by pushing sealant beads into opening to fully wet-out joint sealant substrates. Fill sealant joint opening to full and proper configuration.
 - .2 *Install*, providing uniform cross-sectional shapes and depths in relation to joint width for optimum sealant movement capability per joint sealant manufacturer's instructions.
- .6 Joint sealant tooling is required for non-sag joint sealant installations. Immediately after placing fresh sealants and before skinning or curing begins, tool sealants using metal spatulas designed for this purpose in accordance with the manufacturer's recommendations. *Provide* a smooth, uniform sealant finish, eliminating air pockets and ensuring good contact for optimum sealant adhesion within each side of the joint opening.
 - .1 *Provide* concave joint configuration as indicated per figure 5-A in ASTM C1193- 13 unless otherwise indicated in the Contract Documents. Dry tooling is required for joint sealants, and wet tooling agents are not allowed.
 - .2 Remove excess sealant from surfaces adjacent to joint openings using metal spatula, promptly cleaning any sealant residue from adjacent finished surfaces. Remove masking after joint sealant is installed.
- .7 Allow single-component sealants to fully cure before adhesion testing is performed as recommended by the joint sealant manufacturer.
- .8 Match approved sealant mock-up for colour, finish and overall aesthetics. Remove, refinish or re-install, at the *Contractor's* expense, work not in compliance with the *Contract Documents*.
- .9 When surfaces of adjacent materials are to be painted, perform sealant work before these surfaces are painted.
- .10 Check to make sure shop paint is compatible with primer and sealant. When incompatible, inform the *Consultant* and change primer and sealant to compatible type acceptable to the *Consultant*.
- .11 Check form release agent used on concrete for compatibility with primer and sealant. If they are incompatible, inform the *Consultant* and change primer and sealant to compatible type, or clean concrete to sealant manufacturer's acceptance.
- .12 *Install* joint backing material, filler strips, gaskets, bond breakers and similar type material of comparable performance characteristics. Install bond breaker tape or packing over asphalt impregnated fibre board as recommended by the sealant manufacturer.
- .13 Where joints are 12.7 mm (1/2") or deeper, insert backing material in continuous uniform compression with setback from finished face of adjoining materials equal to required depth of sealant (width/depth ratio) as specified in this Section.
- .14 On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.
- .15 Pack joints tightly with sealant backing set at depth specified for sealant. Fill other voids with filler.

- .16 *Install* bond breaker tape in bottom of joints in lieu of sealant backing where proper depth cannot be obtained when backing is installed.
- .17 Maintain correct sealant depth. Sealant depth shall be 1/2 the width of the joint, maximum depth shall be 12.7 mm (1/2"), minimum depth shall be 6 mm (1/4"). Comply with the manufacturer's written recommendations.
- .18 Fillet bead sealant joints to be sized to *Provide* proper contact area with substrates, in accordance with the manufacturer's written recommendations.
- .19 Apply sealants using pressure-operated guns fitted with suitable nozzles in accordance with the manufacturer's directions. Apply sealants in such manner as to ensure good adhesion to sides of joints and to completely fill voids in joints.
- .20 Apply sealants so that surfaces of joints are smooth, full bead, free from ridges, wrinkles, sags, air pockets and embedded impurities. Tool sealant surfaces to produce a smooth surface.
- .21 Remove droppings and excess sealant as work progresses, before material achieves initial set. Do not use soap and water in tooling.
- .22 *Install* sealant materials and primers when surfaces are prepared, and ambient temperature and weather conditions are prevalent, consistent with the manufacturer's recommendations. Primer is mandatory for gun applied sealants.
- .23 *Install* sealant with exterior face of sealant set back 10 mm (3/8") from face of adjacent materials at building movement joints, unless otherwise indicated.
- .24 Do not apply sealants to areas where installation of paints, coatings or flooring is in progress. Apply sealants after such work is complete and fully cured.

3.5 ADJUSTING AND CLEANING

- .1 Clean off excess sealant or sealant residue adjacent to sealant joint installations as the work progresses by methods approved by the joint sealant manufacturer. Do not damage adjacent surfaces with harmful removal techniques and protect finished surfaces beyond those that have been masked. Protect installed sealants during and after final curing from damage resulting during construction. Remove and replace damaged joint sealants, at the *Contractor's* expense.
- .2 Remove temporary coverings and masking protection from adjacent work areas upon completion. Remove construction debris from the *Site* on a planned and regular basis.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Extended Warranty
- .7 2.1 Manufacturer
- .8 2.2 Performance/Design Requirements
- .9 2.3 Louvres
- .10 2.4 Accessories
- .11 2.5 Finishes
- .12 2.6 Fabrication
- .13 3.1 Installation

1.3 SUMMARY

- .1 Section includes:
 - .1 Access Panels in Drywall Ceilings

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section, including the following information:
 - .1 Material types and thickness.
- .3 *Shop Drawings*:
 - .1 Submit engineered *Shop Drawings*.
 - .2 Include elevations, sections, and specific details for each panel.
 - .3 Show anchorage details and connections for component parts.

1.5 QUALITY ASSURANCE

- .1 Qualifications:

- .1 Installers / applicators / erectors: *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified, and with approval of *Product* manufacturer.

1.6 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Section 01 78 36 – Warranties for a period of two years as specified in Article A-15 of the Agreement Between *Owner* and *Contractor*.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- .1 *Specifications* are based on *Products* of the McGill Architectural Products. The following listed manufacturers are acceptable only when in compliance with requirements of this Section:

BAUCO ACCESS PANEL SOLUTIONS INC. DEVONSHIRE ROAD, VICTORIA, BC CANADA V9A 4T4

Or Equivalent

2.2 PERFORMANCE/DESIGN REQUIREMENTS

Model Number: 20-12-____ *series or 20-58-____ *series

Model Name:

Description:

BAUCO® plus II access panel for drywall

Virtually invisible access panel installs flush with wall and ceiling finishes. Finished panels leave not more than a 1/16" shadow/gap on finished surfaces. Hardware-free finish, opens with concealed touch latches. May be removed for full access, complete with safety catches. Suitable for new construction and repairs. Panels arrive ready for installation with factory installed gypsum board inlay. Door panel receives the same finish as the surrounding surface. Aluminum extrusion with gypsum board installed, no corrosive hardware, safety devices, installation kit, and bracing where needed. Standard: touch latch. Options: keyed latch, special board, acoustic backing. Panel drywall inlay shall equal the same specifications as wall and ceilings.

Finishing:

No bead required. Feather mud so that after the 3rd layer no irregularities shall be visible to the unaided eye at a distance of 1.5 m.

- Dimensions:** Standard sizes: 6" x 6", 8" x 8", 10" x 10", 12" x 12", 14" x 14", 16" x 16", 18" x 18", 20" x 20", 24" x 24", 24" x 36".
Custom size may be applicable. Refer to mechanical specification for access size.
- Sizing:** For a proper fit, the rough opening has to be 2 1/2" wider and longer than the door size, to a maximum of 8".
Cut opening in the gypsum wallboard will be the door size + 3/8".
- Notes:** * Model Numbers: 12 = 1/2" drywall, 58 = 5/8" drywall.
** Last 4 digits indicate panel size: 20-58-1818 = 18" x 18" square panel.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage, and Handling
- .8 2.1 Performance/Design Requirements
- .9 2.2 Materials
- .10 2.3 Fabrication - General
- .11 2.4 Fabrication – Steel Doors and Panels
- .12 2.5 Fabrication – Steel Frames
- .13 2.6 Hardware Reinforcements and Preparations
- .14 2.7 Frame Anchorage
- .15 2.8 Sizes and Tolerances
- .16 2.9 Hardware Locations
- .17 3.1 Examination
- .18 3.2 Installation – Steel Doors and Frames
- .19 3.3 Installation - Finishing Hardware
- .20 3.4 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - .1 Hollow metal doors and panels (steel doors).
 - .2 Insulated metal doors (insulated steel doors).
 - .3 Metal frames (steel frames, transom frames).
 - .4 Thermally broken metal door frames (thermally broken steel frames).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Cooperate fully with finish hardware distributor's representative during preparation of *Shop Drawings* and execution of shop fabrication.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit copy of National Association of Architectural Metal Manufacturers – Hollow Metal Manufacturers Association (NAAMM-HMMA) 840-07 standard.
- .3 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .4 *Shop Drawings*:
 - .1 Include details of each door and frame type, finish hardware types and locations, frame profiles, door and frame elevations, mitre details, fire protection rating, glazing preparation details and anchor details and locations.
 - .2 Include schedule identifying each unit, with door marks and numbers relating to numbering on the *Drawings* and in the door schedule.
 - .3 Electrified hardware requirements and preparations shall be clearly indicated on *Shop Drawings*.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacturers:
 - .1 *Provide* doors and frames manufactured by a firm specializing in the design and production of hollow metal steel doors and frames.
 - .2 Manufacturer shall be a member in good standing of the Canadian Steel Door Manufacturers Association (CSDMA) or *Equivalent* association acceptable to the *Consultant*.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2- PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Exterior insulated metal doors shall be tested to meet an operable U-value of 0.400.
- .2 Fire rating requirements:

- .1 Fire rated labelled doors and frames: tested in accordance with CAN/ULC-S104-10 and listed by a nationally recognized agency having a factory inspection service and shall be constructed as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .2 *Install* fire labelled steel door and frame *Products* in accordance with National Fire Protection Association (NFPA) 80, except where indicated otherwise in the *Contract Documents*.

2.2 MATERIALS

- .1 Steel:
 - .1 Fabricated from tensioned levelled steel in accordance with ASTM A924/A924M-14, galvanized in accordance with ASTM A653/A653M-11, Commercial Steel CS, Type B.
 - .2 Steel shall be free of scale, pitting, coil breaks, surface blemishes, buckles, waves, and other defects.
 - .3 *Equivalent* minimum base steel thicknesses for gauges shall be in accordance with Appendix 1 of Canadian Steel Door Manufacturers Association (CSDMA) "Recommended *Specifications* for Commercial Steel Door and Frame Products".
 - .4 Finish: Galvanneal coating designation ZF120 (A40).
- .2 Door core materials:
 - .1 Honeycomb: Structural small cell 25 mm (1") maximum kraft paper 'honeycomb'. Weight: 36.3 kg (80 lb) per ream (minimum). Density: 16.5 kg/m³ (1.03 pcf) minimum, sanded to required thickness.
 - .2 Polystyrene: Expanded Polystyrene (EPS), Type 1, density: 16 to 32 kg/m³ (1 to 2 pcf), thermal values: RSI 1.06 (R 6.0) minimum, conforming to ASTM C578-14a.
 - .3 Polyisocyanurate: Closed cell, faced board, thermal value: Relative Strength Index (RSI) 2.17 (R12.3) minimum, conforming to ASTM C1289-14a.
- .3 Adhesives:
 - .1 Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive.
 - .2 Rigid insulation cores: Heat resistant, epoxy resin based, low viscosity, contact cement.
 - .3 Lock seam doors: fire resistant, resin reinforced polychloroprene, high viscosity sealant-adhesive.
- .4 Primer: rust inhibitive for touch-up.
- .5 Finishing hardware: in accordance with Section 08 71 00 – Door Hardware.
- .6 Miscellaneous:
 - .1 Door silencers: single stud rubber or neoprene type.
 - .2 Exterior top caps: Rigid polyvinylchloride extrusion.
 - .3 Frame thermal breaks: Rigid polyvinylchloride extrusion.
 - .4 Glazing stops: formed channel of minimum 1 mm (0.039") (20 gauge) steel, 15.9 mm (5/8") high.

2.3 FABRICATION - GENERAL

- .1 Fabricate steel doors, frames, transoms, sidelights and borrowed lights as applicable, to the design and dimensions indicated in the *Contract Drawings*. Take field measurements where coordination with adjoining work is necessary.
- .2 Fabricate steel doors and frames to be rigid, neat in appearance and free from defects, warp, wave or buckle with all corners square unless otherwise indicated in the Contract Documents.
- .3 Operating clearances:
 - .1 *Provide* clearance at floor with allowance made for indicated finish flooring materials.
 - .2 Clearances for Fire-Rated Doors: As required by National Fire Protection Association (NFPA) 80.
 - .3 Clearances for Non-Fire-Rated Doors: Not more than 3 mm (1/8") at jambs and heads, except not more than 6 mm (1/4") between pairs of doors. Not more than 19 mm (3/4") at bottom.
- .4 Drill and tap or reinforce for mortised or surface mounted hardware in accordance with accepted hardware schedule, ANSI A115, NFPA 80, or manufacturers recommendations.
- .5 Countersink exposed fasteners unless otherwise shown in the Contract Documents. Use flat or oval head screws.
- .6 Reinforce components to resist stresses imposed by hardware in use.
- .7 Allow for anticipated expansion and contraction of frames and supports.
- .8 Fit elements at intersections and joints accurately together, in true planes, and plumb and level.
- .9 Weld continuously at joints exposed to view or at joints through which air or water could penetrate from the exterior of building to the interior.
- .10 Perform welding in accordance with CSA W59-15.
- .11 Mortise, reinforce, drill and tap to receive hardware and security devices using templates provided by respective *Supplier*.
- .12 Touch up finish damaged during fabrication.
- .13 Prepare doors or frames to receive seals where seals are indicated.
- .14 Attach labels to suit required fire-protection and temperature rise ratings.

2.4 FABRICATION – STEEL DOORS AND PANELS

- .1 Fabricate steel doors and panels to a thickness of 45 mm (1-3/4"), unless indicated otherwise in the Contract Documents.
- .2 Exterior and insulated doors and panels:
 - .1 Face sheets fabricated from 1.60 mm (0.063") 16 gauge steel.
 - .2 Insulation core:
 - .1 Polystyrene.
 - .2 Polyisocyanurate.

- .3 Longitudinal edges mechanically interlocked.
 - .1 Adhesive assisted with edge seams visible.
- .3 Interior doors and panels:
 - .1 Face sheets fabricated from 1.087 mm (18 gauge) steel.
 - .2 Honeycomb core.
 - .3 Longitudinal edges mechanically interlocked.
 - .1 Adhesive assisted with edge seams visible.
- .4 Fabricate of composite metal face construction with each face formed from flush sheet steel without visible seams, free of scale, pitting, coil brakes, buckles and waves.
- .5 Formed edges shall be true and straight with minimum radius for the thickness of steel used.
- .6 Lock and hinge edges shall be bevelled 3 mm in 50 mm (1/8" in 2") unless hardware or door swing dictates otherwise.
- .7 Top and bottom of doors shall be provided with inverted, recessed, 1.60 mm (0.063") 16 gauge steel end channels, welded to each face sheet at 50 mm (2") on centre maximum.
- .8 Prior to shipment, mark each door with an identification number as shown on the approved shop drawings.
- .9 Exterior doors shall be provided with factory installed flush Polyvinyl chloride (PVC) top caps. Fire labelled exterior doors shall be provided with factory installed flush steel top caps.
- .10 Blank, reinforce, drill and tap doors for mortised, templated hardware. Locate hardware to manufacturer's standard unless indicated otherwise in the Contract Documents.
- .11 Holes 12.7 mm (1/2") and larger shall be factory prepared.
- .12 Glazing:
 - .1 For glazing materials up to and including 8 mm (5/16") thick, doors shall be provided with 1.00 mm (0.039") 20 gauge steel glazing trim and snap-in glazing stops.
 - .2 For glazing materials greater than 8 mm (5/16") thick, doors shall receive 1.00 mm (0.039") 20 gauge steel trim and screw fixed glazing stops. Screws shall be #6 x 32 mm (1 1/4") oval head TekTM (self-drilling) type at 305 mm (12") on centre maximum.
 - .3 Glazing trim and stops shall be accurately fitted (within 0.39 mm (0.015") tolerance), butted at corners, with removable glazing stops located on the 'push' side of the door.
- .13 Fabricate closing stiles of paired doors as indicated in the Shop Drawings and Contract Documents. .
- .14 Where indicated in the *Contract Documents*, prepare doors and panels for installation of fire-rated door grilles. If required to meet door grille manufacturer's rated design, *Provide* reinforcement around door grill opening.

2.5 FABRICATION – STEEL FRAMES

- .1 General: Applicable to frames, transom panel frames, sidelights, and window assemblies.
- .2 Interior and non-thermally broken frames; welded:

- .1 Fabricated from:
 - .1 1.60 mm (0.063") 16 gauge steel.
 - .2 1.98 mm (0.078") 14 gauge steel for frames noted as heavy duty.
- .2 Supplied set-up and welded (SUW).
- .3 Factory assembled frame product shall be square, free of defects, warps or buckles.
- .4 Set-up and welded (SUW) corner joints
 - .1 Profile welded–punch mitred, continuously welded on inside of the profile faces, rabbets, returns and soffit intersections, with exposed faces filled and ground to a smooth, uniform seamless surface, as defined in the CSDMA - "Recommended *Specifications* for Commercial Steel Door and Frame Products".
- .5 SUW joints at mullions, sills and center rails:
 - .1 Coped accurately, butted and tightly fitted.
 - .2 At intersecting flush profile faces, securely weld, fill and grind to flush, smooth, uniform, seamless surface.
 - .3 At intersecting recessed profile faces, securely weld to concealed reinforcements, with exposed hairline face seams.
 - .4 At other intersecting profile elements make exposed face seams to hairline tolerance.
- .6 Glazing stops shall be formed 1.00 mm (0.039") 20 gauge steel, 16 mm (0.625") height channel, accurately fitted, butted at corners and fastened to frame sections with #6 x 32 mm (1¼") oval head Tek (self-drilling) type screws at 305 mm (12") on centre maximum.
- .7 Where required due to *Site* access, when required for co-ordination or installation, or shipping limitations, frame *Product* shall be fabricated in sections for splicing in the field.
 - .1 Field spliced jambs, heads and sills shall be provided with 1.60 mm (0.063") 16 gauge steel splice plates securely welded into one section, extending 100 mm (4") minimum each side of splice joint.
 - .2 Field splices at closed sections (mullions or center rails) shall be 1.60 mm (0.063") 16 gauge steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100 mm (4") minimum into closed sections when assembled.
 - .3 Field splice joints shall be welded, filled and ground to present a smooth uniform surface by the installation company responsible for installation after assembly.
- .8 On factory assembled frame *Product*, *Provide* two temporary steel shipping bars welded to the base of the jambs or mullions to maintain alignment during shipping and handling. Remove shipping bars prior to anchoring of frames to floor.
- .9 Each door opening shall be prepared for single stud door silencers. Silencers shall be shipped loose for installation by installer, after finish painting.
 - .1 Single interior doors: three at strike jamb.
 - .2 Pair of interior doors: two at header.
 - .3 Dutch doors: four at strike jamb.

- .4 Weather-stripped doors: None required.
- .5 Sound, light, or smoke sealed doors: None required.
- .6 Transom panels: two at each jamb.
- .10 Prior to shipment, mark each frame with an identification number as shown on the approved submittal drawings.
- .11 *Provide* mullions and transom bars of closed construction type. For fixed condition, attach members to frame with butt-welded joints. For removable condition, attach members with removable mullion anchors.
- .12 Conceal fastenings unless otherwise indicated in the Contract Documents.
- .13 Fasten removable stops by counter-sunk Phillips head screws at approximately 225 mm (9") on centre symmetrically spaced on stop length.
- .14 Anchor frames to floor by 1.60 mm (0.063") 16 gauge thick angle clips, welded to frame and *Provide* with 2 holes for floor anchorage.
- .15 Grind welded corners to a flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- .16 Protect strike and hinge reinforcements using guard boxes welded to frames at masonry construction.
- .17 Reinforce head of frames wider than 1220 mm (48").
- .18 Brace frame units to prevent distortion in shipment and protect finish.
- .19 Where removable mullions provided under this Section are indicated, head or transom mullion shall be reinforced. *Provide* loose mounting bracket/shoe mechanical fasteners and installation instructions.

2.6 HARDWARE REINFORCEMENTS AND PREPARATIONS

- .1 Door and frame *Product* shall be blanked, reinforced, drilled and tapped at the factory for fully templated mortise hardware only, in accordance with the approved hardware schedule and templates provided by the hardware *Supplier*.
- .2 Door and frame *Products* shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
- .3 Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware are required frame *Product* shall be reinforced only, with drilling and tapping done by field installation.
- .4 Templated holes 12.7 mm (1/2") diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by installation on the *Site*. Templated holes less than 12.7 mm (1/2") diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
- .5 Hinge reinforcements shall be 3.51 mm (0.138") 10 gauge steel minimum, high frequency type shall be provided by the Contractor.
- .6 Frames shall be prepared for 114 mm (4.5") standard weight hinges minimum unless otherwise indicated in the Contract Documents.

- .7 Doors and frames in excess of 2450 mm (96") rabbet height shall be prepared for 114 mm (4.5") heavy weight 4.6 mm (0.180") hinges minimum.
- .8 Lock, strike and flush bolt reinforcements shall be 1.60 mm (0.063") 16 gauge steel minimum, with extruded tapped holes that *Provide* equivalent number of threads as 2.74 mm (0.108") 12 gauge.
- .9 Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 1.30 mm (0.051") 18 gauge steel minimum.
- .10 Reinforcements are not required for surface applied hardware supplied with thru-bolts and spacers or sex-bolts.
- .11 *Provide* hardware mortises on perimeter frame members to be grouted in masonry or concrete partitions with 0.84 mm (0.033") 22 gauge steel grout guards.
- .12 Electrified hardware:
 - .1 Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware *Supplier*, hardware enclosures and/or junction boxes, where indicated in the Contract Documents, shall be provided by the Contractor and inter-connected with CSA approved 12.7 mm (1/2") diameter conduit and connectors.
 - .2 Refer to electrical documents for general electrical rough-in details. At door locations indicated in electrical documents as requiring rough-in only of electrical (i.e. where no electrically or electronically operated hardware is specified in the hardware schedule), *Provide* enclosures, boxes, and conduit to permit future installation of devices without removal of grout, demounting of frames, or installation of exposed conduits.
 - .3 Frames:
 - .1 Frames with electrified devices shall include electrical connection boxes sized to accommodate devices specified in Section 08 71 00 – Door Hardware. At time of frame manufacture, electrical connection boxes shall be supplied by Divisions 26 and 28 for installation into frame by work of this Section.
 - .2 Frame electrical connection boxes shall be positioned flush to edge of frame face return. Clearance shall be maintained to allow wall material to be consistently applied for length of frame member. Frame connection boxes shall be welded in place and positioned to allow necessary clearance for electrical *Subcontractor* to install conduit and connection components, with conduit layout in a manner that takes conduit up to ceiling in an uninterrupted configuration and to accommodate wire installation.
 - .4 Doors:
 - .1 Doors with electrified devices shall be manufactured to include wire raceway in door panel to accommodate electrified devices, such as electric hinge, power transfer units, electrified locks, electrified door closures and electrified exit devices. Construction of raceways shall *Provide* a continuous conduit or channel between entry and exit points to accommodate wire installation after door manufacture.
 - .2 Doors with electrified locks may require extended space to accommodate plug-type connection components or wire collection space. Coordinate with work of Section 08 71 00 – Door Hardware and obtain hardware templates for electrified hardware clearly indicated on reviewed *Shop Drawings* and prior to door manufacture.

2.7 FRAME ANCHORAGE

- .1 Frame *Products* shall be provided with anchorage appropriate to floor, wall and frame construction.
- .2 Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb.
- .3 Frame *Products* for installation in new masonry walls shall be provided with steel adjustable wall anchors of the T-strap, stirrup or wire, 1.60 mm (0.063") 16 gauge minimum or 3.96 mm (0.156") diameter wire. Straps shall be not less than 50 mm (2") x 254 mm (10") in size, corrugated and/or perforated.
- .4 Frame products installed in steel stud and drywall partitions shall be provided with 1.00 mm (0.039") 20 gauge steel snap-in or "Z" stud type anchors.
- .5 Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4 mm (1/4") diameter, located not more than 150 mm (6") from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb. Each preparation shall be provided with 1.60 mm (0.063") 16 gauge anchor bolt guides.
- .6 The *Contractor* shall ensure that anchor bolts and expansion shell anchors for the above preparations are provided by the installation company.
- .7 Where frame product is installed prior to construction of the adjacent wall, each jamb shall be provided with 1.60 mm (0.063") 16 gauge steel floor anchors. Each anchor shall be provided with 2 holes for mounting to the floor and shall be securely welded to the inside of the jamb profile.
- .8 On sidelights or windows exceeding 3 m (9'-10") in width, installed in stud partitions, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 2.74 mm (0.108") 12 gauge steel formed channels, mounting angles and adjusting brackets, with mounting angles welded to the inside of frame head. Formed channels, adjusting brackets and fasteners shall be shipped loose. The *Contractor* shall ensure that Channels are mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on *Site*, by the *Subcontractor* responsible for installation.

2.8 SIZES AND TOLERANCES

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

2.9 HARDWARE LOCATIONS

- .1 Hardware preparations in frame *Product* shall be as noted below and locations on doors shall be adjusted for clearances specified in subsection 2.8 of this Section.
- .2 Top of upper hinge preparation for 114.3 mm (4.5") hinges shall be located 180 mm (7.5") down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3 mm (4.5") hinges shall be located 310 mm (12.625") from finished floor as defined in subsection 2.8 of this Section. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts.
- .3 Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033 mm (40-5/16") from finished floor. Strikes for deadlocks shall be centered at 1220 mm (48") from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer's templates.
- .4 Push and/or pulls on doors shall be centered 1070 mm (42") from finished floor.
- .5 Preparations not noted above shall be as per hardware manufacturer's templates.
- .6 Hardware preparation tolerances shall comply with the ANSI A115 standards.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION – STEEL DOORS AND FRAMES

- .1 Set frame *Product* plumb, square, aligned, without twist at correct elevation in accordance with NAAMM-HMMA 840-07.
- .2 Frame *Product* installation tolerances:
 - .1 Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be ± 1.6 mm ($\pm 1/16$ ").
 - .2 Squareness tolerance, measured through a line 90 from one jamb at the upper corner of the product, to the opposite jamb, shall be ± 1.6 mm ($\pm 1/16$ ").
 - .3 Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be ± 1.6 mm ($\pm 1/16$ ").
 - .4 Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be ± 1.6 mm ($\pm 1/16$ ").
- .3 Fire labelled *Product* shall be installed in accordance with NFPA 80.
- .4 Brace frame *Product* rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install temporary wood spreaders at mid-point of frame rabbet height to maintain frame widths. Remove wood spreaders after product has been built-in.
- .5 *Provide* vertical support at center of head for openings exceeding 1250 mm (48") in width.

- .6 Secure anchorages and connections to adjacent construction.
- .7 Execute installation and assembly using skilled forces under supervision of a competent joinery foreperson.
- .8 *Install* doors in accordance with National Association of Architectural Metal Manufacturers – Hollow Metal Manufacturers Association (NAAMM-HMMA) 840-07, maintaining clearances outlined in paragraph 2.8 of this section.
- .9 *Install* finishing hardware in accordance with ANSI A115.1G-1994, manufacturers' templates and instructions, and Section 08 71 00 – Door Hardware.
- .10 Adjust operable parts for correct clearances and function.
- .11 Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.
- .12 Remove grout or other bonding material from *Products* immediately following installation.
- .13 *Provide* appropriate anchorage for floor and wall construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite the strike jamb. On each jamb, install two anchors for openings up to and including 1525 mm (60") high and install one anchor for each additional height of 760 mm (30") of height or fraction thereof, except as indicated below. Frames placed in previously placed concrete, masonry or structural steel shall be *Provided* with anchors located not more than 150 mm (6") from top and bottom of each jamb, and intermediate anchors at 660 mm (26") on centre maximum.
- .14 Secure frames set in previously constructed concrete or masonry openings by countersunk expansion bolts at same centres as for adjustable Tee wall anchors. Reinforce frame at fastening location to prevent indentation of frame by fastening device.
- .15 Fill and grind smooth "punch and dimpled" frame installations.
- .16 Prior to *Site* touch-up, exposed surfaces of galvanized steel to be finished shall be cleaned to remove foreign matter. Refer to paint manufacturers recommendations for additional information and requirements of Section 09 91 00 - Painting.
- .17 Touch-up exposed field welds shall be finished to present a smooth uniform surface and with a rust inhibitive primer.
- .18 Touch-up exposed surfaces that have been scratched or otherwise marred during shipment, installation, and handling shall be with a rust inhibitive primer.
- .19 Finish paint in accordance with Section 09 91 00 - Painting.
- .20 *Install* door silencers.
- .21 Adequately fasten units and secure in place with concealed fixings wherever possible. Include grounds and furring where required.
- .22 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00 – Door Hardware.
- .23 Make allowance for deflection to ensure structural loads are not transmitted to frames.
- .24 Adjust operable parts for correct clearances and function.

3.3 INSTALLATION - FINISHING HARDWARE

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

3.4 ADJUSTING AND CLEANING

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Extended Warranty
- .7 2.1 Manufacturer
- .8 2.2 Performance/Design Requirements
- .9 2.3 Louvres
- .10 2.4 Accessories
- .11 2.5 Finishes
- .12 2.6 Fabrication
- .13 3.1 Installation

1.3 SUMMARY

- .1 Section includes:
 - .1 Access Panels in Drywall Ceilings

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section, including the following information:
 - .1 Material types and thickness.
- .3 *Shop Drawings*:
 - .1 Submit engineered *Shop Drawings*.
 - .2 Include elevations, sections, and specific details for each panel.
 - .3 Show anchorage details and connections for component parts.

1.5 QUALITY ASSURANCE

- .1 Qualifications:

- .1 Installers / applicators / erectors: *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified, and with approval of *Product* manufacturer.

1.6 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Section 01 78 36 – Warranties for a period of two years as specified in Article A-15 of the Agreement Between *Owner* and *Contractor*.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- .1 *Specifications* are based on *Products* of the McGill Architectural Products. The following listed manufacturers are acceptable only when in compliance with requirements of this Section:

BAUCO ACCESS PANEL SOLUTIONS INC. DEVONSHIRE ROAD, VICTORIA, BC CANADA V9A 4T4

Or Equivalent

2.2 PERFORMANCE/DESIGN REQUIREMENTS

Model Number: 20-12-____ *series or 20-58-____ *series

Model Name:

Description:

BAUCO® plus II access panel for drywall

Virtually invisible access panel installs flush with wall and ceiling finishes. Finished panels leave not more than a 1/16" shadow/gap on finished surfaces. Hardware-free finish, opens with concealed touch latches. May be removed for full access, complete with safety catches. Suitable for new construction and repairs. Panels arrive ready for installation with factory installed gypsum board inlay. Door panel receives the same finish as the surrounding surface. Aluminum extrusion with gypsum board installed, no corrosive hardware, safety devices, installation kit, and bracing where needed. Standard: touch latch. Options: keyed latch, special board, acoustic backing. Panel drywall inlay shall equal the same specifications as wall and ceilings.

Finishing:

No bead required. Feather mud so that after the 3rd layer no irregularities shall be visible to the unaided eye at a distance of 1.5 m.

- Dimensions:** Standard sizes: 6" x 6", 8" x 8", 10" x 10", 12" x 12", 14" x 14", 16" x 16", 18" x 18", 20" x 20", 24" x 24", 24" x 36".
Custom size may be applicable. Refer to mechanical specification for access size.
- Sizing:** For a proper fit, the rough opening has to be 2 1/2" wider and longer than the door size, to a maximum of 8".
Cut opening in the gypsum wallboard will be the door size + 3/8".
- Notes:** * Model Numbers: 12 = 1/2" drywall, 58 = 5/8" drywall.
** Last 4 digits indicate panel size: 20-58-1818 = 18" x 18" square panel.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- 1.1 General Instructions
- 1.2 Section Includes
- 1.3 Summary
- 1.4 Submittals
- 1.5 Closeout Submittals
- 1.6 Quality Assurance
- 1.7 Delivery, Storage, and Handling
- 2.1 Performance/Design Requirements
- 2.2 Materials
- 2.3 Four-Fold Metal Doors
- 2.4 Motorized Operation
- 2.5 Fabrication
- 3.1 Examination
- 3.2 Electrical Wiring
- 3.3 Installation – General
- 3.4 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - .1 Four-fold metal doors; motorized.
- .2 All costs associated with the work of this Section shall be included in the *Contract Price*.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 *Shop Drawings*:
 - .1 Include details of each door and frame type, hardware types and locations, frame profiles, door and frame elevations, anchor details and locations.
 - .2 Include schedule identifying each unit, with door marks and numbers relating to numbering on the *Drawings* and in the door schedule.

- .3 Indicate materials, operating mechanisms, required clearances and electrical connections

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacturers: The *Contractor* shall ensure that doors are manufactured by a firm with a minimum of 10 years' experience in the fabrication and installation of specified doors.
 - .1 The *Contractor* shall ensure that manufacturers proposed for use, which are not named in these *Specifications*, submit evidence of ability to meet performance and fabrication requirements specified in Division 8 of the specifications, and include a list of five projects of similar design and complexity completed within the past five years.
 - .2 Installers / applicators / erectors: The *Contractor* shall ensure that the installation of doors is performed by the authorized representative of the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Package or crate, and brace *Products* to prevent distortion in shipment and handling. Label packages and crates and protect finish surfaces by sturdy wrappings.

PART 2- PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Exterior door construction shall be designed to withstand wind load in accordance with the requirements of the Ontario Building Code.

2.2 MATERIALS

- .1 General:
 - .1 Single-source responsibility: *Provide* doors, tracks, motors, and accessories from one manufacturer for each type of door. *Provide* secondary components from source acceptable to manufacturer of primary components.
- .2 Steel:
 - .1 Structural steel: ASTM A36/A36M.
 - .1 Hot dip galvanizing: for irregular sections, conforming to CAN/CSA G164- M92, minimum zinc coating of 600 g/m² (21 oz. /ft²).
 - .2 Steel sheets: Steel sheets of commercial quality, complying with ASTM A36/A36M cold-rolled steel sheet, or ASTM A1011/A1011M-10 hot-rolled steel sheet.
 - .1 Zinc coated sheet steel: sheet steel to ASTM A653/A653M-11 with coating designation Z275 (G90) to ASTM A924/A924M-14.

- .3 Hardware: Door manufacturer's standard heavy-duty hardware components, galvanized.
- .4 Fasteners:
 - .1 Zinc-coated steel.

2.3 FOUR-FOLD METAL DOORS

- .1 Manufacturers/Acceptable *Products*:
 - .1 Door Engineering and Manufacturing Company, Tel: 1-800-959-1352, or *Equivalent*.
 - .2 Acceptable *Product*:
 - .1 Door; complete with glazing panels: 'FF300 Series' as supplied by Northern Dock Systems Inc. or *Equivalent*.
- .2 Construction:
 - .1 Door assembly shall be fully welded minimum 2.5 mm (0.1") 11-gauge structural steel tube framing with sheet steel facing on the exterior and interior faces, hot-dipped galvanized after door fabrication.
 - .2 Steel sheeting shall be formed on vertical edges with no visible welds on interior or exterior panel faces.
 - .1 Face sheets fabricated from:
 - .1 1.5 mm (0.06") 16-gauge steel.
 - .3 Frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 3 mm in 6000 mm (1/8" in 20').
 - .4 Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.
 - .5 Door panels thickness: 50 mm (2") thick minimum.
 - .6 Insulation:
 - .1 Fibreglass
 - .7 Door finish:
 - .1 All steel shall be painted with standard factory applied gray oxide primer. Finish paint shall be factory applied: Ral Color 7024 (Charcoal Gray) or *Equivalent*.
- .3 Operating hardware:
 - .1 Hardware shall include guide tracks and brackets, trolleys, guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation.
 - .2 Jamb hinges shall be dual shear and have two thrust bearings and two needle bearing.
 - .3 Fold hinges shall be dual shear with two thrust bearings.
 - .4 Bearings shall be completely concealed within hinge barrels.
 - .5 Hinge pins shall be non-removable, minimum 19 mm (3/4") diameter hardened steel.

- .6 Trolleys to be equipped with nylon, bronze or ball bearing rollers.
- .4 Weatherstripping:
 - .1 Material shall be adjustable and readily replaceable and *Provide* a substantially weathertight installation.
 - .2 Weatherstripping at and bottom shall be 1.6 mm (1/16") cloth inserted neoprene.
 - .3 Weatherstripping shall be retained continuously.
 - .4 Perimeter weatherstripping: Jamb and head weatherstripping, 1.6 mm (1/16") cloth-inserted neoprene bulb or closed cell neoprene.
- .5 Glazing panels:
 - .1 Vision panels: *Provide* vision panels of type, size, shape and location as noted on the *Drawings*.
 - .1 Glazing type: 25mm, Sealed, insulated, tempered, grey tinted units, with Low E coating on 2nd surface – Pilkington Energy Advantage or *Equivalent*.
 - .2 *Provide* Bird-Friendly dots in accordance with the *Contract Documents*.

2.4 MOTORIZED OPERATION

- .1 Motorized operation:
 - .1 Door opening speed: 0.6096 mm/s (2 fps).
 - .2 Each four-fold door shall be operated by an overhead mounted electro- mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.
 - .3 Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to free wheeling mode for manual operation.
 - .4 Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity.
 - .5 Power supply: 3 phase 230 VAC, 60 Hertz, unless otherwise indicated.
 - .6 Electric controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest National Electrical Manufacturers Association (NEMA) standards. Control circuits shall not exceed a nominal 110 volts.
 - .1 Controls shall include a self diagnostic programmable logic controller with digital message display and input LED. Controller shall include programmable close time delays and maximum open and close run-time timers.
 - .2 Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.

- .3 Enclosures shall be NEMA 4 with programmable door logic controller, Variable Frequency Drive (VFD) for Speed Control, O/C/S Pushbuttons, Auto/Hand selector switch and power disconnect.
- .4 Pushbuttons for each door shall have one momentary pressure three-button push-button station marked "OPEN", "CLOSE" and "STOP". Push button enclosure shall be NEMA 4.
- .5 Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
- .7 Safety edges: Electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
- .8 Photo eyes: One interior and one exterior mounted photo eye (sender/receiver type) with mounting brackets. Photo eyes shall be NEMA 4.
- .9 Remote control units:
 - .1 *Provide* radio receiver and single button remote control units.
 - .1 Quantity; remote control units: as directed by the *Consultant*.
- .10 Wiring: Door manufacturer shall supply controls only. The *Contractor* shall ensure that the electrical *Subcontractor Installs* controls, and furnishes and Installs conduits and wiring for *Site* power and control wiring.

2.5 FABRICATION

- .1 Fabricate work of this Section with materials, and with component dimensions and gauges, reinforcing, attached anchors and fastenings of adequate strength to prevent warping, buckling, opening of joints and seams, loosening of hardware, distortion, and displacement within limits of intended and specified use.
- .2 Conceal and weld connections wherever possible.
- .3 Fit joints and junctions between components tightly and in true planes.
- .4 Isolate from each other dissimilar metals, and metal from concrete or masonry to prevent electrolysis. On aluminum, use bituminous paint in concealed locations and lacquer where exposed to view.
- .5 Finishing:
 - .1 File and grind exposed welds smooth.
 - .2 Zinc coating: clean and smooth ground surfaces at welds, fill if necessary, and prime all areas from which zinc coating has been removed with zinc rich paint applied in a minimum thickness of 0.102 mm (0.004").

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine building structure, finishes and conditions at the *Place of the Work*.
- .2 Notify the *Consultant* of any adverse conditions which could jeopardize system installation or system operation. Do not proceed until such conditions have been documented, assessed, rectified and approved for installation. Starting work indicates acceptance of conditions unless the *Consultant* is notified otherwise in writing.

3.2 ELECTRICAL WIRING

- .1 Power shall be brought up to circuit breaker/disconnect switch adjacent to controller and in conformance with requirements specified in this Section.
- .2 Wiring from motor to switches, controls, starters, safety devices and other items requiring power shall be carried out under work of this Section.
- .3 Use Electric Metallic Tube (EMT) conduit for fixed wiring. Use purpose-made and approved type flexible cables or cords at applicable locations; adequately support so as not to impede access or foul moving parts of equipment.

3.3 INSTALLATION – GENERAL

- .1 *Install* doors and operators in accordance with the door manufacturer's printed instructions.
- .2 The *Contractor* shall ensure that *Work* is performed by qualified personnel approved by door manufacturer.
- .3 Fit doors snugly to edges of jambs and heads of frames. Doors shall operate smoothly and freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward.
- .4 Furnish necessary appurtenances relating to door installation, including those required on door frames.
- .5 Upon completion of installation of doors and operating equipment, lubricate moving parts prior to putting into operation. Supply oil to gear reduction units and grease sprockets, bearings, cables, link chains and door guides. Check and re-adjust as required, items of operating hardware, including weatherstripping.
- .6 *Install* doors to operate freely and to close tight.
- .7 Full commissioning and training shall be completed after installation.

3.4 ADJUSTING AND CLEANING

- .1 Adjust work of this Section to ensure free-running, tightly closing and properly counterbalanced operation. Ensure that installation is free from warp, twist or other distortion. Lubricate operating hardware.
- .2 Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at the *Site* only if approved.
- .3 Clean work on completion of installation.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SUMMARY

- .1 Section includes:
 - .1 Sectional overhead metal doors.

1.3 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Product data sheets:
 - .1 Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Include details of each door and frame type, hardware types and locations, frame profiles, door and frame elevations, anchor details and locations.
 - .2 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in door schedule.
 - .3 Indicate materials, operating mechanisms, required clearances and electrical connections

1.4 CLOSEOUT SUBMITTALS

- .1 Operation and maintenance data:
 - .1 Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals in accordance with Section 01 77 00.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacturers: Sectional doors shall be manufactured by a firm with a minimum of 5 years experience in the fabrication and installation of sectional doors. Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past 5 years.
 - .2 Installers / applicators / erectors: Installation of sectional doors shall be performed by the authorized representative of the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Package or crate, and brace Products to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- .1 The Contract Documents have been based on the following system:

- .1 'SDI – C175 75mm High Lift Sectional Door, as manufactured by Service Door Industries., 2700 mm wide x 3400 mm high.

2.2 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Design exterior door assembly to withstand windload of 1 kPa (0.1 PSI) with a maximum horizontal deflection of 1/240 of opening width.
- .2 Design door panel assemblies with thermal insulation factor R14.
- .3 Design door panel assemblies to withstand minimum 50,000 cycles per annum.

2.3 MATERIALS

- .1 General:
 - .1 Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
 - .2 Galvanized steel sheet: 0.5 mm (0.02") roll formed commercial quality to ASTM A653/A653M-08 with Z275 zinc coating to both faces.
 - .3 Steel structural shapes, plates, bars, angles, dowels, and the like: to CSA G40.21-04, grade 300W.
 - .4 Aluminum extrusions: 6063-T6 alloy and temper, clear anodized.
 - .5 Touch-up primer: to CAN/CGSB 1.181-M99 for galvanized steel surfaces.
 - .6 Insulation: polyurethane, to achieve R14.
 - .7 Cable: multi-strand galvanized steel aircraft cable to ASTM A1023M.

2.4 ACCESSORIES

- .1 Overhead horizontal track and operator supports: galvanized steel, type and size to suit installation.
- .2 Track guards: 5 mm (1/4") thick formed sheet 1500 mm (59") high.
- .3 Pusher springs.
- .4 Weather stripping: aluminum vinyl C 'Arctic' standard.

2.5 HARDWARE

- .1 All hardware to be galvanized steel.
- .2 Track: standard hardware with 75 mm (3") size minimum 2.28 mm (0.09") core thickness galvanized steel track.
- .3 Track supports: 2.3 mm (0.1") core thickness continuous galvanized steel angle track supports constructed of 32 mm (1-1/4") x 4.76 mm (0.2") steel angle neatly cut and connected. Punched steel angle is not acceptable.
- .4 Spring counter balance: heavy duty oil tempered torsion spring with manufacturer's standard brackets and as follows:
 - .1 Minimum rating: 50,000 cycles per annum.
 - .2 Drum: 133 mm (5.2") diameter.
 - .3 Shaft: 25 mm (1") diameter solid steel.

- .4 Install cycle counter device.
- .5 Top roller carrier: galvanized steel minimum 2.28 mm (0.09") thick adjustable.
- .6 Rollers: full floating, grease packed hardened steel, ball bearing minimum 75 mm (3") diameter, stamped tire.
- .7 Roller brackets: adjustable, galvanized steel, 2.5 mm (0.1") thick.
- .8 Hinges: standard duty industrial 2.28 mm (0.09") thick galvanized steel.
- .9 Cable: minimum 4 mm (0.2") diameter galvanized aircraft cable.

2.6 FINISHES

- .1 Sheet steel shall be prefinished with factory applied silicone modified polyester to the following:
 - .1 Colour: manufacturer's standard white. Submit sample to Consultant for review prior to fabrication.
 - .2 Specular gloss: 30 units in accordance with ASTM D523-08.
 - .3 Coating thickness: not less than 25 micrometres.
 - .4 Resistance to accelerated weathering for chalk rating of 8 colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .5 Outdoor exposure period 1000 hours.
 - .6 Humidity resistance exposure period 1000 hours.
- .2 Galvanizing: hot dipped with zinc coating 600 g/m² (21 oz/ft²) to CAN/CSA G164-M92, except as otherwise noted.

2.7 MOTORIZED OPERATION

- .1 Motorized Operation: Jackshaft type:
 - .1 Heavy duty: Manaras Model Opera-SH – 0.5 HP, voltage to suit supply voltage.
 - .2 Auxiliary operation: include hand chain to operate door manually and independently of motor operator. Incorporate interlock to disconnect motor mechanically and electrically when auxiliary operator is engaged.
 - .3 Provide momentary relay contact for off-delay timers, and rated for 25 cycles per hour or 100 cycles per day.
- .2 Electrical supply is 120/208 Volt, 3 Phase.
- .3 Entrapment Protection:
 - .1 Photoelectric sensors.
- .4 Operator Controls:
 - .1 Type: Push-button.
 - .2 Function: operated control stations with open, close, and stop buttons for surface mounting, for interior location.

2.8 FABRICATION

- .1 Fabricate work of this section with materials, and with component dimensions and gauges, reinforcing, attached anchors and fastenings of adequate strength to prevent warping, buckling,

opening of joints and seams, loosening of hardware, distortion, and displacement within limits of intended and specified use.

- .2 Conceal and weld connections wherever possible.
- .3 Fit joints and junctions between components tightly and in true planes.
- .4 Isolate from each other dissimilar metals, and metal from concrete or masonry to prevent electrolysis. On aluminum, use bituminous paint in concealed locations and lacquer where exposed to view.
- .5 Finishing:
 - .1 File and grind exposed welds smooth.
 - .2 Zinc coating: clean and smooth ground surfaces at welds, fill if necessary, and prime all areas from which zinc coating has been removed with zinc rich paint applied in a minimum thickness of 0.102 mm (0.004").

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine building structure, finishes and conditions at the Place of the Work.
- .2 Notify Consultant of any adverse conditions which could jeopardize system installation or system operation. Do not proceed until such conditions have been documented, assessed, rectified and approved for installation. Starting work indicates acceptance of conditions unless Consultant is notified otherwise in writing.

3.2 ELECTRICAL WIRING

- .1 Power shall be brought up to circuit breaker/disconnect switch adjacent to controller under the work of Divisions 26, 27, and 28 and in conformance with requirements specified therein.
- .2 Wiring from motor to switches, controls, starters, safety devices and other items requiring power shall be carried out under this Section.
- .3 Use EMT conduit for fixed wiring. Use purpose-made and approved type flexible cables or cords at applicable locations; adequately support so as not to impede access or foul moving parts of equipment.

3.3 INSTALLATION – GENERAL

- .1 Install sectional overhead doors and operators in accordance with door manufacturer's printed instructions.
- .2 Work shall be performed by qualified personnel approved by door manufacturer.
- .3 Secure guides to steel framing members, header box to side guides and the motor to header box.
- .4 Drill and tap door frames to receive hardware. Fasten door tracks and stops to door frame by means of machine bolts; welding will not be permitted.
- .5 Fit doors snugly to edges of jambs and heads of frames. Doors shall operate smoothly and freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward. Furnish necessary appurtenances relating to door installation, including those required on door frames.
- .6 Upon completion of installation of doors and operating equipment, lubricate moving parts prior to putting into operation. Supply oil to gear reduction units and grease sprockets, bearings, cables,

link chains and door guides. Check and re-adjust as required, items of operating hardware, including weatherstripping.

- .7 Install doors to operate freely and to close tight.

ADJUSTING AND CLEANING

- .1 Adjust work of this section to ensure free-running, tightly closing and properly counterbalanced operation. Ensure that installation is free from warp, twist or other distortion. Lubricate operating hardware.
- .2 Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at site only if approved.
- .3 Clean work on completion of installation.
- .4 Adjust weather-stripping to form a weathertight seal.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Closeout Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage, and Handling
- .8 1.8 Field Conditions
- .9 1.9 Warranty
- .10 2.1 Manufacturer
- .11 2.2 Performance/Design Requirements
- .12 2.3 Materials
- .13 2.4 Entrance Framing
- .14 2.5 Aluminum Entrance doors - Exterior
- .15 2.6 Aluminum Entrance Doors - Interior
- .16 2.7 Aluminum Curtain Wall
- .17 2.8 Finishes
- .18 2.9 Fabrication
- .19 3.1 Installation
- .20 3.2 Air Vapour Barrier Closures
- .21 3.3 Glazing
- .22 3.4 Sealants
- .23 3.5 Hardware
- .24 3.6 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - .1 Aluminum entrances.
 - .2 Aluminum windows.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:

- .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 *Shop Drawings*:
 - .1 Further to requirements of Section 01 33 00 – Submittal Procedures, indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anticipated deflection under load, affected related work, weep drainage network, expansion and contraction joint location and details, field welding, coordination with hardware and electrical requirements.
 - .2 Identify and describe material types being supplied, wall thicknesses of extrusions, and shapes including connections and grades, dimensions and tolerances (minimum and maximum), attachments, reinforcing, anchorage and locations of fastenings, and provisions for thermal and structural movement between components of this section and adjacent materials.
 - .3 Include description of materials, metal finishing specifications, and other pertinent information.
 - .4 Design loads, typical reactions and support movement allowances, both vertical and horizontal, shall be placed on the *Shop Drawings*.
 - .5 *Shop Drawings* shall clearly indicate the specification of materials and, where applicable, indicate installation methods and coordination with other Sections.
 - .6 Submit framing member structural and physical characteristics, calculations, dimensional limitations, special installation requirements.
- .4 Samples:
 - .1 Submit samples of frame, sill and mullion sections, sill flashing and accessories, fasteners for connection of frame to opening, glazing tape, glass retainers, glazing gaskets, screening and frame, spandrel panels and each finish material and any other material, as requested.
 - .2 Samples of colour and finish prepared as specified on respective metal components for both extrusion and sheet.
 - .3 Identify samples as to treatment, thickness, alloy, framing composition, colour, manufacture, performance standard and portion of the work to which they apply.
 - .4 Fabrication shall not proceed without written acceptance of samples from the *Consultant*.
- .5 Test reports:
 - .1 Submit valid laboratory test reports, prepared by an independent laboratory, verifying that proposed system has been tested by an independent laboratory and achieved performance values that meet the specified performance criteria.

1.5 CLOSEOUT SUBMITTALS

- .1 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for incorporation into the operation and maintenance manuals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Installers / applicators / erectors:

- .1 Execute work of this Section only by company who has adequate plant, equipment, and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.
- .2 *Provide* at least one Foreperson who shall be thoroughly trained and experienced in skills required, be completely familiar with referenced standards and requirements of this work, and personally direct installation performed under this Section.
 - .1 Foreperson experience: Minimum 10 years' experience as glazing mechanic.
 - .2 Typical glazing mechanic experience: Minimum 3 years' experience as glazers.
- .3 Welding: Perform welding of structural components only by fabricators certified by Canadian Welding Bureau to CSA Welding qualification codes; CSA W47.1-09(2014) for welding of steel, and CSA W47.2-12 for welding of aluminum or *Equivalent* certification acceptable to the *Consultant*.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Store parts in a dry place and permit natural ventilation over their finished surfaces.
- .2 Store materials in locations protected from damage of other subcontractors.
- .3 Under conditions of high humidity or cold temperatures, *Supply* heating or forced air ventilation to prevent accumulation of surface moisture.
- .4 Mark components to show location on building and on the *Drawings*.
- .5 Protect finishes with strippable coating that will not mar, nor deface finish on removal, or a similar method designed to afford an equivalent amount of protection. Leave protected coating intact until damage risk is past or immediately prior to final cleaning.
- .6 Stacking should be done to prevent bending pressure or abrasion of finished surfaces.
- .7 Brace and protect frame units to prevent distortion and damage in shipment and handling.
- .8 *Provide* methods for lifting or hoisting units into place without causing damage.

1.8 FIELD CONDITIONS

- .1 Comply with requirements of *Product* manufacturers.

1.9 WARRANTY

- .1 The Contractor shall assume responsibility for warranties of glass and glazing included in the work of this Section, in accordance with Section 08 80 00 – Glass and Glazing.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- .1 The work of this Section shall be provided by:

- .1 Alumicor,
- .2 Kawneer,
- .3 Or *Equivalent* (substitutions in accordance with Section 01 25 00 – Product Substitution Procedures).

2.2 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Air Leakage; except entrance doors: Air leakage through the work shall not exceed 0.3 L/s/m² (0.06 cfm/ft²) of glazing area when tested in accordance with ASTM E283- 04(2012) at test pressure of 300 Pa (6.24 psf).
- .2 Water Penetration (other than entrance doors): No water penetration shall occur when the work is tested in accordance with ASTM E331-00(2009), amended to prohibit water from passing through interior glazing seals or frame joints, at a test pressure of 300 Pa (6.24 psf).
- .3 Fabricate mullions to ensure under specified loads a maximum deflection of 1/175 of mullion span or 19 mm (3/4"), whichever is less.
- .4 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with Ontario Building code.
- .5 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with Ontario Building code.
- .6 *Provide* system to accommodate, without damage to components or deterioration of seals:
 - .1 Movement within system,
 - .2 Movement between system and perimeter framing components,
 - .3 Dynamic loading and release of loads,
 - .4 Deflection of structural support framing,
- .7 Maintain continuous air barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound, in accordance with the *Contract Documents*.
- .8 Position thermal insulation to exterior of air barrier, in accordance with the *Contract Documents*.
- .9 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.
- .10 *Provide* anchors sufficiently rigid to resist wind and snow loads caused by aluminum shades and brackets, without damage to wall system.

2.3 MATERIALS

- .1 Aluminum extrusions: Aluminum Association alloy AA6063-T5 or T6 temper for framing.
- .2 Sheet aluminum: aluminum sheet, 0.92 mm (0.04") minimum thickness.
 - .1 Aluminum alloy:
 - .1 AA3003-H14 Painting Quality.
 - .2 AA5005H14 Anodizing Quality.

- .3 Concealed sheet metal air barriers: 1 mm (0.04") (22 gauge) Z275 galvanized steel sheet.
- .4 Fasteners: aluminum or Type 304 stainless steel, finished to match adjacent material.
- .5 Isolation coating: alkali resistant bituminous paint or epoxy solution.
- .6 Glazing gaskets: fully resilient, shim type butyl glazing tape or Ethylene Propylene Diene Terpolymer (EPDM) glazing gasket.
- .7 Glass and other glazing materials: Refer to Section 08 80 00 – Glass and Glazing.
- .8 Silicone Sealant: One component, chemical curing; capable of water immersion without loss of properties: cured Shore A Durometer hardness of 15 to 25 in accordance with ASTM D2240- 05 (2010), colour as selected by the *Consultant*, where exposed, in accordance with ASTM C920-11.
- .9 Sheet metal work air barrier sealant: One component elastomeric chemical curing, in accordance with ASTM C920-11.
- .10 Air barrier membrane:
 - .1 Self-Adhesive membrane: Composite preformed modified membrane system consisting of SBS modified asphalt for low temperature flexibility and polyethylene scrim reinforcing.
Acceptable *Products*:
 - .1 Henry 'Blueskin SA' Self-Adhesive Grade Air Barrier Membrane.
 - .2 Soprema 'Soprseal Stick 1100'.
 - .3 W.R. Meadows 'Air Shield'.
 - .4 . Or *Equivalent*.
 - .2 Primer: as recommended by manufacturer.
 - .3 Membrane Properties:
 - .1 Thickness: 1.0 mm (40 mils).
 - .2 Application temperature: minimum +5°C.
 - .3 Service temperature: -40°C to +70°C.
 - .4 Elongation: 200% minimum in accordance with ASTM D412-06a (2013)- modified.
 - .5 Low temperature flexibility: in accordance with -30°C to CGSB 37-GP-56M-1985.
 - .6 Air leakage: 0.005 L/m2.s under a pressure differential of 75 Pa (0.01 PSI) in accordance with ASTM E283-04(2012).

2.4 ENTRANCE FRAMING

- .1 Exterior aluminum framing: 50.8 mm x 152.4 mm (2" x 6") frames and 152.4 mm x 152.4 mm (6" x 6") jambs, thermally broken extruded aluminum assembly with flush sight lines.
 - .1 Acceptable *Product*: Kawneer Tri Fab 601UT or *Equivalent*.
- .2 Interior aluminum framing: 45 mm x 114 mm (1-3/4" x 4-1/2") frames and 114 mm x 114 mm (4-1/2" x 4-1/2") jambs, non-thermally broken extruded aluminum assembly with flush sight lines.
 - .1 Acceptable *Product*: Kawneer Tri Fab 450 or *Equivalent*.

- .3 All section shall be designed for shear block joinery.

2.5 ALUMINUM ENTRANCE DOORS - EXTERIOR

- .1 Entrance glazing system shall be designed according to Section 08 41 00 - Aluminum Framed Glazing Systems requirements and the following:
- .1 Doors:
- .1 Acceptable *Product*: Kawneer '350 Medium Stile' or *Equivalent*.
- .2 Fasteners connecting and fixing the frame members shall be concealed.
- .3 Reinforce mechanically-joined corners of doors by welding, spigotting, welding and spigotting or by one piece cast aluminum angle to produce sturdy door unit.
- .4 Door stiles shall be weathered with metal backed polypropylene pile weather- stripping. *Provide* weather-stripping sweeps at door bottoms.
- .5 Door hardware: Norton 1605 closer or equivalent, 1 MS lock and 2 thumb latches (locations as scheduled or indicated), exterior threshold 115 mm (4.5"), 1 pair butt hinges, weather stripping and Classic Hardware CO-9 with stainless steel US32 polished finish, flash cap across the top of door.
- .1 *Provide* Unican locks where indicated or scheduled in the *Contract Documents*.
- .2 Barrier free door operators: in accordance with Section 08 71 13 - Automatic Door Operators.
- .6 Weathering on offset pivot or butt hung doors (single or pairs) shall be Kawneer SEALAIR elastomeric weathering of tubular shape, with a semi-rigid polymeric backing, or *Equivalent*.
- .7 Door bottom rail weathering (where required) shall be an extruded elastomeric blade sweep strip applied with concealed fasteners.
- .8 Glass: Refer to Section 08 80 00 – Glass and Glazing.

2.6 ALUMINUM ENTRANCE DOORS - INTERIOR

- .1 Interior entrance and interior glazing system shall be designed according to the requirements of this Section and the following:
- .1 Doors:
- .1 Acceptable *Product*: Kawneer '350 Medium Stile' or *Equivalent*.
- .2 Fasteners connecting and fixing the frame members shall be concealed.
- .3 Reinforce mechanically-joined corners of doors by welding, spigotting, welding and spigotting or by one piece cast aluminum angle to produce sturdy door unit.
- .4 Door stiles shall be weathered with metal backed polypropylene pile weather- stripping. *Provide* weather-stripping sweeps at door bottoms.
- .5 Door hardware: Norton 1605 closer or equivalent, 1 MS lock and 1 thumb latch (locations as scheduled or indicated), 1 pair butt hinges, and Classic Hardware CO-9 with stainless steel US32 polished finish, flash cap across the top of door.
- .1 Barrier free door operators: in accordance with Section 08 71 13 – Automatic Door Operators.

- .6 Weathering on offset pivot or butt hung doors (single or pairs) shall be Kawneer SEALAIR elastomeric weathering of tubular shape, with a semi-rigid polymeric backing, or *Equivalent*.
- .7 Door bottom rail weathering (where required) shall be an extruded elastomeric blade sweep strip applied with concealed fasteners.
- .8 Glass: Refer to Section 08 80 00 – Glass and Glazing.

2.7 ALUMINUM CURTAIN WALL

- .1 Glass Design:
 - .1 Glass shall be designed according to CAN/CGSB 12.20-M89 and Section 08 80 00 - Glass and Glazing.
 - .2 Glass subjected to guard loads shall be designed with an alternative resistance path in the event of failure of one lite or ply of glass.
 - .3 Insulating glass units in accordance with Section 08 80 00 - Glass and Glazing.
- .2 Curtain wall shall be designed according to Section 08 41 00 – Aluminum Framed Glazing Systems requirements and the following:
 - .1 Acceptable *Products*:
 - .1 Alumaticor 'ThermaWall 2200 Series'.
 - .2 Or *Equivalent*.
 - .2 Thermally broken sections.
 - .3 Mechanically fasten horizontal and vertical edges of infill materials and glass units with mechanically fastened continuous pressure plates complete with caps.
 - .4 Glazing cavity shall be compartmentalized at every floor level and every 6000 mm horizontally to prevent the movement of air in accordance with standard rain screen design.
 - .5 Fasteners: concealed.
 - .6 Cap extensions shall be extruded to profiles indicated and scheduled. Break- formed cap extensions will not be accepted
 - .7 Spandrel Panel shall have backpans fabricated with 22 Ga. Galvanised sheet steel, Top hat Section to integrate into Curtain wall framing. Inside face of backpan to align with inside face of adjacent mullions..

2.8 FINISHES

- .1 Exposed aluminum surfaces; anodized in accordance with AAMA 611-98:
 - .1 Clear anodized in accordance with AA Designation AA-M12C22A41 at exterior, AA-M12C22A31 at interior.

2.9 FABRICATION

- .1 Sills: extruded aluminum, finished to match window frames, 15 mm (5/8") minimum projection beyond wall surface. *Provide* preformed end caps wherever sill terminates. Butt joint sill and *Provide* preformed splice connector and sealant to prevent water penetration. Locate splice connectors (joint covers) at center line of mullions when required. Trim and detail corners neatly.

- .2 Make allowances for deflection of structure. Ensure that structural loads are not transmitted to aluminum work.
- .3 *Provide* structural steel reinforcement for strength, stiffness and connections.
- .4 Fit intersecting members to flush hairline weathertight joints and mechanically fasten together, except where indicated otherwise.
- .5 Conceal fastenings from view. Exposed fastenings where indicated in the Contract Documents.
- .6 Form cut-outs, recesses, mortising or milling for finishing hardware to templates supplied. Reinforce with aluminum or galvanized steel plates.
- .7 Field apply isolation coating to aluminum in contact with dissimilar metals and/or cementitious materials.
- .8 Fabricated assemblies shall make required clearances other assemblies and for deflection of structure.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 *Install* work of this Section plumb, square, level, free from warp, twist and superimposed loads.
- .2 Secure work in required position. Do not restrict thermal movement.
- .3 *Install* hardware in accordance with templates.
- .4 Adjust operable parts for correct function.
- .5 Isolate from cementitious materials.

3.2 AIR VAPOUR BARRIER CLOSURES

- .1 It is the *Contractor's* responsibility under this section to provide and maintain the continuity of air/vapour seal to adjacent materials to which the windows and frames abut. Fit flexible seals, tapes, sealants and gaskets at locations required to achieve air/vapour/water resistant and weathertight junctions. Ensure continuity of seal at end joints between lengths of material by overlapping and cementing. Caulk junctions of system components to themselves and other work with sealant to maintain effective vapour, air and water barrier and fix in place with an aluminum flat to the air/vapour seal line at the adjacent material and to the glazing rebate.
- .2 Where deflection of structure will cause dynamic joint movement between aluminum work and dissimilar materials, install flexible seals of sufficient width to allow formation of bellows to take up any torsional and shear stresses.

3.3 GLAZING

- .1 Glaze aluminum framed windows and doors at exterior using insulating glazing units in accordance with Section 08 80 00 – Glass and Glazing.
- .2 Glaze interior windows and doors in accordance using glass types given in the glazing schedule and in accordance with section 08 80 00 – Glass and Glazing.

3.4 SEALANTS

- .1 Seal between frame members, sills and adjacent construction as a part of the work of this Section and in accordance with Section 07 92 00 – Joint Sealants.

3.5 HARDWARE

- .1 *Install* in accordance with manufacturer's installation instructions.
- .2 Accurately locate and adjust hardware to meet manufacturer's instructions. Use special tools and jigs as recommended.
- .3 Set, fit and adjust hardware according to manufacturer's directions, at heights as confirmed by the *Consultant*. Hardware shall operate freely. Protect installed hardware from damage and paint spotting.
- .4 Powered hardware:
 - .1 Power wiring will be supplied and installed by electrical work installer including conduit, boxes and other electrical appurtenances, including connections and terminations. Be responsible for ensuring that all wiring work is done in accordance with the *Suppliers* wiring diagrams and directions.
 - .2 Arrange for testing and commissioning of system by the distributor of the system. Submit a copy of reports to the *Consultant*.

3.6 ADJUSTING AND CLEANING

- .1 Cleaning on completion of installation:
 - .1 Remove deposits which affect appearance or operation of units.
 - .2 Remove protective materials.
 - .3 Clean interior and exterior surfaces by washing with clear water; or with water, and soap or detergent; followed by a clear water rinse.
 - .4 Clean and restore stained metal surfaces in accordance with manufacturer's recommendations. Replace if cleaning is impossible.
 - .5 Final cleaning is specified in Section 01 77 00 – Contract Closeout Procedures and Submittals.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- 1.1 General Instructions
- 1.2 Section Includes
- 1.3 Summary
- 1.4 Submittals
- 1.5 Closeout Submittals
- 1.6 Quality Assurance
- 1.7 Delivery, Storage, and Handling
- 2.1 Performance/Design Requirements
- 2.2 Materials
- 2.3 Sliding Doors
- 2.5 Fabrication
- 3.1 Examination
- 3.3 Installation – General
- 3.4 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - 1.4 A. WORK INCLUDED: FURNISH SPECIFIED MANUAL DOOR SYSTEM THAT HAS BEEN MANUFACTURED, FABRICATED & INSTALLED TO MEET MANUFACTURER'S STANDARDS WITHOUT DEFECTS, DAMAGE OR FAILURE.
 - 1.5 B. RELATED WORK: OPENINGS: DIVISION 08, APPLICABLE SECTIONS.
- .1 All costs associated with the work of this Section shall be included in the *Contract Price*.

1.02 REFERENCES

- A. THE ALUMINUM ASSOCIATION (AA) Aluminum Finishes Manual.
- B. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA) 101: Dissimilar Materials.
- C. AMERICAN NATIONAL STANDARDS INSTITUTE
 1. ANSI A117.1 Standard for Accessible and Usable Buildings and Facilities
 2. ANSI A156.5: Standard for Auxiliary Locks and Associated Products
 3. ANSI A156.18: Standard for Materials and Finishes
- D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) B221: Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.

- E. ARCHITECTURAL WOODWORK STANDARDS (AWS): Specification for the fabrication, finishing, and installation of architectural woodwork.
- E. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 101: Safety to Life from Fire in Buildings & Structures.
- F. INTERTEK, WARNOCK HERSEY (ETL): Testing Laboratory and Certification Agency joined with ETL SEMKO

1.03 SUBMITTALS

- A. SHOP DRAWINGS & PRODUCT DATA: Submit drawings and product data showing layout, profiles, product components including anchorage, accessories, finish and glazing details (where required).
- B. CLOSEOUT SUBMITTALS: Submit Owner's Manual & Warranty document as specified herein.

1.04 QUALITY ASSURANCE

- A. INSTALLERS QUALIFICATIONS: Installer experienced to perform work of this section who has specialized in the installation of work like that required for this project and who is acceptable to product manufacturer.
- B. MANUFACTURER'S QUALIFICATIONS: Manufacturer to have minimum (5) five years successful experience in the fabrication of intensive/critical care doors of the type required for this project. Manufacturer to provide field service representation during installation, approving acceptable installer and approving application method.
- C. [CERTIFICATIONS](#): Manual sliding door systems to be certified in accordance with NFPA 105.
- D. OPENING FORCE REQUIREMENT: Shall be 5 lbs. or less for standard wood door. Note: Selection of self-closing mechanism and/or alternative seal options may increase opening force.
- E. HEADER CAPACITY: Up to 200 lbs. (90.7 kg) per slide panel.

1.05 WARRANTIES

- A. MANUFACTURER'S WARRANTY: Units to be warranted against defect in material and workmanship for a period of one year from the Date of Substantial Completion. Manufacturer's warranty is in addition to, and not a limitation of, other rights owner may have under Contract Documents.
- B. DISTRIBUTOR'S WARRANTY: 1-year warranty: Labor & transportation charges for defective parts replacement.

1.06 PROJECT CONDITIONS

FIELD MEASUREMENTS: Verify actual dimensions/openings by field measurements before fabrication and record on shop drawings. Coordinate with fabrication and construction schedule to avoid construction delays.

1.07 DELIVERY, STORAGE AND HANDLING

- A. ORDERING AND DELIVERY: Comply with factory's ordering instructions and lead time requirements. Delivery shall be in factory's original, unopened, undamaged containers with identification labels intact.
- B. STORAGE AND PROTECTION: Provide protection from exposure to harmful weather conditions and vandalism.

2.1 PART II – PRODUCTS

2.01 MANUFACTURER

HORTON AUTOMATICS, a division of Overhead Door Corporation, shall manufacture manual slide door(s) of type(s) and size(s) specified on plans and door schedule.

2.02 EQUIPMENT

- A. MANUFACTURED DOOR UNITS: Includes header with roller track, carrier assemblies with interlocked valance framing system, concealed floor guide(s), slide door panel(s), and accessories required for complete installation.
1. Configuration: Single Slide or Biparting.
 2. Mounting Type: Drywall cased with interlocked header on exterior.
 3. Door Types: Type 010 P-X, X-P & P-X-X-P: Slide panel(s) 'X' slide along wall utilizing concealed floor mounted guide.
 4. Minimum Clear Slide Opening Widths:
 - a. 36" (914mm) for Single Slide
 - b. 48" (1219mm) for Biparting
- B. HEADER: To be aluminum with double top track & removable faceplate and integral end caps. Header to be interlocked with valance frame and located on exterior side with no exposed fasteners. Header size to be 2 7/8" (73mm) deep by 4" (102mm) high. Biparting units (P-X-X-P) shall incorporate door synchronizing mechanism that allows for simultaneous opening of door panels. Header options shall be:
1. Soft Opening Dampening: approximately 6" (152mm) from Full-Open, switch engages internal spring to auto open door to Full-Open.
 2. Soft Closing Dampening: approximately 6" (152mm) from Full-Close, switch engages internal spring to auto close door to Full-Close.
 3. Soft Opening and Soft Closing Dampening Combination
 4. Spring Retractor Self-Closing Mechanism
- C. CARRIER ASSEMBLIES AND HEADER ROLLER TRACK: Double track system shall be integral part of header. Tracks shall be 1/4" (6mm) wide. Rollers will be steel, high quality ball bearing wheels 1 1/8" (29mm) diameter. Anti-Derailing accomplished by means of a continuous aluminum extrusion full length of slide panel travel.
- D. SLIDE PANEL(S): Shall be wood veneered door with structural composite lumber core with 5-ply (SCLC-5) construction.
1. Optional Sliding Panel(s) shall be:
 - a. Plastic laminated door with High-Pressure Decorative Laminates (HPDL) and structural composite lumber core with 5-ply (SCLC-5) construction.
 - b. Wood door panel by others.
 2. Locking Hardware: shall be provided as follows:
 - a. Single Slide Units: Shall be provided with positive latch that will latch the panel in place when closed. A lever handle shall be provided on each side of the sliding panel to unlock the door along with interior thumb-turn and exterior key-turn lock.
 - b. Biparting Units: Shall be provided with interior thumb-turn and exterior key-turn lock. Each slide panel shall be provided with a raised 1" (25mm) diameter tubular pull.
 3. Optional Locking Hardware:
 - a. Flush Turn - Key one side or both sides
 - b. Lever handle only or with key both sides
 - c. Lever handle – ADA Turn/Key
 - d. ADA LaviLock – Left Hand or Right Hand
 - e. ADA Indicator – Left Hand or Right Hand
 - f. ADA Magnetic Privacy Lock

g. Raised 1" (25mm) diameter tubular pull only

E. VALANCE CASED FRAME: Shall be aluminum with no exposed fasteners with mitre corner joints and interlocked with header. Two-piece overlapping casement frame shall be 2" (51mm) wide with adjustable casement depth of 5" (129mm) to 8" (203mm).

2.03 MATERIALS, FINISHES AND FABRICATION

A. EXTRUDED ALUMINUM: ASTM B221, 6063-T5 alloy and temper, anodized:

1. Structural Header Sections: Minimum 3/16" (5mm) thickness.
2. Structural Frame Sections: Commercial grade.

B. FINISHES (for all exposed aluminum surfaces): Shall be one of the following with optional antimicrobial coating:

1. 215-R1 Clear: Architectural Class 1 Clear Anodized Coating, AA-MI2C22A41.
2. 313-R1 Dark Bronze, 312-R1 Light Bronze, or 315-R1 Black: Architectural Class 1 Anodized Coating, AA-MI2C22A44.
3. Special Powder-coat Paint Coating: Color as selected.
4. Antimicrobial coating.

C. FRAME CONSTRUCTION: Drywall cased open framing system with no exposed fasteners.

PART III - EXECUTION

3.01 EXAMINATION

SITE VERIFICATION OF CONDITIONS: Installer shall verify base conditions are acceptable for product installation as per manufacturer's instructions. Notify Contractor in writing of conditions detrimental to proper & timely completion of work. All negative conditions to be corrected in a manner acceptable to the manufacturer.

3.02 INSTALLATION

- A. GENERAL: Install door units plumb, level and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.
- B. DISSIMILAR MATERIALS: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.

3.03 CLEANING, ADJUSTMENT AND PROTECTION

- A. CLEANING AND ADJUSTMENT: Remove temporary protection of adjacent work areas. Remove construction debris from construction site and legally dispose of debris. Repair or replace damaged installed products. Clean product surfaces and lubricate operating equipment for optimum condition and safety
- B. ADVISE CONTRACTOR: Of precautions required through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of acceptance.

Horton Automatics reserves the right to make product improvements and change specifications without notice.

3.1 END OF SECTION

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 References
- .5 1.5 Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage and Handling
- .8 1.8 Coordination
- .9 1.9 Warranty
- .10 2.1 Manufacturers
- .11 2.2 Materials
- .12 2.3 Hanging Devices
- .13 2.4 Flush Bolts and Accessories
- .14 2.5 Cylinders and Keying
- .15 2.6 Locking Devices
- .16 2.7 Electric Strikes
- .17 2.8 Exit Devices
- .18 2.9 Automatic Door Operators
- .19 2.10 Door Closers
- .20 2.11 Door Trim and Protective Plates
- .21 2.12 Door Stops and Holders
- .22 2.13 Gasketing and Thresholds
- .23 2.14 Silencers
- .24 2.15 Sliding Door Track
- .25 2.16 Electronic Products and Accessories
- .26 2.17 Finishes
- .27 3.1 Examination
- .28 3.2 Preparation
- .29 3.3 Installation
- .30 3.4 Field Quality Control
- .31 3.5 Adjusting
- .32 3.6 Cleaning And Protection
- .33 3.7 Demonstration

1.3 SUMMARY

- .1 Related documents
 - .1 *Drawings* and general provisions of the *Contract*, including General and Supplementary Conditions and Division 01 *Specification* Sections, apply to this Section.
- .2 Section includes
 - .1 Furnishing of all items of finish hardware as hereinafter specified or obviously necessary for all swinging, sliding, folding and other doors as indicated in the Contract Documents. Except, items which are specifically excluded from this Section of the specification or are of unique hardware specified in the same Sections as the doors and frames on which they are installed.
- .3 Related sections
 - .1 06 40 00 – Architectural Woodwork
 - .2 08 11 13 – Steel Doors and Frames
 - .3 08 35 13 – Four-Fold Metal Doors
 - .4 08 36 13 – Sectional Overhead Metal Doors
 - .5 08 41 00 – Aluminum Framed Glazing
 - .6 08 71 13 – Automatic Door Operators
 - .7 28 00 00 – Security System

1.4 REFERENCES

- .1 Codes and standards
 - .1 ANSI A117.1 – Accessible and Usable Buildings and Facilities
 - .2 ANSI A156.1 – Butts and Hinges
 - .3 ANSI A156.3 – Exit Devices
 - .4 ANSI A156.4 – Door Controls – Closers
 - .5 ANSI A156.5 – Cylinders and Input Devices for Locks
 - .6 ANSI A156.6 – Architectural Door Trim
 - .7 ANSI A156.7 – Template Hinge Dimensions
 - .8 ANSI A156.8 – Door Controls – Overhead Stops and Holders
 - .9 ANSI A156.9 – Cabinet Hardware
 - .10 ANSI A156-10 – Power Operated Pedestrian Doors
 - .11 ANSI A156.11 – Cabinet Locks
 - .12 ANSI A156.12 – Interconnected Locks
 - .13 ANSI A156.13 – Mortise Locks and Latches Series 1000

- .14 ANSI A156.16 – Auxiliary Hardware
- .15 ANSI A156.18 – Materials and Finishes
- .16 ANSI A156.19 – Power Assist and Low Energy Power Operated Doors
- .17 ANSI A156.21 – Thresholds
- .18 ANSI A156.22 – Door Gasketing and Edge Sealing Systems
- .19 ANSI A156.25 – Electrified Locking Devices
- .20 ANSI A156.26 – Continuous Hinges
- .21 ANSI A156.28 – Recommended Practices for Mechanical Keying Systems
- .22 ANSI A156.29 – Exit Locks, Exit Alarms, Alarms for Exit Devices
- .23 ANSI A156.30 – High Security Cylinders
- .24 ANSI A156.31 – Electric Strikes and Frame Mounted Actuators
- .25 ANSI A156.32 – Integrated Door Opening Assemblies
- .26 ANSI A156.36 – Auxiliary Locks
- .27 ANSI A250.4 – Steel Doors and Frames Physical Endurance
- .28 NFPA 80 – Standard for Fire Doors and Other Opening Protectives
- .29 NFPA 101 – Life Safety Code
- .30 OBC 2006 – Ontario Building Code
- .31 SDI 122-07 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames
- .32 Door and Hardware Institute Publication – Sequence and Format for the Hardware Schedule (1996)
- .33 Door and Hardware Institute Publication – Keying Systems and Nomenclature (1989)

1.5 SUBMITTALS

- .1 General requirements
 - .1 Submit all documentation and samples in accordance with Division 01, General Requirements.
- .2 Schedules and data
 - .1 *Product Data*: Manufacturer's *Product* data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
 - .2 *Door Hardware Schedule*: Prepared and submitted within 14 Working *Days* of receipt of purchase order by or under the supervision of supplier and coordinated with all *Drawings* and related documents to ensure; size, thickness, hand, function, finish and application of hardware. All approved hardware changes shall be incorporated in the hardware schedule and kept current throughout the duration of the *Project*.

- .1 Format: Vertical format and sequence as detailed in the Door and Hardware Institute (DHI) publication "Sequence and Format for the Hardware Schedule".
- .2 Content: Include the following information for each opening:
 - .1 Location of each hardware set cross-referenced to identifying mark(s) on Architectural floor plans and in door and frame schedule included in the Contract Drawings.
 - .2 Handing and degree of swing of each door.
 - .3 Keying information.
 - .4 Quantity, type, style, function, size and finish of each hardware item.
 - .5 Complete methods of operation for all openings containing electronic components with detailed operational descriptions of each item's function(s) during all typical conditions and ingress/egress situations.
 - .6 Elevation drawings of all openings with electronic hardware systems identifying locations of components, conduit, back boxes, junction boxes and miscellaneous system requirements.
 - .7 Name and manufacturer of each hardware item.
 - .8 Fastenings and other pertinent installation information.
 - .9 Hardware mounting locations when different from standard.
- .3 Samples: *Provide* each type of hardware in finish indicated in the *Contract Drawings* as requested. Items will be returned in original packaging and working order to the *Contractor* to be incorporated into the *Project* scope of *Work*.
- .4 Templates: Furnish a complete, indexed list with templates and finish hardware schedule to the Contractor for each trade supplying materials requiring hardware preparations.
- .5 Electronic hardware systems:
 - .1 Wiring Diagrams: Prepared and submitted within 10 *Working Days* of receipt of purchase order by or under the supervision of *Supplier* and coordinated with all *Drawings* and related documents to ensure accurate function and coordination.
 - .1 Elevations: *Provide* diagrams for each unique opening with electronic hardware components identifying individual item locations, conduits, back boxes, junction boxes and miscellaneous system requirements and devices.
 - .2 Risers: *Provide* diagrams detailing locations and infrastructure between door openings, power supplies, access control panels and system components.
 - .3 Point to Points: *Provide* diagrams detailing wiring terminations at all electrified devices as applicable to function of all openings. (inclusion depending on installation)
 - .4 Responsibility matrix: *Provide* documentation for approval detailing basic responsibilities inclusive of all related Sections involved in the preparation for, installation and commissioning of electrified systems.
- .6 Keying Schedule: Prepare a separate schedule, in accordance with DHI publication "Keying Systems and Nomenclature", detailing final keying instructions for all locksets and cylinders. Include; keying system explanation, door numbers, keyset symbols, hardware set numbers, and

special instructions. The *Owner* to approve submitted keying schedule prior to the ordering of permanent cylinders.

- .7 Operations and Maintenance Manuals: *Provide* operating and maintenance manuals in accordance with Division 01, Section 01 77 00 - Contract Closeout Procedures and Submittals and 01 78 23 Operation and Maintenance Manuals. Manuals must include; complete manufacturer and distributor contact information, manufacturers documentation for care and maintenance of all *Products* and finishes, manufacturers *Product* parts lists, manufacturers installation and adjustment instructions, manufacturers/service representatives warranty documentation, and 'as built' copies of all submittal documentation.
- .8 Warranties and Maintenance Agreements; *Provide* manufacturers/service representatives special warranties and maintenance agreements specified in this Section.

1.6 QUALITY ASSURANCE

.1 Substitutions

- .1 Refer to Section 01 25 00 – Product Substitution Procedures.

.2 *Supplier* qualifications

- .1 A recognized Architectural door hardware *Supplier* who has maintained an office and has minimum of five years' documented experience in providing consulting services and supplying mechanical and electromechanical hardware comparable in material, design and extent to that required for this *Project*.
- .2 Have an office and warehouse facilities to accommodate this *Project*.
- .3 Authorized factory distributor in good standing of all *Products* specified in this Section.
- .4 Have in their employment a minimum of one Architectural Hardware *Consultant* (AHC) as administered and certified by The Door and Hardware Institute, Chantilly VA or *Equivalent* certification. AHC shall be responsible for preparation of finish hardware/keying schedules.

.3 Installer qualifications

- .1 Trained by the primary *Product* manufacturers with a minimum of five years' documented experience in the installation of both mechanical and electromechanical hardware comparable in material, design and extent to that required for this *Project*.

.4 Source limitations

- .1 Electrified modifications and enhancements made to a source manufacturer's *Product* line by a secondary or third party source will not be accepted.
- .2 *Provide* electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated in the *Contract Documents*.

.5 Fire-rated openings

- .1 *Provide* door hardware for fire-rated openings that complies with NFPA 80 and requirements of the *Authorities Having Jurisdiction*. *Provide* only items that are listed/labelled by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.

.6 Keying conference

- .1 Conduct conference to comply with requirements in Division 01, Section 01 31 19 - Project Meetings. Keying conference to incorporate the following criteria into the final keying schedule document:
 - .1 Function of building, purpose of each area and degree of security required.
 - .2 Plans for existing and future key system expansion.
 - .3 Requirements for key control storage and software.
 - .4 Installation of permanent keys, cylinder cores and software.
 - .5 Address and requirements for delivery of keys.
- .7 Pre-submittal conference
 - .1 Conduct conference to comply with requirements in Division 01, Section 01 31 19 -Project Meetings, with attendance by representatives of *Supplier(s)*, installer(s) and *Subcontractor(s)* to review proper methods and the procedures for receiving, handling and installing door hardware.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Marking and packaging
 - .1 Mark items according to the approved hardware schedule indicating hardware set and door number.
 - .2 Items to be sorted, verified and repackaged in manufacturer's original packaging complete with necessary screws, accessories, templates, installation instructions and any specialized tools required for installation.
- .2 Delivery
 - .1 The *Contractor* shall ensure that delivery times for receipt of door hardware are acceptable to the *Consultant*. The *Contractor* shall check deliveries against accepted list and *Provide* written acceptance assuming responsibility for storage and care. Immediately identify any shortages or damaged items in writing.
 - .2 The *Contractor* shall ensure that hardware items are jointly inventoried on *Site* by representatives from hardware *Supplier*, installer and relevant *Subcontractor*.
 - .3 Deliver permanent keys, cylinders, cores, access control credentials, software and related accessories directly to the *Owner* via registered mail or as established at the 'Keying Conference'.
 - .4 Do not store electronic access control hardware, software or accessories at the *Site* without prior authorization.
 - .5 Construction master keys to be separately packaged from all other items and delivered to *Owner* as previously coordinated.
- .3 Storage
 - .1 The *Contractor* shall *Provide* a clean, dry and secure hardware storage room with adequate shelving to layout each item by door number and hardware set number. Room size, location and layout to be jointly coordinated with hardware *Supplier*, installer and *Subcontractor*.

1.8 COORDINATION

- .1 Obtain and distribute templates for doors, frames and other work specified to be factory prepared for installing standard and electrified hardware. Review *Shop Drawings* of related Sections to ensure that adequate provisions and modifications are made for locating and installing hardware.
- .2 Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required power connections, conduit, fire alarm connections, junction boxes, back boxes, reinforcing and mounting locations for low voltage power supplies, detection/monitoring hardware, power transfer devices and all other listed components.
- .3 Coordination meetings:
 - .1 The *Contractor* shall ensure that hardware *Supplier* meets with the *Owner*, the *Consultant*, the electrical *Subcontractor*, security contractor and Access Control *Subcontractor* to review, coordinate and implement all details relating to the proper operation and location of all electronic hardware prior to start of construction. Review methods of operation for each unique opening with electrified components.
 - .2 Conduct a *Project* specific training meeting to instruct the installation *Subcontractor's* personnel on the proper installation and adjustment of all *Products*. *Product* training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates, physical *Product* samples as required and review of method of operation for electrified openings.
 - .3 Inspect and review electrical rough-ins, power supply connections and all other applicable work by related trades.
 - .4 Review and finalize construction schedule and verify material availability.
 - .5 Review the required inspection, testing, commissioning and demonstration procedures.
- .4 Upon completion of installation, *Provide* written documentation that components were applied as per manufacturer's instructions and recommendations according to the approved hardware schedule. Identify any defective or damaged materials.

1.9 WARRANTY

- .1 General Warranty in accordance with Division 01, General Requirements and Article A-15 of the Agreement Between *Owner* and *Contractor*. Special warranties specified in this article shall not deprive the *Owner* of other rights under other provisions of the *Contract Documents* and shall be in addition to, and run concurrent with other warranties made by the *Contractor* under requirements of the *Contract Documents*.
- .2 Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period of two years as specified in Article A-15 of the Agreement Between *Owner* and *Contractor*. Failures include, but are not limited to:
 - .1 Structural failures including excessive deflection, cracking, or breakage.
 - .2 Faulty operation of hardware.
 - .3 Deterioration of metals, finishes and other materials beyond normal weathering.
 - .4 Electrical component defects and failures within system operation.

- .3 Extended warranty periods:
 - .1 Hinges - Lifetime
 - .2 Mortise Locksets – Seven (7) years
 - .3 Exit Devices – Five (5) years
 - .4 Door Closers – Ten (10) years
 - .5 Electric Strikes – Five (5) years
 - .6 Electromechanical Locksets – Two (2) years
 - .7 Electromagnetic Locks – Lifetime
 - .8 Power Supplies - Lifetime

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- .1 Manufacturers as listed below have been determined as the acceptable standard. Obtain each type of finish hardware (hinges, latch and locksets, exit devices, door closers, etc.) From a single manufacturer.

2.2 MATERIALS

- .1 Screws and fasteners
 - .1 All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.

2.3 HANGING DEVICES

- .1 Hinges
 - .1 Hinges shall conform to ANSI A156.1 and have the number of knuckles as specified, oil-impregnated bearings as specified with NRP (non-removable pin) feature, at all exterior and interior locked reverse bevel doors. Unless otherwise scheduled, supply 2 hinges for doors up to 60" (1520mm) in height and supply one (1) additional hinge for every 30" (760mm) of door height or part thereof. Hinges shall be sized per the manufacturer's recommendations. Hinges shall be a minimum of 4 1/2" high and 4" wide; heavy weight hinges (.180) shall be supplied at all doors where specified in the *Contract Documents*.

- .2 Provide hinge size to comply with the following:

Door Width	Hinge Height	Hinge Width
Up to 36"	4-1/2"	4"
Over 36"	5"	4-1/2"
Up to 48"	5"	5"
Over 48"	6"	6"

- .1 Specified Manufacturer: McKinney TA/T4A Series or *Equivalent*
- .2 Electric hinges

- .1 Electric hinges shall be provided with Molex standardized plug connectors to accommodate up to 12 wires. Plug connectors shall plug directly into Molex through-door wiring harnesses for connection to electric locking devices and power supplies. *Provide* sufficient number of concealed wires to accommodate electric function of specified hardware. *Provide* a mortar guard for each electric hinge specified in Contract Documents.

- .1 Specified Manufacturer: Assa Abloy McKinney or Markar - QC Series or *Equivalent*

- .3 Continuous geared hinges

- .1 All hinges to be non-handed and completely reversible. Hinge line to be available in concealed flush mount with or without inset, full surface and half surface types as specified in the hardware sets. All hinges to be made of extruded 6060 T6 aluminum alloy with polyacetal thrust bearings, anodized after cutouts are made for bearings. All concealed hinges to be fire-rated for 20, 45 and 90 minutes when incorporated into proper door and frame labeled installations, without necessitating the use of fusible-link pins. All concealed hinges to be available in standard, heavy, and extra heavy duty weights; all full surface and half surface hinges in standard and heavy duty weights as specified in the hardware sets. All hinges to be factory cut for door size.

- .1 Specified Manufacturers: Assa Abloy McKinney

- .2 Or *Equivalent*. Refer to Section 01 25 00 – Product Substitution Procedures.

2.4 FLUSH BOLTS AND ACCESSORIES

- .1 All manual and automatic flush bolts to be furnished as specified.

- .1 Specified Manufacturer: Assa Abloy Rockwood

- .2 Or *Equivalent*. Refer to Section 01 25 00 – Product Substitution Procedures

2.5 CYLINDERS AND KEYING

- .1 Cylinders

- .1 All Permanent Cylinders are to be Schlage Large Format Interchangeable Core.

- .1 Specified Manufacturer: Schlage IFIC C keyway

- .2 Or *Equivalent*. Refer to Section 01 25 00 – Product Substitution Procedures

- .2 Keying

- .1 Permanent Cores to be Master keyed & keyed Different at the factory.

- .2 Furnish the Cylinders directly to the *Owner*. The *Owner* will have their Locksmith Rekey the cylinders to their requirement.

- .3 The *Contractor* shall remove all construction cores and install all permanent cores, unless otherwise directed by the *Owner*.

- .4 Pack all permanent cylinders and keys separately from locksets. Identify door number and keyset symbol on each envelope.

- .5 Ship the control keys directly to the *Owner* unless directed otherwise.

- .6 Furnish the following:

- .7 Two change keys per lock.

- .8 I/C Core – four construction control keys and four permanent control keys.
- .9 15 construction keys.
- .10 The construction keys are to be shipped separate from the locksets, directly to the *Contractor*.
- .3 Key cabinet
 - .1 *Provide* a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall expansion capacity of 150% of the number of locks required for the project. The *Contractor* shall ensure that the hardware *Supplier* assists the *Owner* with the set up of the key cabinet.
 - .1 Specified Manufacturer: Telkee AWC Series or *Equivalent*.

2.6 LOCKING DEVICES

- .1 Mortise locksets
 - .1 All locksets shall be ANSI 156.13 Series 1000, Grade 1 Certified. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The lockset shall have a field-adjustable, beveled armored front, with a .125" minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2 3/4" backset with a two-piece 3/4" anti-friction stainless steel latchbolt. The deadbolt shall be a full 1" throw made of stainless steel and have 2 hardened steel roller inserts. All strikes shall be non-handed with a straight lip. To ensure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs and shall be the product of one manufacturer.
 - .1 Specified Manufacturer: Corbin Russwin Inc. ML2000 Series or *Equivalent*.
- .2 Electrified locksets
 - .1 Mechanical features of locksets shall conform to standards as specified above. Locksets shall be fail-secure unless otherwise specified. Where specified electrified locksets shall be provided with a switch to monitor inside or outside lever handle or signal remote location. *Provide* an in-line power controller with all electrified locksets.
 - .1 Specified Manufacturer: Corbin Russwin Inc. or *Equivalent*.
- .3 Lockset strikes
 - .1 Strikes shall be non-handed and straight lip. *Provide* strikes with lip-length required to accommodate jamb and/or trim detail and projection.

2.7 ELECTRIC STRIKES

- .1 Standard strikes
 - .1 All standard electric strikes shall meet BHMA standard 501, grade 1 and be UL Listed for Burglary Resistance, category 1034. Strikes shall be all stainless steel construction for corrosion resistance, strength and durability. Strikes shall have been tested to withstand a forcing strength of a minimum 2400 lbs. before releasing and perform with a minimum of one million cycles of operation. Strikes shall be 24VDC fail-secure unless otherwise specified in the *Contract* documents. *Provide* an in-line power controller with all electric strikes.
 - .1 Specified Manufacturers: Assa Abloy HES 1006 Series or *Equivalent*.

.2 Surface mounted strikes

- .1 All surface mounted electric strikes shall meet BHMA standard 501, grade 1 and be UL Listed for Burglary Resistance, category 1034. Strikes shall have two heavy-duty, stainless steel locking mechanisms operating independently to *Provide* tamper resistance. Optional latchbolt and latchbolt strike monitoring that indicates position of the latchbolt and locked condition of the strike shall be available. Strikes shall have been tested for a minimum of 500,000 operating cycles. *Provide* an in-line power controller with all electric strikes.
- .1 Specified Manufacturers: Assa Abloy HES 9500(Fire Rated) HES 9600(non-Rated) or *Equivalent*.

2.8 EXIT DEVICES

.1 Conventional devices – push rail

- .1 All exit devices shall be ANSI A156.3, Grade 1 Certified and shall be listed by Underwriters Laboratories and bear the UL label for life safety in full compliance with NFPA 80 and NFPA 101. Mounting rails shall be formed from a solid single piece of stainless steel, brass or bronze no less than 0.072" thick. Push rails shall be constructed of 0.062" thick material. Painted or anodized aluminum shall not be considered heavy duty and is not acceptable. Lever trim shall be available in finishes and designs to match that of the specified locksets.
- .1 Specified Manufacturer: Von Duprin 99/33 Series or *Equivalent*.

.2 Electrified devices

- .1 Electrified exit devices shall conform to all traditional exit device standards. All power requirements for exit devices used must utilize a continuous circuit electric hinge for clean design and no visible means of interrupting power to device.
- .2 All exit devices, both fire labeled and non-labeled devices, requiring electric dogging shall be held in the "dogged" or retracted position. All exit devices with electric latch retraction shall *Provide* for a remote means of unlocking for momentary or maintained periods of time.
- .3 Where specified exit devices shall be provided with a switch to monitor push rail or signal remote location and latchbolt monitoring.
- .4 *Provide* a 782 Series Controller from Corbin Russwin Inc. with all Electric Latch Retraction devices or *Equivalent*.

2.9 AUTOMATIC DOOR OPERATORS

- .1 All operators shall be ANSI 156.19, Grade 1 Certified. Units shall have adjustments for door closing force and backcheck, motor assist from 0 to 30 seconds, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay up to 30 seconds. Operator units shall *Provide* conventional door closer opening and closing forces unless the power operator motor is activated by an initiating device with door closer assembly having adjustable spring size, backcheck valve, sweep valve, latch valve, speed control valve, and pressure adjustment valve to control door closing. Operators shall have push and go function to activate power operator or power assist functions. Units shall have a presence detector input to prevent a closed door from opening or a door that is fully opened from closing and shall have a hold open toggle input to allow remote activation for indefinite hold open; door shall close the second time the input is activated. Operators shall have a SPDT relay for interfacing with latching or locking devices. All controlling operator switches shall be of radio- frequency design and not hard-wired.

- .1 Specified Manufacturer: Assa Abloy BESAM SW200i(exterior) BESAM SW100(interior) or *Equivalent*.

2.10 DOOR CLOSERS

- .1 Surface mounted closers – heavy duty

- .1 All door closers shall be ANSI 156.4, Grade 1 Certified. All closers shall have aluminum alloy bodies, forged steel arms, and separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to *Provide* up to 50% increase in spring power. Closers shall be furnished with parallel arms mounting on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

- .1 Specified Manufacturer: Yale Security Inc. Norton 7500 Series or *Equivalent*.

- .2 Surface mounted closers – standard duty

- .1 All door closers shall be ANSI 156.4, Grade 1 Certified. All closers shall have aluminum alloy bodies, forged steel arms, and separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to *Provide* up to 50% increase in spring power. Closers shall be furnished with parallel arms mounting on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

- .1 Specified Manufacturer: Yale Security Inc. Norton 8500 Series or *Equivalent*.

2.11 DOOR TRIM AND PROTECTIVE PLATES

- .1 Door Pulls/Push/Kick/Armour Plates: to be 0.050 inches thick and 1.5 inches less full width of door, or as specified. Furnish all push/kick and armour plates with 'B4E' beveled edges. Where door pulls and push plates are specified countersink door pull throughbolts in door for flush fit and apply push plates over top of throughbolts. Follow specific mounting instructions where push plate, door pull and deadlock applications occur. Fasteners for push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware schedule. Where full height door pulls are specified supply units less 150mm from the top of door and 300mm from bottom of door. Submit shop drawing of pulls for review.

- .1 Specified Manufacturer: Assa Abloy Rockwood or *Equivalent*.

2.12 DOOR STOPS AND HOLDERS

- .1 Wall mounted door stops

- .1 Where a door is indicated in the *Contract Drawings* to strike flush against a wall, wall bumpers shall be provided. *Provide* convex or concave design as indicated.

- .1 Specified Manufacturers: Assa Abloy Rockwood or *Equivalent*.

- .2 Overhead stops/holders

- .1 Where specified, overhead stops/holders as shown in the hardware sets are to be provided. Track, slide, arm and jamb bracket shall be constructed of extruded bronze and shock

absorber spring shall be of heavy tempered steel. Overhead stops shall be of non-handed design.

.1 Specified Manufacturers: Assa Abloy Rixson 1/2/9/10 Series or *Equivalent*.

2.13 GASKETING AND THRESHOLDS

- .1 On exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. *Provide* seals as required to meet UL10C. *Provide* only those units where silicon seal strip is easily replaceable and readily available from stocks maintained by manufacturer. *Provide* head seal as solid aluminum extrusion suitable for stop applied hardware i.e. P/A closers or surface overhead door stops.
- .2 Door Sweeps: House nylon brush seal in extruded aluminum case. Surface applied and adjusted to suit gap at bottom of door, complete with snap cover.
- .3 Auto Door Bottoms: Surface or semi mortise automatic door bottoms housed in aluminum case and equipped with nylon brush inserts. Each unit sized to suit the door width and meets the requirements of ANSI/BHMA 156.22-2003 for latching force and air infiltration.
- .4 Astragal Seal: House nylon brush seal in extruded aluminum case. Surface applied, meeting stile astragal, consisting of two pieces attached to pull side face of door. Adjust during installation for proper seal prior to attaching snap cover.
- .5 *Provide* threshold units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the *Accessibility for Ontarians with Disabilities Act* (AODA).

.1 Specified Manufacturers: Assa Abloy Pemko or *Equivalent*.

2.14 SILENCERS

- .1 Furnish rubber door silencers all hollow metal frames; two per pair and three per single door frame.

2.15 SLIDING DOOR TRACK

- .1 Supply sliding door track and hardware for doors weighing up to 200lbs for standard applications. *Provide* needle bearing rollers and aluminum track. Where noted *Provide* sliding door hardware in kit form consisting of hangers, nylon guide, stops and adjustable wrench and mounting hardware. For applications of heavy sliding doors use individual components designed to carry required load capacities, as noted in the hardware schedule.

.1 Specified Manufacturer: Assa Abloy Pemko or *Equivalent*.

2.16 ELECTRONIC PRODUCTS AND ACCESSORIES

- .1 Keypads
 - .1 Keypads shall be 24VDC and operate a 5-amp Double Pole double Throw (DPDT) relay to switch any type of fail-safe or fail-secure electric lock or strike and be weather proof, vandal resistant and suitable for mounting on a narrow mullion. The keypad system circuit board shall be a remote unit to allow for increased security. Release time shall be programmable from 1 to 99 seconds. Keypads shall support 2-to-7-digit codes for a minimum of 59 users and shall be locked out for 30 seconds when 16 wrong digits are entered. System shall have user/installer programmable options such as anti-tailgate, anti-door prop, and duress code alarm.

- .1 Specified Manufacturer: Assa Abloy Securitron DK26 Series or *Equivalent*.
- .2 Keyswitches
 - .1 Keyswitches shall be furnished on a stainless steel single gang face plate with a 12/24VDC bi-color LED and an integral backing bracket that shall permit integration with any 1.25" or 1.125" mortise cylinder. Keyswitches shall be available for momentary or maintained action and in narrow stile designs.
 - .1 Specified Manufacturers: Assa Abloy Securitron MK Series or *Equivalent*.
- .3 In-line power controller
 - .1 Where specified, electrified *Products* shall be supplied with an in-line power controller that enables the hardware to operate from 12 to 32 volts. On board safety features shall include an in-line fuse to protect the hardware and host system from any possible reverse current surges. The controller shall regulate current to *Provide* continuous duty operation without the typical head build up.
 - .1 Specified Manufacturers: Assa Abloy HES 2005 Smart-Pac III or *Equivalent*.
- .4 Power supplies
 - .1 Power supplies shall furnish regulated 24VDC and shall be UL class 2 listed. LED's shall monitor zone status (voltage/no voltage) and slide switches shall be provided to connect or disconnect the load from power; 1, 4 or 8 separate output circuit breakers shall be provided to divide the load. Power supplies shall have the internal capability of charging optional 24VDC sealed lead acid batteries in addition to operating the DC load. Power supplies shall be supplied complete requiring only 120VAC to the fused input and shall be supplied in an enclosure. Power supplies shall be provided with emergency release terminals that allow the release of all devices upon activation of the fire alarm system.
 - .1 Specified Manufacturer: Assa Abloy Securitron BPS or *Equivalent*.
- .5 Elynx cables
 - .1 All power transfer hinges, electrified locksets, electric exit device trim and electric exit devices are to be equipped with Molex plug connectors. Door and Frame Elynx cables have been specified at a provisional length at each of these locations. The *Contractor* shall ensure that the finishing hardware *Supplier* supplies these cables, prior to door/frame manufacture, in appropriate lengths required by the various manufacturers. The Contractor shall ensure that the hardware *Supplier* contacts the door manufacturers to determine the cabling route and supply the correct length. Where the door manufacturer requires flying ends on Elynx cables the hardware installer will be responsible to map and pin Molex connectors.
 - .1 Specified Manufacturer: Assa Abloy McKinney or *Equivalent*.

2.17 FINISHES

- .1 The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their *Products*.
- .2 *Provide* quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine scheduled openings, with installer present, for compliance with requirements for; installation tolerances, labelled fire door assembly construction, wall and floor conditions, and other *Site* conditions affecting performance. Notify the *Consultant* in writing of any discrepancies or conflicts between the door schedule, door types, *Drawings* or scheduled hardware. Discrepancies and conflicts to be resolved in writing prior to installation of hardware.
- .2 Examine hardware to ensure it is free from defects prior to installation.
- .3 Ensure that building is secured and free from weather elements prior to installation of interior door hardware.

3.2 PREPARATION

- .1 Door and Frame Preparation: Field prepare doors and frames for all function holes and fasteners under 25.4mm (1") as per the manufacturer(s) templates and installation instructions provided. Drill and tap as required.

3.3 INSTALLATION

- .1 *Install* each item of mechanical and electromechanical hardware and access control equipment to comply with the manufacturer's written instructions and according to specifications. All items to be installed with fasteners identified by manufacturer's installation instructions unless otherwise noted in the *Contract Documents*.
- .2 Mounting Heights: Install door hardware at heights indicated in the following applicable publications unless; specifically indicated or required by Authorities Having Jurisdiction , requirements to match existing conditions, special templates, necessary coordination with door elevations, and or to ensure consistency with pairs of doors.
 - .1 DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames"
 - .2 DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors"
 - .3 ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities"
 - .4 NWWDA
- .3 Power door operator *Products* and accessories are required to be installed by an AAADM certified technician or equivalent certification acceptable to the *Consultant*, as approved by the manufacturer. Adjust for proper opening and closing operation after final balancing of HVAC system.
- .4 Wall stops: Locate wall stops to contact door pulls/levers at mounting post connecting to door. Ensure existence of necessary wall reinforcing where specified for installation on drywall, plaster or clad wall conditions prior to installation.
- .5 Closers: Size closers as per manufacturer's installation instructions. Adjust all closers after final balancing of HVAC system to ensure; proper latching of doors, proper closing/latch speed, adequate backcheck and opening force in accordance with referenced accessibility requirements.
- .6 Protection plates – Install on clean surface, and in temperature range of 5-25 degrees Celsius where tape applied. Pre-drill pilot holes doors when using mechanical fasteners.

- .7 Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Section 07 92 00 -Joint Sealants.
- .8 Architectural Seals – Install prior to other soffit mounted door hardware as indicated in hardware schedule. Ensure continuous seal of gasketing to door without impeding latching.
- .9 Door Bottoms – Ensure continuous seal to threshold or finished floor.
- .10 Electronic hardware systems: Install all electronic hardware as per electrical elevations and point-to-point drawings furnished under 01 33 00 Submittals & Procedures.

3.4 FIELD QUALITY CONTROL

- .1 The *Contractor* shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures for coordinating all portions of work under the *Contract*, unless the *Contract Documents* give other specific instructions.
- .2 The *Contractor* shall conduct periodic inspections to ensure that door frames are installed plumb, level and square with verification by installer prior to installation of doors and door hardware.
- .3 The *Contractor* shall ensure that the hardware *Supplier* attends *Site* meetings as required to ensure proper execution of the guidelines set forth in this Section.
- .4 The *Contractor* shall ensure that the hardware *Supplier* performs a final field inspection of installed door hardware after final adjustment of all *Products* and documents and reports any deficiencies or omissions for correction and written acceptance by the *Consultant*.

3.5 ADJUSTING

- .1 Adjust and verify proper operation and function of each operating item of hardware (including electromechanical) on all doors prior to acceptance and occupancy. Replace units that cannot be adjusted to operate freely and as intended for the application made, without any additional cost to the Owner.

3.6 CLEANING AND PROTECTION

- .1 The *Contractor* shall protect all hardware, as it is stored on construction *Site* in a covered, dry and secure place. Protect exposed hardware installed on doors and frames during the construction phase. Install any and all hardware at the latest possible time frame.
- .2 Remove manufacturer's protective coating from items after written acceptance of installation by the *Consultant*.
- .3 Clean operating items as necessary to restore to proper function and finish of hardware and doors.
- .4 Clean adjacent surfaces soiled by door hardware installation.

3.7 DEMONSTRATION

- .1 Instruct the *Owner's* maintenance personnel in the proper adjustment, operation and maintenance of mechanical and electromechanical door hardware, electronic devices and maintenance of finishes.

END OF SECTION

HARDWARE SCHEDULE FOR

VAUGHAN 7-12 FIRE STATION

VAUGHAN

Consultant: **Shaun Craig, DHC**

Submittal Date: **MAR 20, 2024**

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

HOLLOW METAL - GENERAL NOTES

- MATERIAL SHOWN ON THESE DRAWINGS WILL BE FABRICATED ONLY AFTER FORMAL APPROVAL BY THE ARCHITECT AND CONTRACTOR, RECEIPT OF APPROVED FINISH HARDWARE SCHEDULE AND ALL NECESSARY TEMPLATES.
- DOORS AND FRAMES WILL BE REINFORCED FOR SURFACE MOUNTED HARDWARE AS REQUIRED. DRILLING AND TAPPING FOR ATTACHING OF HARDWARE BY OTHERS.
- ALL WELDED FRAMES WILL BE SUPPLIED WITH TWO TEMPORARY SHIPPING BARS TO MAINTAIN PROPER ALIGNMENT DURING SHIPPING AND MUST BE REMOVED PRIOR TO INSTALLATION.
- SUPPLY AND INSTALLATION OF GLASS AND GLAZING MATERIALS BY OTHERS.
- ALL DOORS AND FRAMES WILL BE MARKED WITH ARCHITECTS OPENING NUMBERS.
- ALL PLANT ON TYPE MOULDINGS BY OTHERS.
- ALL FRAME INSULATION BY OTHERS.
- PAINT BY OTHERS.

FRAME INSTALLATION VIDEO - <https://www.youtube.com/watch?v=vWFJ1OK00dU>

HARDWARE - GENERAL NOTES

- GENERAL CONTRACTOR TO INSURE ALL WOOD DOORS , FRAMES AND WALLS WHERE REQUIRED TO HAVE FULL WOOD BLOCKING FOR HARDWARE ITEMS SUCH DOOR CLOSERS , OPERATORS, EXIT DEVICES , TRACK HARDWARE ETC.
- ALL HOLD OPEN DOOR CLOSERS TO BE INSTALLED TO THE MAXIMUM OPENING DEGREE POSSIBLE WITHOUT HITTING THE WALL .
- DOOR CLOSERS TO BE MOUNTED OUT OF THE CORRIDOR WHERE EVER POSSIBLE.

WOOD DOORS - GENERAL NOTES

- IF DOORS ARE UNFINISHED, ALL EDGES MUST BE SEALED WITHIN 24 HOURS OF DELIVERY TO SITE TO MAINTAIN WARRANTY.
- DOORS MUST BE STORED FLAT ON A SKID INSIDE FOR 24 HOURS TO ACCLIMATIZE, AVOID WARPAGE AND MAINTAIN WARRANTY.
- NO GLASS OR LOUVRES ARE INCLUDED, ALL BY OTHERS.
- DOORS ARE PREPARED FOR STANDARD HARDWARE ONLY, ANY HARDWARE PREPS OTHER THAN ON HARDWARE LIST AT TIME OF TENDER ARE EXTRA.
- SHOP DRAWINGS RETURNED WITH "REVIEWED" OR "REVIEWED AS NOTED" INDICATES ACCEPTANCE OF MATERIALS AS LISTED.
- ELITE DOOR & HARDWARE WILL NOT TAKE RESPONSIBILITY FOR AN INCOMPLETE REVIEW THAT RESULTS IN UNWANTED MATERIALS ON SITE.
- ANY CHANGES WILL RESULT IN ADDITIONAL CHARGES.

PLEASE NOTE

SCHEDULES (HARDWARE, HOLLOW METAL & WOOD) MUST BE REVIEWED IN DETAIL FOR DESIGN, FUNCTION AND MANUFACTURER, JAMB DEPTH, GAUGE AND ALL OTHER INFORMATION LISTED IN SCHEDULE.
SCHEDULES RETURNED WITH REVIEWED OR REVIEWED AS NOTED INDICATES ACCEPTANCE OF ALL HARDWARE AND MATERIALS AS INDICATED.
IF SCHEDULES ARE NOT REVIEWED IN COMPLETE DETAIL ELITE DOOR & HARDWARE INC WILL NOT TAKE ANY RESPONSIBILITY.
ANY CHANGES COULD RESULT IN ADDITIONAL CHARGES.

SIGNED BY _____ PRINT _____ DATE _____

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Manufacturers & Finishes

Manufacturers

Adams Rite Manufacturing Co.
Camden Door Controls
CorbinRusswin
DORMA
dormakaba
HES
McKinney
MEDECO
Norton Door Control Products
Pemko
Rixson Specialty Door Control
Rockwood Manufacturing
Sargent
Securitron
User Hardware

Finishes

626 - Satin chromium plated over
nickel
628 - Satin aluminum, clear
anodized
630 - Satin stainless steel
689 - Aluminum painted
C26D - Satin chromium plated over
nickel
C32D - Satin stainless steel

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Openings Schedule

Opening Number(s)	Qty	Heading Num.	Location 1	To/ From	Location 2	Nominal Width	Nominal Height	Door Thickness	Hand	Label	Frame Mat'l	Door Mat'l
100A	1	1	EXTERIOR	From	ENTRANCE VESTIBULE 100	1098	2429	51	RHR		ALUM	ALUM
100B	1	2	ENTRANCE VESTIBULE 100	From	ACCESS CORRIDOR 101	1095	2424	51	LHR		ALUM	ALUM
102	1	3	ACCESS CORRIDOR 101	To	RECEPTION 102	965	2150	44	RH		HM	HM
103	1	4	ACCESS CORRIDOR 101	To	UNIVERSAL WASHROOM 103	965	2150	44	LH		HM	HM
104	1	5	ACCESS CORRIDOR 101	To	CAPTAIN'S OFFICE 104	965	2150	44	LH		HM	HM
105A	1	6	ACCESS CORRIDOR 101	To	TRAINING ROOM 105	965	2150	44	LH		HM	HM
105B	1	7	PATIO	From	TRAINING ROOM 105	1063	2429	51	LHR		ALUM	ALUM
114	1	8	PATIO	From	ACCESS CORRIDOR 114	1063	2393	51	RHR		ALUM	ALUM
115A	1	9	VESTIBULE 115	From	ACCESS CORRIDOR 114	1075	2424	51	RHR		ALUM	ALUM
115B	1	10	EXTERIOR	From	VESTIBULE 115	1088	3014	51	LHR		ALUM	ALUM
116	1	3	ACCESS CORRIDOR 114	To	EXERCISE ROOM 116	965	2150	44	RH		HM	HM
120	1	11	ACCESS CORRIDOR 114	From	CLEAN LAUNDRY 120	965	2150	44	LHR		HM	HM
121	1	12	ACCESS CORRIDOR 114	To	LOCKER ROOM 121	965	2150	44	LH		HM	HM
122	1	13	LOCKER ROOM 121	To	WASHROOM & SHOWER 122	965	2150	44	LH		HM	HM
123	1	13	LOCKER ROOM 121	To	WASHROOM & SHOWER 123	965	2150	44	RH		HM	HM
124	1	13	LOCKER ROOM 121	To	WASHROOM & SHOWER 124	965	2150	44	RH		HM	HM
125	1	14	LOCKER ROOM 121	To	CHANGE ROOM 125	860	2150	44	LH		HM	HM
126	1	15	ACCESS CORRIDOR 114	To	SECURITY & IT ROOM 126	965	2150	44	RH		HM	HM
127	1	16	ACCESS CORRIDOR 101	From	JANITOR	965	2150	44	LHR		HM	HM
128	1	17	STAIR TO MEZZANINE 128	From	ACCESS CORRIDOR 101	965	2150	44	LH	45 MIN.	HM	HM
129A	1	18	APPARATUS BAY 128	From	ACCESS CORRIDOR 101	1060	2100	44	RHR	60 MIN.	HM	HM

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Opening Number(s)	Qty	Heading Num.	Location 1	To/ From	Location 2	Nominal Width	Nominal Height	Door Thickness	Hand	Label	Frame Mat'l	Door Mat'l
129B	1	19	APPARATUS BAY 128	From	ACCESS CORRIDOR 114	1060	2106	44	LHR	60 MIN.	HM	HM
129C	1	20	EXTERIOR	From	APPARATUS BAY 128	965	2150	44	LHR		HM	HM
129D	1	20	EXTERIOR	From	APPARATUS BAY 128	965	2150	44	RHR		HM	HM
129E	1	21	EXTERIOR	To/From	APPARATUS BAY 128	4200	4200	50	FOLDING		METAL	METAL
129F	1	21	EXTERIOR	To/From	APPARATUS BAY 128	4200	4200	50	FOLDING		METAL	METAL
130	1	22	APPARATUS BAY 128	To	BUNKER GEAR WASH 127	965	2150	44	LH		HM	HM
131A	1	23	APPARATUS BAY 128	To	BUNKER GEAR 130	965	2150	44	RH		HM	HM
131B	1	23	APPARATUS BAY 128	To	BUNKER GEAR 130	965	2150	44	LH		HM	HM
132	1	24	APPARATUS BAY 128	To	SPRINKLER ROOM 147	965	2150	44	LH		HM	HM
133	1	22	APPARATUS BAY 128	To	ELECTRICAL ROOM	965	2150	44	LH		HM	HM
136A	1	25	EXTERIOR	To	GARBAGE ROOM 136	965	2150	44	LH		HM	HM
136B	1	26	EXTERIOR	To/From	GARBAGE ROOM 136	1800	2400	50	OVRHD		METAL	METAL
200	1	27	BRIDGE 201	From	MECHANICAL ROOM 200	965	2150	51	LHR		HM	HM
201	1	28	BRIDGE 201	To	ROOF	965	2150	44	RH		HM	HM
M109	1	29	DORM. CORRIDOR	To/From	DORMITORY 109	914	2134		SLIDING			
M110	1	29	DORM. CORRIDOR	To/From	DORMITORY 110	914	2134		SLIDING			
M111	1	29	DORM. CORRIDOR	To/From	DORMITORY 111	914	2134		SLIDING			
M112	1	29	DORM. CORRIDOR	To/From	DORMITORY 112	914	2134		SLIDING			

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Hardware Schedule

Heading #1

Item #1	1 Single door 100A, EXTERIOR From ENTRANCE VESTIBULE 100		RHR
	1098 x 2429 x 51 - ALUM DR x ALUM FR		
1	Continuous Hinge	CFM95HD1	C
1	Exit Device	ED4200 630 (K157ET/626) RHR 1098 x 2429 Door W048	630
1	Rim Cylinder Housing	MEDECO 32-0475H LFIC -Rim	
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Cylinder Ring	K24A -CYLINER RING	
2	Construction Core	MEDECO 32-0201-CC	
2	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Electric Strike	9400-630	630
1	Door Pull	BF158 C32D Type 12 HD Mounting	C32D
1	Electronic Closer	ED250-SA-4X6-H-SGL-PUSH-NH-CL-43-R03-19	
2	Wave-To-Open Switch	CM-331S/W-SGLR/42	
2	Mounting Box	CM-43CBL	
1	Overhead Door Stop	6-436 689	689
1	Threshold	252X2AFG43.5 (1100mm)	AFG
1	Door Sweep	29326CNB 43 1/2" (1100mm)	C
1	Door Contact	3287	
1	Card Reader	CR BY SECURITY PROVIDER	
1	REX	REX BY SECURITY PROVIDER	

* NOTE: BALANCE OF GASKETING BY DOOR SUPPLIER

* NOTE: SUPPLY & INSTALLATION OF OPERATOR BY THIS SECTION.

* NOTE: ALL CONDUIT, BACK BOXES WITH HIGH & LOW VOLTAGE WIRING BY OTHERS.

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #2

Item #2 1 Single door 100B, ENTRANCE VESTIBULE 100 From ACCESS CORRIDOR 101 LHR

1095 x 2424 x 51 - ALUM DR x ALUM FR

1	Continuous Hinge	CFM95HD1	C
1	Exit Device	ED4200 630 (K157ET/626) LHR 1095 x 2424 Door W048 M52	630
1	Rim Cylinder Housing	MEDECO 32-0475H LFIC -Rim	
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Cylinder Ring	K24A -CYLINER RING	
2	Construction Core	MEDECO 32-0201-CC	
2	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Electric Strike	9400-630	630
1	Door Pull	BF158 C32D Type 12 HD Mounting	C32D
1	Electronic Closer	ED250-SA-4X6-H-SGL-PUSH-NH-CL-43-R03-19	
2	Wave-To-Open Switch	CM-331S/W-SGLR/42	
2	Mounting Box	CM-43CBL	
1	Overhead Door Stop	6-436 689	689
1	Door Contact	3287	
1	Card Reader	CR BY SECURITY PROVIDER	
1	REX	REX BY SECURITY PROVIDER	

* WAVE THE ACTUATORS BUTTON CYCLES THE OPERATOR. MANUAL OPERATION WITH EXIT DEVICE FROM INSIDE.

* NOTE: SUPPLY & INSTALLATION OF OPERATOR BY THIS SECTION.

* ALL CONDUIT, BACK BOXES WITH HIGH & LOW VOLTAGE WIRING BY OTHERS.

Heading #3

Item #3 1 Single door 102, ACCESS CORRIDOR 101 To RECEPTION 102 RH

Item #4 1 Single door 116, ACCESS CORRIDOR 114 To EXERCISE ROOM 116 RH

965 x 2150 x 44 - HM DR x HM FR

6	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
2	Passage Latchset	ML2010 LWA 626 RH	626
2	Surface Closer	8501-REG 689	689
2	Floor Door Stop	441CU C26D	C26D

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #4

Item #5 1 Single door 103, ACCESS CORRIDOR 101 To UNIVERSAL WASHROOM 103 LH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	T4A3386 5" x 4 1/2" US26D (127x114mm)	C26D
1	Storeroom Lockset	ML2057 LWA 626 LH LC	626
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Cylinder Ring	K24A -CYLINER RING	
1	Electric Strike	1500C-630	630
1	Overhead Door Stop	1-336 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Electronic Closer	ED100-SA-4X6-H-SGL-PULL-NH-CL-38-R03-19	
1	Touchless Switch Restroom System	CX-WC16	
1	Universal Emergency Call Kit	CX-WEC10	
1	Coat Hook	RM821 C32D	C32D

* NOTES:

- DOOR NORMALLY CLOSED AND UNLOCKED VIA FAIL SAFE ELECTRIC STRIKE. WAVE OUTSIDE BUTTON WILL OPEN DOOR. ONCE INSIDE PRESSING THE PUSH TO LOCK BUTTON WILL LOCK THE ELECTRIC STRIKE/LIGHT UP OUTSIDE OCCUPIED LIGHT AND LOCK OUT THE OUTSIDE BUTTON. EGRESS BY PUSHING THE BUTTON OR MANUALLY PULLING OF THE DOOR WILL RESET THE SYSTEM FOR THE NEXT USER.
- EMERGENCY CALL SYSTEM TO SOUND ALARM AND LIGHT UP INSIDE AND OUTSIDE LIGHT AND UNLOCK THE DOOR.
- SUPPLY & INSTALLATION OF OPERATAOR BY THIS SECTION.
- ALL CONDUIT, BACK BOXES WITH HIGH & LOW VOLTAGE WIRING BY OTHERS.

Heading #5

Item #6 1 Single door 104, ACCESS CORRIDOR 101 To CAPTAIN'S OFFICE 104 LH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Dormitory Lockset	ML2065 LWA 626 LH LC	626
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Surface Closer	8501H-REG 689	689
1	Floor Door Stop	441CU C26D	C26D

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #6

Item #7 1 Single door 105A, ACCESS CORRIDOR 101 To TRAINING ROOM 105 LH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D NRP (127 x 114mm)	C26D
1	Passage Latchset	ML2010 LWA 626 LH	626
1	Surface Closer	8501-REG 689	689
1	Floor Door Stop	441CU C26D	C26D

Heading #7

Item #8 1 Single door 105B, PATIO From TRAINING ROOM 105 LHR

1063 x 2429 x 51 - ALUM DR x ALUM FR

1	Continuous Hinge	CFM95HD1	C
1	Deadlatch	4900-36-1-628	628
1	Lever Handle	4560-601-130	130
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Cylinder Ring	K24A -CYLINER RING	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Door Pull	BF158 C32D Type 12 HD Mounting	C32D
1	Surface Closer	CPS7500 689 6891 7786	689
1	Threshold	252X2AFG43.5 (1100mm)	AFG
1	Door Sweep	29326CNB 43 1/2" (1100mm)	C
1	Electric Strike	5000-630 503-630	630
1	Door Contact	3287	
1	Card Reader	CR BY SECURITY PROVIDER	
1	REX	REX BY SECURITY PROVIDER	

* NOTE: BALANCE OF GASKETING BY DOOR SUPPLIER.

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #8

Item #9

1 Single door 114, PATIO From ACCESS CORRIDOR 114

RHR

1063 x 2393 x 51 - ALUM DR x ALUM FR

1	Continuous Hinge	CFM95HD1	C
1	Deadlatch	4900-36-1-628	628
1	Lever Handle	4560-601-130	130
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Cylinder Ring	K24A -CYLINER RING	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Door Pull	BF158 C32D Type 12 HD Mounting	C32D
1	Surface Closer	CPS7500 689 6891 7786	689
1	Threshold	252X2AFG43.5 (1100mm)	AFG
1	Door Sweep	29326CNB 43 1/2" (1100mm)	C
1	Electric Strike	5000-630 503-630	630
1	Door Contact	3287	
1	Card Reader	CR BY SECURITY PROVIDER	
1	REX	REX BY SECURITY PROVIDER	

* NOTE: BALANCE OF GASKETING BY DOOR SUPPLIER.

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN
Submittal Date: MAR 20, 2024

Heading #9

Item #10

1 Single door 115A, VESTIBULE 115 From ACCESS CORRIDOR114

RHR

1075 x 2424 x 51 - ALUM DR x ALUM FR

1	Continuous Hinge	CFM95HD1	C
1	Exit Device	ED4200 630 (K157ET/626) RHR 1075 x 2424 Door W048	630
1	Rim Cylinder Housing	MEDECO 32-0475H LFIC -Rim	
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Cylinder Ring	K24A -CYLINER RING	
2	Construction Core	MEDECO 32-0201-CC	
2	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Electric Strike	9400-630	630
1	Door Pull	BF158 C32D Type 12 HD Mounting	C32D
1	Electronic Closer	ED250-SA-4X6-H-SGL-PUSH-NH-CL-43-R03-19	
2	Wave-To-Open Switch	CM-331S/W-SGLR/42	
2	Mounting Box	CM-43CBL	
1	Overhead Door Stop	6-436 689	689
1	Door Contact	3287	
1	Card Reader	CR BY SECURITY PROVIDER	
1	REX	REX BY SECURITY PROVIDER	

* WAVE THE ACTUATORS BUTTON CYCLES THE OPERATOR. MANUAL OPERATION WITH EXIT DEVICE FROM INSIDE.

* NOTE: SUPPLY & INSTALLATION OF OPERATOR BY THIS SECTION.

* ALL CONDUIT, BACK BOXES WITH HIGH & LOW VOLTAGE WIRING BY OTHERS.

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #10

Item #11 1 Single door 115B, EXTERIOR From VESTIBULE 115 LHR

1088 x 3014 x 51 - ALUM DR x ALUM FR

1	Continuous Hinge	CFM95HD1	C
1	Exit Device	ED4200 630 (K157ET/626) LHR 1088 x 3014 Door W048 M52	630
1	Rim Cylinder Housing	MEDECO 32-0475H LFIC -Rim	
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Cylinder Ring	K24A -CYLINER RING	
2	Construction Core	MEDECO 32-0201-CC	
2	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Electric Strike	9400-630	630
1	Door Pull	BF158 C32D Type 12 HD Mounting	C32D
1	Electronic Closer	ED250-SA-4X6-H-SGL-PUSH-NH-CL-43-R03-19	
2	Wave-To-Open Switch	CM-331S/W-SGLR/42	
2	Mounting Box	CM-43CBL	
1	Overhead Door Stop	6-436 689	689
1	Threshold	252X2AFG43.5 (1100mm)	AFG
1	Door Sweep	29326CNB 43 1/2" (1100mm)	C
1	Door Contact	3287	
1	Card Reader	CR BY SECURITY PROVIDER	
1	REX	REX BY SECURITY PROVIDER	

* NOTE: BALANCE OF GASKETING BY DOOR SUPPLIER

* NOTE: SUPPLY & INSTALLATION OF OPERATOR BY THIS SECTION.

* NOTE: ALL CONDUIT, BACK BOXES WITH HIGH & LOW VOLTAGE WIRING BY OTHERS.

Heading #11

Item #12 1 Single door 120, ACCESS CORRIDOR 114 From CLEAN LAUNDRY 120 LHR

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D NRP (127 x 114mm)	C26D
1	Passage Latchset	ML2010 LWA 626 LHR	626
1	Surface Closer	CPS7500T 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Gasketing	S88 BL18	BL
1	Threshold	252X226AP38" (965mm)	A

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #12

Item #13 1 Single door 121, ACCESS CORRIDOR 114 To LOCKER ROOM 121 LH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Door Pull	110 x 70C C32D	C32D
1	Push Plate	70C-RKW C32D	C32D
1	Surface Closer	7500-REG 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Overhead Door Stop	1-336 689	689

Heading #13

Item #14 1 Single door 122, LOCKER ROOM 121 To WASHROOM & SHOWER 122 LH

Item #15 1 Single door 123, LOCKER ROOM 121 To WASHROOM & SHOWER 123 RH

Item #16 1 Single door 124, LOCKER ROOM 121 To WASHROOM & SHOWER 124 RH

965 x 2150 x 44 - HM DR x HM FR

9	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Privacy Latchset	ML2020 LWA 626 LH	626
2	Privacy Latchset	ML2020 LWA 626 RH	626
3	Overhead Door Stop	9-336 689	689
3	Coat Hook	RM821 C32D	C32D

Heading #14

Item #17 1 Single door 125, LOCKER ROOM 121 To CHANGE ROOM 125 LH

860 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Privacy Latchset	ML2020 LWA 626 LH	626
1	Overhead Door Stop	9-336 689	689
1	Coat Hook	RM821 C32D	C32D

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #15

Item #18 1 Single door 126, ACCESS CORRIDOR 114 To SECURITY & IT ROOM 126 RH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Storeroom Lockset	ML2057 LWA 626 RH LC	626
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Cylinder Ring	K24A -CYLINER RING	
1	Surface Closer	7500-REG 689	689
1	Floor Door Stop	441CU C26D	C26D
1	Electric Strike	1500C-630	630
1	Card Reader	CR BY SECURITY PROVIDER	
1	REX	REX BY SECURITY PROVIDER	

* NOTE: DOOR SCHEDULE DOES NOT CALL FOR CARD READER, BUT ELECTRICAL DRAWINGS DOES - PLEASE CONFIRM.

Heading #16

Item #19 1 Single door 127, ACCESS CORRIDOR 101 From JANITOR LHR

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D NRP (127 x 114mm)	C26D
1	Storeroom Lockset	ML2057 LWA 626 LHR LC	626
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Construction Core	MEDECO 32-0201-CC	
1	Cylinder Ring	K24A -CYLINER RING	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Surface Closer	CPS7500T 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #17

Item #20 1 Single door 128, STAIR TO MEZZANINE 128 From ACCESS CORRIDOR 101 LH

965 x 2150 x 44 - HM DR x HM FR - 45 MIN.

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Exit Device (Passage)	ED5200A 630 (128/910ET/626) LH 44 965	630
1	Surface Closer	7500-REG 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Wall Door Stop	406 C26D	C26D
1	Gasketing	S88 BL18	BL

Heading #18

Item #21 1 Single door 129A, APPARATUS BAY 128 From ACCESS CORRIDOR 101 RHR

1060 x 2100 x 44 - HM DR x HM FR - 60 MIN.

3	Standard Hinge	TA2714 5" x 4 1/2" US26D NRP (127 x 114mm)	C26D
1	Exit Device (Classroom)	ED5200A 630 (128/955ET/626) RHR 44 1060 W048	630
1	Rim Cylinder Housing	MEDECO 32-0475H LFIC -Rim	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Surface Closer	CPS7500 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Gasketing	S88 BL18	BL
1	Auto Door Bottom	420APKL38" (965mm)	
1	Threshold	252X226AP42" (1060mm)	A

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #19

Item #22 1 Single door 129B, APPARATUS BAY 128 From ACCESS CORRIDOR 114 LHR

1060 x 2106 x 44 - HM DR x HM FR - 60 MIN.

3	Standard Hinge	TA2714 5" x 4 1/2" US26D NRP (127 x 114mm)	C26D
1	Exit Device (Classroom)	ED5200A 630 (128/955ET/626) LHR 44 1060 W048	630
1	Rim Cylinder Housing	MEDECO 32-0475H LFIC -Rim	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Surface Closer	CPS7500 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Gasketing	S88 BL18	BL
1	Auto Door Bottom	420APKL38" (965mm)	
1	Threshold	252X226AP42" (1060mm)	A

Heading #20

Item #23 1 Single door 129C, EXTERIOR From APPARATUS BAY 128 LHR

Item #24 1 Single door 129D, EXTERIOR From APPARATUS BAY 128 RHR

965 x 2150 x 44 - HM DR x HM FR

6	Continuous Hinge	CFM83HD1	C
1	Exit Device (Night Latch)	ED5200 630 (128/957ET/626) LHR 44 965 W048 M52	630
1	Exit Device (Night Latch)	ED5200 630 (128/957ET/626) RHR 44 965 W048 M52	630
2	Rim Cylinder Housing	MEDECO 32-0475H LFIC -Rim	
2	Cylinder Ring	K24A -CYLINER RING	
2	Construction Core	MEDECO 32-0201-CC	
2	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
2	Electric Strike	9400-630	630
2	Surface Closer	CPS7500 689	689
2	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
2	Threshold	252X2AFG38" (965mm)	AFG
2	Door Sweep	29326CNB 38" (965mm)	C
2	Weatherstripping	2891AS-38" x 85" (1@965, 2@2150mm)	A
2	Wire Harness	QC-C012 - Confirm Length Required With Door Supplier	
2	Door Contact	3287	
2	Card Reader	CR BY SECURITY PROVIDER	
2	REX	REX BY SECURITY PROVIDER	

* NOTE:

- SWIPE ON CARD READER TO RETRACTS THE LATCH AND OPENS THE DOOR. DOOR CLOSES AND LOCKS. MANUAL OPERATION WITH EXIT DEVICE FROM EXTERIOR.

- ALL WIRING HIGH AND LOW VOLTAGE , CONDUIT AND BACK BOXES BY ELECTRICAL CONTRACTOR.

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #21

Item #25	1 Single door 129E, EXTERIOR To/From APPARATUS BAY 128	FOLDING
Item #26	1 Single door 129F, EXTERIOR To/From APPARATUS BAY 128	FOLDING

4200 x 4200 x 50 - METAL DR x METAL FR

* NOTE: ALL HARDWARE BY DOOR SUPPLIER.

Heading #22

Item #27	1 Single door 130, APPARATUS BAY 128 To BUNKER GEAR WASH 127	LH
Item #28	1 Single door 133, APPARATUS BAY 128 To ELECTRICAL ROOM	LH

965 x 2150 x 44 - HM DR x HM FR

6	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
2	Passage Latchset	ML2010 LWA 626 LH	626
2	Surface Closer	7500H-REG 689	689
2	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
2	Overhead Door Stop	1-336 689	689

* NOTE: FREE PASSAGE IN BOTH DIRECTIONS.

Heading #23

Item #29	1 Single door 131A, APPARATUS BAY 128 To BUNKER GEAR 130	RH
Item #30	1 Single door 131B, APPARATUS BAY 128 To BUNKER GEAR 130	LH

965 x 2150 x 44 - HM DR x HM FR

6	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Passage Latchset	ML2010 LWA 626 LH	626
1	Passage Latchset	ML2010 LWA 626 RH	626
2	Surface Closer	7500H-REG 689	689
2	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
2	Overhead Door Stop	1-336 689	689

* NOTE: DOOR SCHEDULE DOES NOT CALL FOR A CARD READER, BUT ELECTRICAL DRAWINGS DOES - PLEASE CONFIRM

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #24

Item #31 1 Single door 132, APPARATUS BAY 128 To SPRINKLER ROOM 147 LH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Storeroom Lockset	ML2057 LWA 626 LH LC	626
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Surface Closer	7500-REG 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Overhead Door Stop	1-336 689	689
1	Electric Strike	1500C-630	630
1	Digital Keypad	DK-26 SS	SS

* NOTE: ALL CONDUIT, BACK BOXES WITH HIGH & LOW VOLTAGE WIRING BY OTHERS.

* NOTE: PLEASE CONFIRM IF A DIGITAL KEYPAD REQUIRED / OR AN ELECTRIC STRIKE WITH CARD READER / OR A MECHANICAL KEYPAD LOCKSET- TBC.

Heading #25

Item #32 1 Single door 136A, EXTERIOR To GARBAGE ROOM 136 LH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Keypad Lockset	LL1021M-026-41 - LH	026
1	Surface Closer	7500-REG 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Overhead Door Stop	9-336 689	689

* NOTE: IS A KEYPAD REQUIRED? OR MECHANICAL KEYPAD LOCK - TBC.

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #26

Item #33 1 Single door 136B, EXTERIOR To/From GARBAGE ROOM 136 OVRHD

1800 x 2400 x 50 - METAL DR x METAL FR

* NOTE: ALL HARDWARE BY DOOR SUPPLIER.

Heading #27

Item #34 1 Single door 200, BRIDGE 201 From MECHANICAL ROOM 200 LHR

965 x 2150 x 51 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D (127x114mm)	C26D
1	Door Pull	110 x 70C C32D	C32D
1	Push Plate	70C-RKW C32D	C32D
1	Surface Closer	CPS7500 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D

Heading #28

Item #35 1 Single door 201, BRIDGE 201 To ROOF RH

965 x 2150 x 44 - HM DR x HM FR

3	Standard Hinge	TA2714 5" x 4 1/2" US26D NRP (127 x 114mm)	C26D
1	Storeroom Lockset	ML2057 LWA 626 RH LC	626
1	Mortise Cylinder Housing	MEDECO 32-0275 -CAM - LFIC Mortise	
1	Construction Core	MEDECO 32-0201-CC	
1	Permanent Core	MEDECO 320201(P)- LFIC CORE (BY CRAIG SECURITY)	
1	Surface Closer	CPS7500 689	689
1	Kick Plate	K1050 8" x 36 1/2" US32D 4BE SA (200x927mm)	C32D
1	Weatherstripping	2891AS-38" x 85" (1@965, 2@2150mm)	A
1	Door Sweep	29326CNB 38" (965mm)	C
1	Threshold	252X2AFG38" (965mm)	AFG

* NOTE: NO DOOR DETAILS IN DOOR SCHEDULE, BUT SHOWS ON FLOOR PLAN - TBC.

Elite
Door & Hardware Inc

VAUGHAN 7-12 FIRE STATION
VAUGHAN

Submittal Date: MAR 20, 2024

Heading #29

Item #36	1 Single door M109, DORM. CORRIDOR To/From DORMITORY 109	SLIDING
Item #37	1 Single door M110, DORM. CORRIDOR To/From DORMITORY 110	SLIDING
Item #38	1 Single door M111, DORM. CORRIDOR To/From DORMITORY 111	SLIDING
Item #39	1 Single door M112, DORM. CORRIDOR To/From DORMITORY 112	SLIDING

914 x 2134 x __ - HM DR x HM FR

* NOTE: SLIDING DOOR DEVICE AND ASSOCIATED ACCESSORIES BY DOOR SUPPLIER.

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Closeout Submittals
- .7 1.7 Quality Assurance
- .8 1.8 Delivery, Storage, and Handling
- .9 2.1 Performance/Design Requirements
- .10 2.2 Automatic Door Operators - General
- .11 2.3 Automatic Door Operators - Door Frame/Wall Mounted
- .12 2.4 Finishes
- .13 2.5 Fabrication
- .14 3.1 Examination
- .15 3.2 Preparation
- .16 3.3 Installation
- .17 3.4 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - .1 Automatic door operators.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Check dimensions at the *Place of the Work* before fabrication commences, and report to the *Consultant* in writing all discrepancies.
 - .2 Where dimensions are not available before fabrication commences, the dimension required shall be agreed upon between the Contractor and the Consultant.

1.5 SUBMITTALS

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

.3 Shop drawings:

- .1 *Shop Drawings* to be prepared specifically for this *Contract* and to indicate location of components, anchorage details, adjacent construction interface, and dimensions as well as all necessary wiring and electrical requirements.

.4 Samples:

- .1 Submit samples of each finish material proposed for use in the *Work*.

.5 Certificates:

- .1 Submit certificate of conformance to specified standards following procedures for submittal of *Product* data.

.6 Templates:

- .1 Submit templates during construction for use by installers and fabricators as required for proper location and installation of hardware.

1.6 CLOSEOUT SUBMITTALS

.1 Operation and maintenance data:

- .1 Demonstrate, and *Provide* instruction in, the proper operation and maintenance of the *Products Provided* as part of the work of this Section to the *Owner* in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Submit operation data and maintenance data for cleaning and maintenance of hardware for incorporation into the operation and maintenance manual specified in Section 01 77 00 Contract Closeout Procedures and Submittals.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Installers / applicators / erectors:

- .1 Execute the work of this Section only by a *Subcontractor* who has the plant, equipment, and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years, and with 10 years' satisfactory experience.
- .2 The *Contractor* shall ensure that the installer is approved in writing by the manufacturer of the operators for installation of its *Product*.

- .2 Barrier free door operators shall be certified by the manufacturer to performance design criteria in accordance with CAN/CSA C22.2 No. 247-92(R2014), and ANSI/BHMA A156.19-2013.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Store finishing hardware in locked, clean dry area.
- .2 Package each item of hardware, including fastenings, separately or in like groups of hardware, and label each package as to item definition and location.
- .3 Submit hardware with an easily removable covering to protect against scratches, abrasions, coating with dissimilar finish materials on adjacent surfaces, and tarnishing.

PART 2 - PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Use Underwriters Laboratories of Canada (ULC) listed and labelled hardware in fire separations and exit doors.
- .2 The *Contractor* shall be responsible for, and abide by, all requirements and regulations of the Ontario Building Code. Conduct tests and inspections required and pay all charges incidental thereto.

2.2 AUTOMATIC DOOR OPERATORS - GENERAL

- .1 Operation:
 - .1 Activation type:
 - .1 Push-plate.
 - .2 Door to safely stop and reverse if an object is encountered in the opening or closing cycle.
 - .3 Manual opening force: 62 N.
 - .4 Closing force: 26.6 N.
 - .5 Factory-set door hold open voltage.
 - .6 Fail safe: In the event of power failure, door shall operate manually, without damage to operator components.
- .2 Activators; wall-mounted:
 - .1 Push-plate:
 - .1 Formed stainless steel plate, satin finish, approximately 127 mm (5") square, with depressed wheelchair logo marking, two required per opening.
 - .2 Electrical supply: 120 Volt.

2.3 AUTOMATIC DOOR OPERATORS - DOOR FRAME/WALL MOUNTED

- .1 *Provide* adjustment by microprocessor for the following:
 - .1 Opening speed.
 - .2 Back-check.
 - .3 Hold-open, from 5 seconds to 30 seconds.
 - .4 Closing speed.
 - .5 Opening force.
 - .6 Acceleration during opening and recycling, for soft start.
- .2 Controller:
 - .1 Completely electromechanical capable of the following functions:
 - .1 Obstruction detection.
 - .2 Initialization and power on.
 - .3 Door motion learn cycle.

- .4 Manual mode, without spring closer.
- .5 Power open/power close logic.
- .2 Control box and motor/gear box to be contained in aluminum housing finished to match aluminum entrances, precision-machined gears and bearing seats and all- weather lubricant, mounted on vibration isolators.
 - .1 Design for surface-mounted application on surface of door frame/wall, maximum 3 mm (1/8") above top of door.
 - .2 Design for interior application.
- .3 Gears: manufactured by operator manufacturer specifically for operators being provided.
- .4 Motor: Direct Current (DC) permanent magnet motor with shielded ball bearings. Stop motor when door stops or is fully open and when breakaway is operated.
- .5 Door operating arm: forged steel, attached at natural pivot point of door. Do not use side block in top of door. Exposed arms to be factory polished and finished to match operator enclosure.
- .6 Control circuits for actuators and safeties: low-voltage, National Electrical Code (NEC) Class II.
- .7 Service conditions: satisfactory operation between -34°C and 71°C.
- .3 Acceptable Products:
 - .1 Typical: Horton '7100 Series' by Hunter Automatics Inc. or *Equivalent*.

2.4 FINISHES

- .1 Finish components to match aluminum framed glazing systems in conjunction with which they are to be provided, in accordance with Section 08 41 00 – Aluminium Framed Glazing Systems.

2.5 FABRICATION

- .1 Fit intersecting members to flush hairline weathertight joints and mechanically fasten together, except where indicated otherwise in the Contract Documents.
- .2 Conceal fastenings from view, except where indicated otherwise in the Contract Documents.
- .3 Form cut-outs, recesses, mortising or milling for finishing hardware to templates supplied. Reinforce with aluminum or galvanized steel plates.
- .4 Field apply isolation coating to aluminum in contact with dissimilar metals or cementitious materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify that door openings are properly installed and ready to receive the work of this Section.
- .2 Verify that electrical service is available, properly located, and of proper type.

3.2 PREPARATION

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

3.3 INSTALLATION

- .1 *Install* in accordance with the manufacturer's instructions and in accordance with CAN/CSA C22.2 No. 247-92(R2014).
- .2 *Provide* operator system complete in all its parts and connected to electrical service provided as part of the work of Divisions 26 and 28. Secure all wiring such that it is concealed from view.

3.4 ADJUSTING AND CLEANING

- .1 Verify that installed hardware and operators function properly and instruct installers accordingly of requirements and procedures for adjustments for operation without binding or scraping, and without excessive noise.
- .2 Clean hardware after installation in accordance with the *Supplier's* instructions.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 References
- .5 1.5 Submittals
- .6 1.6 Closeout Submittals
- .7 1.7 Quality Assurance
- .8 1.8 Delivery, Storage, and Handling
- .9 1.9 Field Conditions
- .10 1.10 Extended Warranty
- .11 2.1 Performance/Design Requirements
- .12 2.2 Glass Materials
- .13 2.3 Fire Protection Rated Glass
- .14 2.4 Glazing Materials (non-fire rated)
- .15 2.5 Glazing Accessories (fire rated)
- .16 2.6 Fabrication
- .17 3.1 Examination
- .18 3.2 Preparation
- .19 3.3 Glazing - General
- .20 3.4 Tape Glazing
- .21 3.5 Gasket Glazing (Dry)
- .22 3.6 Sealant Glazing (Wet)
- .23 3.7 Installation – Mirrors
- .24 3.8 Field Quality Control
- .25 3.9 Protection
- .26 3.10 Finishing

1.3 SUMMARY

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

1.4 REFERENCES

- .1 Definitions:

- .1 Deterioration of coated glass: Defects developing from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.
- .2 Deterioration of insulating glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture or film on interior surfaces of glass.
- .3 Deterioration of laminated glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delaminating material obstructing vision through glass and blemishes exceeding those allowed by referenced laminated glass standards.
- .4 Interspace or airspace: The space between lites of any insulating glass unit that contains dehydrated air or a specified gas.
- .5 Manufacturer: A firm that produces primary glass or fabricated glass products as defined in referenced glazing publications.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 *Shop Drawings*:
 - .1 Show details of each type of glazing system in conjunction with the framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material, glazing thickness, bite on the glass and glass edge clearance.
 - .2 For glass scheduled or indicated in the Contract Drawings as engineered and glass to serve as guards in accordance with the Ontario Building Code, *Shop Drawings* to be engineered *Shop Drawings*.
 - .3 Indicate analysis of glass including maximum deflection and allowable stresses (from imposed dead/live loads and thermal loads).
- .4 Samples:
 - .1 Submit 305 mm (12") square samples of each type of glass indicated except for clear monolithic glass products, and 305 mm (12") long samples of each color required, except black, for each type of sealant or gasket exposed to view.
 - .1 Submit three control samples for each glass type showing maximum range of visible difference between units for the project.
- .5 Test and evaluation reports:

- .1 Obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials including insulating units.
- .6 Manufacturer reports:
 - .1 Submit glass fabricator's *Product* information and structural calculations indicating compliance with glazing standards established by the Glass Association of North America (GANA) Please review this insertion which was made to ensure compliance with trade treaties. Submittal to include thermal stress and structural load analysis of the proposed glass types, configuration and sizes.
 - .7 Submit sample glazing warranty.
 - .8 Submit letter from Insulating Glass Manufacturers Association of Canada (IGMAC) or equivalent association or a test report prepared by independent testing company confirming insulating glass units of the types required have been successfully tested in accordance with CAN/CGSB 12.8-97 or ASTM E2190-10 and will withstand design loads specified in the *Contract Documents*.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 = Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit maintenance and cleaning instructions for glass and glazing for incorporation into the operating and maintenance manuals.

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of 10 years of fabrication experience and meet ANSI / ASQC 9002 1994.
 - .2 Installers / applicators / erectors: The *Contractor* shall *Provide* the work of this Section executed by *Subcontractor* who is thoroughly trained and experienced in skills required, be completely familiar with referenced standards and requirements of the work of this Section, and who will personally direct installation performed under this Section.
 - .1 Foreperson experience: a minimum of 10 years' experience as glazing mechanic.
 - .2 Typical glazing mechanic experience: a minimum of three years' experience as glazers.
 - .3 Mirror installations: Installation only by applicator trained and approved by adhesive manufacturer for application of its *Products*.
 - .3 Licensed professionals: Retain a *Professional Engineer* to design the work of this Section; to prepare, seal and sign *Shop Drawings*; and to perform field review. *Shop Drawings* must show both design and installation requirements.
- .2 Mock-ups:
 - .1 *Provide* mock-up of mirror installation, including minimum of four full size mirrors.
 - .2 Locate mirror mock-up where approved by the *Consultant*.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 FIELD CONDITIONS

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

1.10 EXTENDED WARRANTY

- .1 Special product warranty for insulating glass unit *Products*:
 - .1 *Provide* a written warranty from date of manufacture for sealed insulating glass units. Warranty must cover the following:
 - .1 Deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.
 - .2 Replacement of sealed insulating glass units.
 - .3 No dollar limit.
 - .4 Non-prorated.
 - .5 10-year warranty duration from the date of Substantial Performance.
- .2 Special *Product* warranty for mirror glass *Products*:
 - .1 *Provide* a written warranty from date of manufacture for mirror silvering. Warranty shall cover the following:
 - .1 Deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.
 - .2 Replacement of mirror glass units.
 - .3 10 year warranty duration from the date of Substantial Performance.

PART 2 – PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 General:
 - .1 Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated in the Contract Documents. Refer to these publications for glazing terms not otherwise defined in this Section.
 - .1 Glass Association of North America (GANA) Glazing Manual.

- .2 GANA Engineering Standards Manual.
- .3 GANA Laminated Glazing Reference Manual.
- .4 GANA Sealant Manual.
- .2 Regulatory requirements:
 - .1 Fire rated glass:
 - .1 Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.
 - .3 Glass strength:
 - .1 *Provide* glass *Products* in the thickness and strengths required to meet or exceed the following criteria based on *Project* loads and in-service conditions.
 - .1 Analysis shall comply with CAN/CGSB 12.20-M89.
 - .2 Minimum thickness of annealed or heat-treated glass *Products* to be selected so the worst case probability of failure does not exceed the following:
 - .1 8 breaks per 1000 for glass installed vertically less than 15 degrees from the vertical plane and under wind action.
 - .2 5 breaks per 1000 for heat soaked tempered glass as a result of verifiable Nickel Sulphide (NiS) inclusion.
 - .3 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.
 - .3 Maximum lateral deflection; insulating glass units:
 - .1 For insulating glass units supported on four edges, limit centre-of-glass deflection at design wind pressure to not more than 1/175 times the long- side length or 19 mm (3/4") maximum.
 - .4 Glass at guards, balustrades, and where glass is likely to be subjected to human impact shall comply with safety glass requirements of CAN/CGSB 12.20-M89 and CAN/CGSB 12.1-M90, where applicable, and the Ontario Building Code.
 - .5 *Provide* annealed, heat strengthened, and tempered lights where required by the Ontario Building Code, and where required for the various solar exposures on the building.
 - .6 Glass thicknesses and glass types specified, indicated, or scheduled in the *Contract Documents* are minimums required. The *Contractor's* glass designer/engineer to modify as required to satisfy design and Ontario Building Code requirements, and requirements of the *Authorities Having Jurisdiction*, and any such modifications shall be clearly indicated on *Shop Drawings*.
- .4 Thermal and optical performance: *Provide* glass *Products* with performance properties specified or published by glass manufacturer where not specified. Performance properties to be manufacturer's published data as determined according to the following procedures:
 - .1 Centre of glass U-Value: National Fenestration Rating Council (NFRC) 100 methodology using LBNL WINDOW 5.2 computer program.

- .2 Centre of glass solar heat gain coefficient: NFRC 200 methodology using LBNL- 35298 WINDOW 5.2 computer program.
- .3 Visible light transmittance: NFRC 200 methodology.
- .4 Solar optical properties: NFRC 300 or LBNL Optics.
- .5 Glazing systems shall be capable of withstanding normal thermal movements, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.
- .6 Protect laminated glass interlayer from damage or discolouration resulting from contact with deleterious and incompatible sealants, substances, and materials. Comply with manufacturer's recommended installation instructions.

2.2 GLASS MATERIALS

.1 General:

- .1 Single source responsibility: *Provide* materials from a single manufacturer or fabricator for each kind and condition of glass indicated in the Contract Documents and composed of primary glass obtained from a single source and manufacturing plant for each type and class required.

.2 Insulating glass units:

- .1 Hermetically sealed, CAN/CGSB 12.8-97, minimum 12 mm (1/2") air space, air filled, double sealed edges (primary to be polyisobutylene, secondary to be polysulphide/polyurethane, desiccant filled aluminum spacer bar.
 - .1 The minimum thickness of the secondary seal shall be 1.59 mm (1/16").
 - .2 The target width of the primary seal shall be 3.97 mm (5/32").
 - .3 There shall be no voids or skips in the primary seal.
 - .4 Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1.59 mm (1/16") by maximum length of 50 mm (2") with gaps separated by at least 450 mm (18"). Continuous contact between the primary seal and the secondary seal is desired.
 - .5 Both primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.
- .2 Warm edge, hermetically sealed, CAN/CGSB 12.8-97, minimum 12 mm (1/2") air space, air filled, double sealed edges (primary to be polyisobutylene, secondary to be polysulphide, desiccant filled warm edge spacer (splice connectors at corner of each glass unit).
 - .1 The minimum thickness of the secondary seal shall be 1.59 mm (1/16").
 - .2 The target width of the primary seal shall be 3.97 mm (5/32").
 - .3 There shall be no voids or skips in the primary seal.
 - .4 Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1.59 mm (1/16") by maximum length of 50 mm (2") with gaps separated by at least 450 mm (18"). Continuous contact between the primary seal and the secondary seal is desired.

- .5 Both primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.
- .6 Warm edge spacer:
 - .1 Vinyl faced, electrolytic tinplated steel: Fenzi North America 'Warmedge' or *Equivalent*.
 - .2 Spacer bar colour:
 - .3 Black.
- .3 Insulating Glass Manufacturers Association of Canada (IGMAC) or certified by equivalent association.
- .4 Low 'E' coating (double silver):
 - .1 Acceptable *Products*:
 - .1 Vitro Architectural Glass 'Solarban 90'.
 - .2 Or *Equivalent*.
- .5 Glass thickness: 6 mm (1/4") minimum, and as required to suit design requirements.
- .6 Glass colour: clear, unless otherwise indicated in the *Contract Documents*.
- .7 Performance Requirements:
 - .1 Visible Light Transmittance: 41 percent minimum
 - .2 Winter Nighttime U-Factor: 0.47 (Btu/hr*ft²*°F) maximum
 - .3 Summer daytime U-Factor: 0.45 (Btu/hr*ft²*°F) maximum
 - .4 Shading Coefficient: 0.26 maximum
 - .5 Solar Heat Gain Coefficient: 0.23 maximum
 - .6 Outdoor Visible Light Reflectance: 16 percent maximum
- .3 Annealed (float) glass:
 - .1 Clear, annealed glass, 6 mm (1/4") thick minimum, CAN/CGSB 12.3-M91, Glazing Quality.
- .4 Heat treated (tempered or heat strengthened) float glass:
 - .1 CAN/CGSB 12.1-M90.
 - .2 *Provide* thickness as indicated or greater thickness as needed to comply with requirements. Minimum thickness: 6 mm (1/4").
 - .3 Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated in the Contract Documents.
 - .4 For uncoated glass, comply with requirements for Condition A in accordance with ASTM C1048-12e1.
 - .5 For coated vision glass, comply with requirements for Condition C (other coated glass) in accordance with ASTM C1048-12e1.

- .6 Heat strengthened glass shall have surface compression of 24-52 MPa (3,500- 7,500 psi).
- .5 Mirrors:
 - .1 Annealed glass, to ASTM C1503-08(2013) as follows:
 - .1 Grade: Mirror Cut Size.
 - .2 Quality: Mirror Select Quality, except allowable distortion shall be $\geq 80^\circ$ vision interference angle to ASTM C1036-11e1 Table 5.
 - .3 Colour: Clear.
 - .4 Thickness: 6 mm (1/4")
 - .5 Exposed edges shall be chamfered, ground, and polished.
 - .6 Ceramic-coated spandrel glass:
 - .1 Glass treatment:
 - .1 Tempered float glass.
 - .2 Thickness: 6 mm (1/4") minimum thickness.
 - .3 Coating Location: Second surface.
 - .4 Fallout Resistance: Passes fallout-resistance test in ASTM C1048-12e1 for an assembly of glass and adhered reinforcing material.
 - .5 Ceramic enamel coating, baked on.
 - .1 Colour: Custom colour to later selection by the *Consultant*
 - .6 Acceptable ceramic coating manufacturers:
 - .1 Viracon Inc.
 - .2 Prelco Inc.
 - .3 Or *Equivalent*.

2.3 FIRE PROTECTION RATED GLASS

- .1 Fire rated, impact safety resistant glass, non-wired:
 - .1 Film-faced ceramic glazing:
 - .1 Fire-rated and impact safety-rated, clear ceramic glazing material with surface applied impact safety film, and listed for use in doors, sidelites, transoms, and borrowed lites in both interior and exterior applications, not functioning as a barrier to heat.
 - .2 Fire-ratings: as indicated or scheduled, from 20 minutes to 90 minutes, 3 hours in doors where applicable, with hose stream test.
 - .3 Impact Safety Resistance: ANSI Z97.1-2010 and CPSC 16 CFR 1201 (Cat. I and II).
 - .4 Surface finish:
 - .1 Premium Grade: clear glass, polished for superior optical clarity.
 - .5 Acceptable *Product*:

- .1 Schott Gemtron (Canada) Corporation 'Pyran Platinum F'.
- .2 Technical Glass Products Ltd. 'FireLite NT'.
- .3 Or *Equivalent*.

2.4 GLAZING MATERIALS (NON-FIRE RATED)

- .1 Glazing materials; general: Select glazing sealants, tapes, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass *Products*, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
- .2 Glazing gaskets: Moulded or extruded gaskets of profile and hardness required to maintain watertight seal, made from the following:
 - .1 Preformed, Ethylene Propylene Diene Monomer (EPDM) to ASTM C864-05(2011).
- .3 Setting blocks: Moulded or extruded material with Shore, Type A Durometer hardness of 85, plus or minus 5, made from the following:
 - .1 Preformed, EPDM to ASTM C864-05(2011).
- .4 Spacers: Moulded or extruded blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated made from the following:
 - .1 Preformed, EPDM to ASTM C864-05(2011).
- .5 Edge blocks: Moulded or extruded material of hardness needed to limit glass lateral movement (side walking) made from the following:
 - .1 Preformed, EPDM to ASTM C864-05(2011).
- .6 Cleaners, primers and sealers: Type recommended by sealant or gasket manufacturer.
- .7 Polyurethane foam glazing tape:
 - .1 High density, closed-cell, flexible, non-extruding tape, adhesive backed one side only; recommended by manufacturer for exterior applications with nominal pressure in glazing channel.
 - .2 Acceptable manufacturer: Norton Company or *Equivalent*.
 - .3 Acceptable *Products*: As recommended by manufacturer suitable for conditions of application and use.
- .8 Silicone glazing (Weatherseal) sealant:
 - .1 Medium-modulus, neutral-curing silicone sealant; complying with ASTM C920- 11, Type M or S, Grade NS, Class 25.
 - .2 Acceptable *Products*:
 - .1 Dow Corning '790' or '795'.
 - .2 Pecora Corporation '864' or '890'.
 - .3 Sika Canada Inc. 'Sikasil WS-290' or 'WS-295'.
 - .4 Tremco Inc. 'Spectrum 2'.

- .5 Momentive Performance Materials Inc. 'SilGlaze II'.
- .6 Or *Equivalent*.
- .9 Mirror clips:
 - .1 Nickel plated, CR Laurence 'Vancouver' clips or *Equivalent*.
- .10 Mirror adhesive: Palmer Mirro-Mastic, or *Equivalent*. Complete with sealer as required.

2.5 GLAZING ACCESSORIES (FIRE RATED)

- .1 Glazing tape; fire-rated glass (non-wired):
 - .1 Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapour seal.
 - .2 Silicone sealant: One-part neutral curing silicone, medium modulus sealant, to ASTM C920-11, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.
 - .1 Acceptable Products:
 - .1 Dow Corning '795'.
 - .2 Momentive Performance Materials Inc. 'Silglaze-II 2800'.
 - .3 Tremco Inc. 'Spectrem 2'.
 - .4 Or *Equivalent*.
 - .3 Setting blocks: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
 - .4 Cleaners, primers, and sealers: Type recommended by manufacturer of glass and gaskets.

2.6 FABRICATION

- .1 Factory sealed insulating glass units:
 - .1 Fabricate units to requirements of CAN/CGSB 12.8-97.
 - .2 Spacer core shall be straight and evenly set into glass units.
 - .3 Insulating glass units shall be manufactured to conform to IGMAC recommendations (Insulated Glass Manufacturers Association of Canada) and the manufacturer shall be a member of IGMAC or *Equivalent*. Sealed units shall bear IGMAC certification markings.
- .2 Grind, chamfer, and polish exposed glass edges, unless otherwise indicated in the *Contract Documents*.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine framing, glazing channels, and stops, with glazing installer present, for compliance with the following:

- .1 Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - .2 Inspect butt and mitre joints in framing. Seal joints found to be open with a compatible sealant prior to glazing.
 - .3 Glazing pockets and surfaces are free of dust, construction debris, and contaminants.
 - .4 Presence and functioning of weep systems.
 - .5 Minimum required face and edge clearances as per IGMA and GANA standards.
 - .6 Effective sealing between joints of glass-framing members.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 GLAZING - GENERAL

- .1 Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated in the *Contract Documents*, including those in referenced glazing publications.
- .2 Adjust glazing channel dimensions as required by conditions during installation to *Provide* necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- .3 Protect glass edges from damage during handling and installation. Remove damaged glass from the *Site* and legally dispose of off *Site*. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- .4 Clean glazing rebate surfaces of traces of dirt, dust, or other contaminants.
- .5 Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- .6 Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- .7 Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- .8 *Provide* spacers for glass lites where length plus width is greater than 1270 mm (50").
 - .1 Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

- .2 *Provide* 3.2 mm (1/8") minimum bite of spacers on glass and use thickness equal to sealant width.
- .9 *Provide* edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel.
- .10 Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- .11 Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- .12 Glaze hollow metal doors and frames specified under work of Section 08 11 13 using tape glazing installation.
- .13 Install fire rated glazing in accordance with fire rated glazing material manufacturer's specifications. Field cutting or tampering is not permissible.

3.4 TAPE GLAZING

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

3.5 GASKET GLAZING (DRY)

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

3.6 SEALANT GLAZING (WET)

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

3.7 INSTALLATION – MIRRORS

- .1 *Provide* frameless mirrors only. Grind and polish exposed mirror edges.
- .2 Mount mirrors in true planes, free of distortions. Surfaces of butted mirrors shall be flush to ≤ 1 mm (0.04"). Mirror installation shall be flat to within 1.5 mm in 1220 mm (1/16" in 4 ft).
- .3 Locate joints in mirrors at maximum available mirror sizes to the *Consultant's* direction, unless otherwise indicated. *Provide* butt joints with flat ground and polished edges to *Provide* inconspicuous joint complete with black tape behind joint to hide wall substrate.
- .4 Mastic adhesive and top and bottom support clip installation:
 - .1 Secure mirrors in place over mastic adhesive with metal clips. Locate clips at not more than 914 mm (36") on centre on top and bottom edges of mirrors.
 - .2 Make sure mirror and substrate are free of dust, clean, and dry. On nonporous substrates, such as glass, tile, or metal, sealing is not necessary. On porous substrates, such as drywall or wood, use Mirro-Mastic Bond or equivalent (or a primer or sealer, not paint) on the substrates and allow it to dry. Painted surfaces should be sanded through to the original surface and the substrate cleaned and sealed where the mastic is to be applied.
 - .3 Support mirror at the bottom using concealed bottom angles.
 - .4 Apply mirror adhesive to the mirror or substrate in a minimum of 1 ping-pong ball size mound for every 0.0929 m² (1 ft²) of mirror. Do not apply mastic too close to the edge to prevent "squeeze out". Place the mounds so space will be left between them when the mirror is installed. Mastic adhesive shall be at room temperature (22°C).
 - .5 Press mirror firmly in place making good contact between the mirror, mastic, and substrate. Mastic should spread to a pat approximately 114 mm (4-1/2") in diameter. The mastic needs air circulation to cure properly. Curing time will depend on temperature, humidity, type of substrate, and amount of air that can reach the mastic.

3.8 FIELD QUALITY CONTROL

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

3.9 PROTECTION

- .1 *Provide* safety markings to installed glass by attaching streamers or tape to face of sash. Do not apply tape directly to the glass. Do not mark the glass with paint or any other substance that is hard to remove or could leave permanent stains.

- .2 Take all precautions necessary to protect stored glass and installed glass from lime mortar, water run-off from concrete or copper, weld spatter, acids, roofing tar, solvents, abrasive cleaners, careless handling of construction machinery and equipment, and any other activities that could permanently damage the glass.
- .3 *Install* protective cover to glass where there is a high risk of damage. Use plywood, heavy kraft paper, or non-staining transparent plastic sheet. Do not let protective materials contact surface of glass.
- .4 Do not rely on use of adhesive plastic films to protect installed glass. When plastic sheeting is used, it must be transparent, suspended away from the surface of the glass, and be provided with adequate ventilation holes to prevent heat build-up.

3.10 FINISHING

- .1 Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.
- .2 Final cleaning of glass in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Extended Warranty
- .7 2.1 Manufacturer
- .8 2.2 Performance/Design Requirements
- .9 2.3 Louvres
- .10 2.4 Accessories
- .11 2.5 Finishes
- .12 2.6 Fabrication
- .13 3.1 Installation

1.3 SUMMARY

- .1 Section includes:
 - .1 Louvres.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section, including the following information:
 - .1 Air flow and water entrainment performance test results.
 - .2 Material types and thickness.
- .3 *Shop Drawings*:
 - .1 Submit engineered *Shop Drawings*.
 - .2 Include elevations, sections, and specific details for each louvre.
 - .3 Show anchorage details and connections for component parts.
- .4 Samples:

- .1 Submit colour chips for approval. Submit duplicate samples of each type of louvre showing colour and finish.
- .5 Test and evaluation reports:
 - .1 Air and water performance data: Submit Air Movement and Control Association (AMCA) test data as required to confirm that the louvres have the specified air and water performance characteristics when tested in accordance with AMCA Standard 500-L-99.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors: *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified, and with approval of *Product* manufacturer.

1.6 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Section 01 78 36 – Warranties for a period of two years as specified in Article A-15 of the Agreement Between *Owner* and *Contractor*.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- .1 *Specifications* are based on *Products* of the McGill Architectural Products. The following listed manufacturers are acceptable only when in compliance with requirements of this Section:
 - .1 E.H. Price Ltd.
 - .2 McGill Architectural Products
 - .3 TenPlus Architectural Products Ltd.
 - .4 Or *Equivalent*

2.2 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Structural requirements: Design louvres to withstand wind and snow loads as required by the Ontario Building Code. Maximum allowable deflection for the louvre structural members to be L/180 or 19 mm (3/4"), whichever is less. Maximum allowable deflection for the louvre blades to be L/120 or 13 mm (1/2") across the weak axis, whichever is less.
- .2 Aluminum framing members shall be designed in accordance with CAN/CSA-S157- 05/S157.1-05.
- .3 Design structural steel structural components and fasteners in accordance with CSA- S16-09.
- .4 Delegated design: Design louvres, including comprehensive engineering analysis by a *Professional Engineer*, using structural performance requirements and design criteria indicated.
- .5 Structural performance: Louvres shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louvre blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

- .6 Thermal movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

2.3 LOUVRES

- .1 Except as noted under subsection 2.3.2 (below), *Provide* HP245 , frame depth 50mm, flanged frame, complete with bird screen, to sizes indicated.

2.4 ACCESSORIES

- .1 Bird screen and frames:
 - .1 Bird screen mesh: 15.9 mm (5/8") mesh, 1.27 mm (0.050") thick expanded and flattened aluminum screen secured within 1.40 mm (0.055") thick extruded aluminum frames with mitered corners and corner locks.
 - .2 Finish: Mill finish.
- .2 Aluminum extrusions: ASTM B211-12, Alloy 6063-T5, 6063-T6 or 6061-T6.
- .3 Aluminum sheet: ASTM B209-14, Alloy 1100, 3003 or 5005. For anodized finish if required use Alloy 5005.
- .4 Fasteners and anchors: Stainless steel Type 304.
- .5 Arrange blades and frame extrusions as indicated.
- .6 Attach bird screen to non-exposed face of louvres.
- .7 Isolate from other dissimilar metals and materials to prevent electrolysis.
- .8 Sealant: in accordance with Section 07 92 00 – Joint Sealants.

2.5 FINISHES

- .1 Exposed aluminum surfaces:
 - .1 Elsewhere: Finish to be Interpon D2000, AAMA 2604, Powder Coating, or *Equivalent*
 - .1 Colour: to be selected by the *Consultant*.
- .2 Finish exposed metal fasteners, if applicable, to related aluminum surfaces.
- .3 Finish steel clips and reinforcing steel with 380 g/m2 (13 oz/ft2) zinc coating in accordance with CAN/CSA G164-M92.

2.6 FABRICATION

- .1 Fabricate finish work free from distortion and effects detrimental to appearance and performance.
- .2 Fasten aluminum louvre framing, blade with stainless steel screws or heliarc welding.
- .3 Louvres indicated to wrap continuously around corners shall be mitred at corner intersection.
- .4 Blank off panels to be full extent of louvres except where penetrated by mechanical services, unless indicated otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Verify dimensions of supporting structure at the *Site* by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure. Fasten louvres with angle, lag bolts and anchors where required for support with rust proof screws and anchor bolts.
- .2 Apply sealant to joints and penetrations to maintain weather tight installation, while allowing drainage to exterior at sill flashing.
- .3 Anchor louvres to the building substructure.
- .4 Allow for thermal expansion and contraction.
- .5 Repair or replace damaged finishes or materials.
- .6 Erection tolerances:
 - .1 Maximum variation from plane or location shown on the reviewed *Shop Drawings*: 3 mm per 3660 mm (1/8" per 12 feet) of length, but not exceeding 13 mm (1/2") in any total building length or portion thereof (non-cumulative).
 - .2 Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 75 mm (3"): 1.5 mm (1/16") (shop or field joints). This limiting condition shall prevail under both load and no-load conditions.
- .7 Cut and trim component parts during erection only with the approval of the manufacturer, and in accordance with its recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.
- .8 Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed, at the *Contractor's* expense.
- .9 Set units level, plumb and true to line, with uniform joints.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 2.1 Performance/Design Requirements - Fire Resistance Rated Assemblies
- .7 2.2 Materials - General
- .8 2.3 Partition Support Materials
- .9 2.4 Ceiling Support Materials and Systems
- .10 2.5 Furring
- .11 2.6 Accessories
- .12 3.1 Installation General
- .13 3.2 Blocking
- .14 3.3 Furring - General
- .15 3.4 Suspended and Furred Ceilings
- .16 3.5 Wall Furring
- .17 3.6 Resilient Furring
- .18 3.7 Metal Stud Partition Framing
- .19 3.8 Control Joints
- .20 3.9 Concrete Anchors
- .21 3.10 Field Quality Control

1.3 SUMMARY

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

1.4 SUBMITTALS

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

.3 Test and evaluation reports:

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

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installers / applicators / erectors:

- .1 *Provide* work of this Section, executed by a *Subcontractor* with a minimum five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

PART 2 - PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS - FIRE RESISTANCE RATED ASSEMBLIES

- .1 Fire resistance rating: Where gypsum board systems with fire resistance ratings are indicated in the Contract Documents or required, *Provide* materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to the *Authorities Having Jurisdiction*.
- .2 Materials for fire resistance rated construction shall conform to requirements of indicated fire resistance rated assembly.

2.2 MATERIALS - GENERAL

- .1 For sheet metal *Products*: Sheet metal thickness indicated herein pertains to the "minimum base steel thickness exclusive of coating".

2.3 PARTITION SUPPORT MATERIALS

- .1 Interior non-loadbearing channel stud framing: in accordance with ASTM C645-14; roll formed from 0.455 mm (0.0179") minimum thickness unless otherwise indicated in the Contract Documents or as recommended by gypsum board manufacturer, electro-galvanized steel sheet. *Provide* service holes starting at 450 mm (18") from bottom, then 914 mm (36") on centre to top of studs.
- .1 Steel studs; at backer plate locations: 0.836 mm (0.0329") minimum thickness.
- .2 Steel studs at cement board locations: 0.836 mm (0.0329") minimum thickness.
- .3 Steel studs at tile backer board locations: 0.836 mm (0.0329") minimum locations.
- .2 Interior floor and ceiling tracks (runners): in accordance with ASTM C645-14; in widths to suit stud sizes.
- .1 Metal thickness: to match studs.
- .2 For openings wider than 914 mm (36"), *Provide* 0.836 mm (0.0329") minimum thickness for header.
- .3 At carpet locations: 124 mm (4-7/8") high floor tracks, Bailey Metal Products 'Carpet Base Track' or *Equivalent*.
- .3 Runner fasteners:
- .1 To concrete and masonry: Use stub nails or power-driven fasteners.

- .2 To suspended ceilings: Use prefinished clips to match ceiling grid, as manufactured by CGC or *Equivalent*.
- .4 Bracing channels: Minimum 19 mm x 10 mm x 1.087 mm (3/4" x 3/8" x 0.0428") cold rolled galvanized steel.

2.4 CEILING SUPPORT MATERIALS AND SYSTEMS

- .1 General: Size ceiling support components to comply with ASTM C754-15 unless otherwise indicated in the *Contract Documents*.
- .2 Main runners: Steel channels, hot or cold rolled; Z180 (G60) galvanized where used in shower rooms, other wet areas, and outdoors.
- .3 Hanger wire: in accordance with ASTM A641/A641M-09A (2014), soft, Class 1 galvanized, minimum 4.064 mm (0.160", 8 AWG).
- .4 Hanger rods and flats: Mild steel with zinc coating, galvanized for exterior applications.
 - .1 General: Size devices for five times load imposed by completed system as determined in accordance with ASTM E488/E488M-15.
 - .1 Power actuated fastening systems are not permitted.
 - .2 Screws, clips, bolts, concrete inserts, or other devices for ceiling hangers whose suitability for use intended has been proven through standard construction practices or by certified test data.
 - .3 Hangers: Comply with ASTM C754-15 for maximum ceiling area and loads to be supported.
 - .4 Interior concrete ceiling anchors; acceptable *Products*:
 - .1 Dynabolt Sleeve Anchor 'TW-1614' or 'Redi-Drive Tie Drive' or 'Redi-Drive' by ITW Ramset/Red Head.
 - .2 Redi-Drive by ITW Construction Products Canada, complete with galvanized angle clip.
 - .3 ITW Ramset Trubolt, or Dynabolt anchors by ITW Construction Products Canada, complete with galvanized angle clip.
 - .4 Hilti Corporation Kwik-Bolt 3 - HHDCa 1/4 Ceiling Hangers by Hilti.
 - .5 Or *Equivalent*.
 - .5 Fasteners exposed to weather, condensation, and corrosion: Zinc-plated or stainless steel fasteners in applicable *Product* lines specified in preceding subsections.
- .5 Tie wire: 1.19 mm (0.047", 18 AWG) minimum zinc coated, soft-annealed wire, in accordance with ASTM A641/A641M-09A (2014).
- .6 Furring anchorages: 1.62 mm (0.0637", 16 AWG) galvanized wire ties, manufacturer's standard wire type clips, bolts, nails or screws as recommended by furring manufacturer and complying with ASTM C754-15.
- .7 Runner (carry) channels: 1.367 mm (0.0538") thick cold rolled steel, primer painted, or zinc coated for interior locations, Z275 galvanized for exterior locations, in accordance with ASTM C754- 15, with minimum 228 MPa yield strength:
 - .1 38 mm x 12.7 mm (1-1/2" x 1/2") where supported at centres of 914 mm (36") maximum.

- .2 38 mm x 19 mm (1-1/2" x 3/4") where supported at centres of 1220 mm (48") maximum.

2.5 FURRING

- .1 Furring channels: 0.455 mm (0.0179") minimum typical thickness, minimum 0.836 mm (0.0329") at exterior soffits, cold rolled steel, wiped coated, nominal size of 22 mm (7/8") depth x 35 mm (1-3/8") face, hat type with knurled face.
- .2 Resilient furring channels: 'Resilient Channel' as manufactured by Nicholson Roll forming or Bailey Metal or *Equivalent*.
- .3 Z-furring members: Galvanized steel z-shaped furring members; ASTM A653/A653M-11, G60, 0.836 mm (0.0329") minimum thickness of base metal, of depth indicated, designed for mechanical attachment of insulation boards or blankets.
- .4 Fasteners for furring members: Type and size recommended by furring manufacturer for substrate and application indicated, corrosion resistant finish for exterior building envelope applications, load rating and spacing to support materials carried by assembly with factor of safety of 3x per fastener manufacturer data sheets.

2.6 ACCESSORIES

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

PART 3- EXECUTION

3.1 INSTALLATION GENERAL

- .1 Comply with ASTM C754-15 and manufacturer's instructions, except as modified in this Section. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated in the Contract Documents.
- .2 *Provide* and *Install* studs, framing, shimming, and furring to *Provide* proper support for gypsum board to achieve the following installation tolerances:
 - .1 Do not exceed 3 mm (1/8") in 3 m (10') variation from plumb, level, and plane.
 - .2 Do not exceed 10 mm (3/8") from the Drawing locations.
 - .3 Do not exceed 1.5 mm (1/16") variation between planes of abutting edges or ends.
 - .4 *Install* each framing member so fastening surfaces vary not more than 3.2 mm (1/8") from the plane formed by faces of adjacent framing.
 - .5 In double stud walls, do not bridge across studs on opposite sides of wall with gypsum board or metal cross bracing.

- .3 Give complete cooperation and direction to trades erecting framing and furring over which this work is applied. Coordinate finished joint location with framing.
- .4 Coordinate installation and cooperate with mechanical and electrical work to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with the partitions, ceiling, and soffit systems.
 - .1 Where the presence of suspended ductwork or other mechanical or electrical services or devices above ceiling framing conflicts with ceiling framing suspension points from structure above, *Provide* bridging framing below conflicting work as required to support ceiling framing on specified intervals.
 - .2 Do not suspend ceiling framing from mechanical or electrical suspension systems unless agreement is obtained in writing from *Professional Engineer* for the *Subcontractor* installing such framing that additional imposed loads are acceptable; The *Contractor* shall obtain the *Consultant's* acceptance before proceeding.
- .5 *Provide* clearances between work of this Section and structural elements to prevent transference of structural loads.
- .6 Do not bridge building expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members or as indicated in the Contract Documents.
- .7 Size framing systems according to manufacturer's engineered load tables, to meet allowable deflection without permanent deformation.
 - .1 Maximum allowable deflection: $L/240$.
 - .2 Maximum allowable deflection for tiled partitions: $L/360$.

3.2 BLOCKING

- .1 Attach to framing adequate backer plates to support the load of, and to withstand the withdrawal and shear forces imposed by, items installed upon the work of this Section. Such items include, but are not restricted to:
 - .1 Coat hooks.
 - .2 Washroom accessories.
 - .3 Mop brackets/shelving.
 - .4 Handrail anchors.
 - .5 Guards.
 - .6 Fitments.
 - .7 Cabinetry.
 - .8 Shelving.
 - .9 Window shades.
 - .10 Finish hardware.
 - .11 Toilet partition wall attachment points.
 - .12 Urinal screen wall attachment points.

- .13 Miscellaneous specialties.
- .14 Glazing accessories.
- .15 Benches.
- .16 Items as indicated in the Contract Documents.

3.3 FURRING - GENERAL

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

3.4 SUSPENDED AND FURRED CEILINGS

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

3.5 WALL FURRING

- .1 *Install* steel furring for braced walls, free standing walls, walls that are furred out as indicated in the *Contract Documents*.

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

3.6 RESILIENT FURRING

- .1 Erect gypsum board resilient furring maximum 610 mm (24") on centre and not more than 150 mm (6") from ceiling/wall juncture. Secure to each support with 25 mm (1") gypsum wallboard screw.
- .2 *Install* 150 mm (6") continuous strip of 12.7 mm (1/2") gypsum board along base of partitions where resilient furring installed.
- .3 *Provide* resilient furring channel transverse to framing members, or as indicated in the *Contract Documents*.
- .4 On partitions, *Install* resilient furring with outer leg oriented upward.

3.7 METAL STUD PARTITION FRAMING

- .1 *Provide* partition tracks (runners) at floor and underside of structural assembly and as follows:
 - .1 Align accurately and lay out according to partition layout.
 - .2 Secure runners to concrete access flooring and to concrete slabs, as applicable, with screwed or shot fasteners located 50 mm (2") from each end and spaced at maximum 610 mm (24") on centre.
 - .3 At partition corners, extend one runner to end of corner and butt other runner to it, allowing necessary clearance for gypsum board thickness. Runners should not be mitred.
- .2 Unless otherwise indicated in the Contract Documents, place interior studs vertically at centres as follows:
 - .1 *Provide* studs at 400 mm (16") on centre, and as specially spaced in accordance with details indicated.
 - .2 *Provide* studs not more than 50 mm (2") from abutting walls, openings, and each side of corners.
 - .3 *Provide* freedom for 19 mm (3/4") deflection under beams, structural slabs and the like to avoid transmission of structural loads to studs or *Install* 50 mm (2") leg ceiling tracks.
- .3 *Install* studs in tracks at floor and ceiling.
- .4 Where horizontal runs of service lines are scheduled to be installed, arrange with applicable trades and *Install* studs simultaneously with services.
- .5 At openings in stud walls, erect track at head and sills to accommodate intermediate studs. At each end of track, cut out flanges, turn up web, and fasten to studs. *Install* intermediate studs above and below openings in same manner and spacing as wall studs. *Install* double studs at each jamb, and double tracks at head of door openings.
- .6 At partitions requiring fire rating, erect in accordance with requirements of listing.

- .7 Size studs, connections, and runners to carry loads according to stud manufacturer's load tables, at 24 kg/m² (5 lb/ft²) live load to meet maximum allowable deflection limits. Where depth of stud is indicated, size metal thickness to meet allowable deflection limits.
- .8 *Provide* three studs at corner and intermediate intersections of partitions.
- .9 Coordinate work with others installing horizontal runs of service lines so that work is done simultaneously. Where standard holes are too small for installed services, notch studs, and splice notched flanges with splice pieces 305 mm (12") longer than notches, each fastened with two screws.
- .10 *Provide* metal studding to maximum tolerance of 3 mm in 3 m (1/8" in 10 ft).
- .11 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .12 Coordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other sections.
- .13 Unless otherwise indicated, partitions, together with gypsum board facings, shall extend above ceilings to underside of structure above.
- .14 Maintain clearance to avoid transference of structural loads to studs.
- .15 Chase walls:
 - .1 *Provide* chase walls where indicated, consisting of two parallel steel stud partitions.
 - .2 *Provide* cross bracing consisting of metal furring, located at quarter points on each pair of studs. Attach cross bracing to studs with metal screws. Coordinate construction of partitions to suit installation of services.
- .16 Lateral support bracing channels:
 - .1 Stiffen partitions over 3 m (10') in vertical span, at mid-height to maximum vertical spacing of 2440 mm (8') on centre, with at least one 19 mm (3/4") horizontal bracing channel, extending full length of partition, overlapping at least two stud spaces at ends of bracing channels.
 - .2 Stiffen partitions at not more than 150 mm (6") from the top and bottom of openings and across two full stud spaces at each side of openings with horizontal bracing channel.

3.8 CONTROL JOINTS

- .1 Control joints: in accordance with Section 09 29 00 – Gypsum and Cement Board.

3.9 CONCRETE ANCHORS

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

3.10 FIELD QUALITY CONTROL

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Delivery, Storage, and Handling
- .7 1.7 Field Conditions
- .8 2.1 Performance/Design Requirements
- .9 2.2 General
- .10 2.3 Gypsum Board Panels
- .11 2.4 Cement Board Panels
- .12 2.5 Attachment Materials
- .13 2.6 Accessories
- .14 2.7 Related Support Assemblies and Backer Plates
- .15 2.8 Joint Treatment Materials
- .16 2.9 Acoustic Wall Assembly Materials
- .17 2.10 Access Doors
- .18 3.1 Installation
- .19 3.2 Accessories
- .20 3.3 Board Application - General
- .21 3.4 Water Resistant Gypsum Board Application
- .22 3.5 Exterior Sheathing Board Application – Gypsum Sheathing Board
- .23 3.6 Interior Tile Backer Board Application
- .24 3.7 Interior Cement Board
- .25 3.8 Acoustic Wall Assemblies
- .26 3.9 Finishing
- .27 3.10 Fire Separations
- .28 3.11 Access Doors
- .29 3.12 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes
 - .1 Gypsum board; plain.

- .2 Gypsum board; fire-rated.
- .3 Water resistant backing board; paper faced gypsum.
- .4 Tile backer board; cement board.
- .5 Exterior sheathing board; glass scrim gypsum sheathing board.
- .6 Gypsum board accessories and miscellaneous related materials.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 Fire-rated assembly listings:
 - .1 Submit fire-rated assembly listings for each required fire resistance rated assembly for work of this Section.

1.5 QUALITY ASSURANCE

- .1 The *Contractor* shall ensure that the *Subcontractor* executing the work of this Section has a minimum of 10 years' continuous experience in successful installation of work of type and quality indicated and specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Store materials in protected dry areas. Store gypsum board flat in piles with edges protected.
- .2 Ensure that finish metal members are not bent, dented, or otherwise deformed.
- .3 Deliver *Products* supplied under the work of this Section only to those who are responsible for installation, to the place they direct, and to meet installation schedules.
- .4 Package fire rated materials with labels attached.

1.7 FIELD CONDITIONS

- .1 Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum boards.
- .2 When ambient outdoor temperatures are below 12°C maintain continuous, uniform comfortable building working temperatures of not less than 12°C for a minimum period of 48 hours before, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
- .3 Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.
- .4 Protection:

- .1 *Provide* adequate protection of materials and work of this Section from damage by weather and other causes. Protect work of other subcontractors from damage resulting from work of this Section. Make good such damage at no additional cost to the *Owner*.
- .2 Exterior sheathing board's exposure to weather: Comply with manufacturer's printed instructions. *Provide* protection prior to exposure for periods greater than manufacturer's recommendations and warranty.

PART 2 – PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Fire resistance rating:
 - .1 Where gypsum board systems with fire resistance ratings are indicated or required, *Provide* materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to the *Authorities Having Jurisdiction*.

2.2 GENERAL

- .1 Single source responsibility: Obtain gypsum board *Products* from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

2.3 GYPSUM BOARD PANELS

- .1 Plain gypsum board:
 - .1 Paper faced gypsum core panel solid set core enclosed in paper, 12.7 mm (1/2") or 16 mm (5/8") thick unless otherwise indicated, 1220 mm (48") wide x maximum practical length, ends square cut, tapered edges, in accordance with ASTM C1396/C1396M-11.
 - .2 Acceptable *Products*:
 - .1 CertainTeed 'Regular Gypsum Board'.
 - .2 CGC Inc. 'SHEETROCK Gypsum Panel, Regular'.
 - .3 Georgia-Pacific 'ToughRock Gypsum Board'.
 - .4 Lafarge 'Gypboard'.
 - .5 National Gypsum 'Gold Bond Gypsum Board'.
 - .6 Or *Equivalent*.
- .2 Fire-rated gypsum board:
 - .1 Paper faced gypsum core panel with a specially formulated core for use in fire- resistive Type X or Type C designs, in accordance with ASTM C1396/C1396M-11.
 - .2 Acceptable *Products*:
 - .1 CertainTeed 'Type X and Type C'.
 - .2 CGC Inc. 'SHEETROCK Firecode and Firecode C'.
 - .3 Georgia-Pacific 'ToughRock Fireguard and Fireguard Gypsum Board'.
 - .4 Lafarge 'Firecheck C and X'.
 - .5 National Gypsum 'Gold Bond Fire-Shield and Fire Shield C Gypsum Board'.

- .6 Or *Equivalent*.
- .3 Water resistant gypsum backing board (greenboard), wall applications:
 - .1 Paper faced gypsum core panel with enhanced water and water resistant paper facers in accordance with ASTM C1396/C1396M-11, fire rated where indicated in the Contract Documents.
 - .2 Acceptable *Products*:
 - .1 CertainTeed 'ProRoc Moisture Resistant'.
 - .2 CGC Inc. 'SHEETROCK Mold Tough Panel'.
 - .3 Georgia-Pacific 'ToughRock Moisture-Guard'.
 - .4 Lafarge 'Mold Defense'.
 - .5 Or *Equivalent*.
 - .4 Exterior sheathing board:
 - .1 Service grade: Exterior grade.
 - .2 Fibreglass mat faced on front and back sides and long edges, silicone-treated water-resistant core, in accordance with ASTM C1177/C1177M-08, fire rated where indicated in the Contract Documents.
 - .1 Acceptable *Products*:
 - .1 CertainTeed 'GlasRoc Sheathing'.
 - .2 CGC Inc. 'Securock Glass-Mat Sheathing'.
 - .3 Georgia-Pacific 'Dens-Glass Gold'.
 - .4 Lafarge; Weather Defense Platinum Sheathing'.
 - .5 Or *Equivalent*.

2.4 CEMENT BOARD PANELS

- .1 Cement board; interior and exterior grade, tile backer board and sheathing applications:
 - .1 Composition:
 - .1 Portland cement, sand, and expanded polystyrene beads, with a fully embedded alkali resistant glass fibre mesh facing.
 - .2 Free of asbestos, gypsum, organic fibres or cellulose.
 - .2 Thickness: 12.7 mm (1/2") minimum.
 - .3 Acceptable *Products*:
 - .1 CGC 'Durock'.
 - .2 National Gypsum 'PermaBase Plus Cement Board'.
 - .3 Or *Equivalent*.

2.5 ATTACHMENT MATERIALS

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

2.6 ACCESSORIES

- .1 Accessories: in accordance with ASTM C1047-14a unless otherwise indicated in the Contract Documents, maximum length pieces per location. Flanges shall be free from dirt, grease, or other material that adversely affects the bond of joint treatment or decoration.
- .2 Trim reveal:
 - .1 Standard metal trim reveal for suspended gypsum board walls or ceilings abutting concrete block walls, suitable for paint finish in all locations except where indicated otherwise in the *Contract Documents*.
- .3 Control joints: No. 093 Zinc Control Joint by CGC Inc. or *Equivalent*, certified by manufacturer for use at fire resistance rated assemblies.
- .4 Casing beads, corner beads: 0.5 mm (0.02") base thickness commercial grade sheet steel with Z275 zinc finish in accordance with ASTM A525, perforated flanges, one piece length per location.

2.7 RELATED SUPPORT ASSEMBLIES AND BACKER PLATES

- .1 Dimensional wood blocking at interior assemblies: in accordance with Section 06 10 53 – Rough Carpentry.
- .2 Metal support systems and backer plates at interior assemblies: in accordance with Section 09 22 00 – Metal Supports for Gypsum and Cement Board.

2.8 JOINT TREATMENT MATERIALS

- .1 General: Comply with ASTM C475/C475M-12e1.
- .2 Joint tape:
 - .1 Interior gypsum board: Paper.
 - .2 Glass-mat gypsum sheathing board: 10-by-10 glass mesh.
 - .3 Tile backing panels: As recommended by panel manufacturer.
- .3 Joint compound for interior gypsum board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - .1 Prefilling: Use setting-type compound as recommended by panel manufacturer.

- .2 Embedding and first coat: Use setting-type or taping compound as recommended by panel and trim manufacturers.
- .3 Fill and finish coats: Use sanding type setting-type or taping compound as recommended by panel manufacturer.
- .4 Joint compound for exterior applications:
 - .1 Glass-mat gypsum sheathing board: As recommended by sheathing board manufacturer.
- .5 Joint compound for tile backing panels:
 - .1 Cementitious backer units: As recommended by backer unit manufacturer.
 - .2 Water-resistant gypsum backing board: Use setting-type taping compound and setting-type, sandable topping compound.

2.9 ACOUSTIC WALL ASSEMBLY MATERIALS

- .1 Acoustic sealant; concealed locations: non-skinning butyl sealant, non-hardening, remains soft and tacky, in accordance with CGSB 19.21-M87:
 - .1 Sealant shall not deteriorate (stain or bleed into) painted surfaces.
 - .2 Acceptable *Products*:
 - .1 DAP 'Mono Acoustic Sealant'.
 - .2 Pecora 'BA98'.
 - .3 Quiet Solution 'QuietSeal'.
 - .4 Tremco 'Acoustical Sealant'.
 - .5 Or *Equivalent* (substitutions in accordance with Section 01 25 00 – Product Substitution Procedures).
- .2 Acoustic sealant; exposed locations: Interior paintable sealant in accordance with Section 07 92 00 - Joint Sealants.
- .3 Acoustic compound: premixed perlite plaster.
- .4 Acoustic (sound attenuation) insulation:
 - .1 Mineral-fibre sound attenuation batts: in accordance with CAN/ULC S702-09, Type 1, fire resistant and non-combustible in accordance with CAN/ULC-S114-05, high density for sag-free, tight fitting installation.
 - .1 Density: minimum 40 kg/m³ (2.5 lbs/ft³).
 - .2 Acceptable *Products*:
 - .1 Roxul Inc. 'AFB'.
 - .2 Or *Equivalent*.
 - .2 Fasteners: use mechanical fasteners where required to secure insulation into position in accordance with insulation manufacturer.

2.10 ACCESS DOORS

- .1 Access doors: in accordance with Divisions 21, 22, and 23 and Divisions 26 and 28.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 General: Comply with ASTM C840-11, GA-216, GA-600, and manufacturer's instructions, except as otherwise indicated in the Contract Documents. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated in the Contract Documents.
- .2 *Install* exposed gypsum board with face side out. Do not *install* imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1.6 mm (1/16") open space between boards. Do not force into place.
- .3 Cover both faces of stud partition framing with gypsum board in concealed spaces (above ceiling, and the like) unless otherwise indicated in the Contract Documents, except in chase walls which are properly braced internally.
- .4 Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cut-outs.
- .5 Securely attach trim, casings, framing, and accessories.
- .6 Apply components of fire-rated assemblies in conformance with indicated designs.
- .7 Erect materials to dimensions indicated, plumb, level, straight, and square to adjoining elements.
- .8 Do not apply gypsum board in close proximity to hot pipes or heating ducts.
- .9 *Install* materials with the minimum number of joints. Tightly butt joints, without force, and neatly align them.
- .10 Frame openings on every side. *Provide* clearances with services.
- .11 The work shall include bulkheads over doors, frames, screens, and changes in ceiling levels, pipe space and as indicated in the Contract Documents.
- .12 *Provide* clearances between work of this Section and structural elements to prevent transference of structural loads in accordance with Section 09 22 00 – Metal Supports for Gypsum and Cement Boards.
- .13 Tolerances:
 - .1 Do not exceed 3 mm (1/8") in 3 m (10') variation from plumb, level, and plane in exposed surfaces, except at end joint between gypsum board panels.
 - .2 Do not exceed 10 mm (3/8") from indicated location.
 - .3 Do not exceed 1.5 mm (1/16") variation between planes of abutting edges or ends.
 - .4 Surface flatness shall not exceed 1.5 mm (1/16") within 305 mm (12") straight edge. For non-tapered-edge end joints between boards, measure flatness tolerance with end of straight end at centreline of joint.

3.2 ACCESSORIES

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

3.3 BOARD APPLICATION - GENERAL

- .1 Before application of gypsum board commences, ensure that internal services have been installed, tested, and approved; that conduits, pipes, cables, and outlets are plugged, capped, or covered; and that fastenings and supports installed by other subcontractors are in place.
- .2 Extend board into door, window, and other openings, reveals, behind fitments, and other applied items and on metal stud partitions to structure above unless indicated otherwise in the *Contract Documents*.
- .3 Apply board with long dimension perpendicular to supports, unless otherwise indicated in the *Contract Documents*.
- .4 Locate joints on opposite sides of partitions on different studs, and at least 305 mm (12") from opening jambs.
- .5 *Install* board to minimize joints, and align end joints to be the least objectionable (where they are unavoidable), according to the indicated lighting design. Locate joints in ceilings where least prominently discerned, and never line them up with opening edges.
- .6 Form smooth joints at ends and at field cut edges of board panels.
- .7 Fasten board to metal support members by metal gypsum board screws, 9.5 mm (0.374") minimum to, and 12.7 mm (1/2") maximum from, center of joints. Space screws:
 - .1 At fire rated board as per fire-rated assembly.
 - .2 At typical board walls at 400 mm (16") on centre at edges and field unless otherwise required in the Contract Documents.
 - .3 At typical board ceilings at 305 mm (12") on centre at edges and field unless otherwise required in the Contract Documents.
- .8 At laminated plain gypsum board locations: Apply adhesive with notched spreader to leave ribbons 10 mm x 13 mm (3/8" x 1/2") at 38 mm (1-1/2") apart over entire back side of face layer. Erect

board immediately after spreading adhesive. Temporarily secure face boards with screws or bracing to ensure adequate bond until adhesive sets. Temporary face screws may also be used. Substrate shall be fully cured and sufficiently dry to allow adhesive to fully cure and not re-emulsify.

- .9 Offset gypsum board joints 150 mm (6") minimum from corners of openings.
- .10 Gypsum panel *Product* joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.

3.4 WATER RESISTANT GYPSUM BOARD APPLICATION

- .1 Apply water resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

3.5 EXTERIOR SHEATHING BOARD APPLICATION – GYPSUM SHEATHING BOARD

- .1 *Install* sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253, ASTM C1280-13, and ASTM C1397-13. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated in the *Contract Documents*.
- .2 Use maximum board lengths to minimize number of joints. Sheathing joints shall be staggered, offset by at least one framing member. Offset gypsum board joints 150 mm (6") minimum from corners of openings.
- .3 *Install* sheathing with exterior board side facing exterior. Butt boards together for a light contact at edges and ends with not more than 1.6 mm (1/16") open space between boards. Do not force into place.
- .4 Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.
- .5 Locate fasteners minimum 10 mm (3/8") from edges and ends of sheathing boards.
- .6 *Provide* clearances between work of this section and structural elements to prevent transference of structural loads, and in no case less than 16 mm (5/8").
- .7 Tolerances:
 - .1 Sheathing where acting as substrate for direct applied or insulated finishing system shall be flat to within 6 mm in 3050 mm (1/4" in 10'), in accordance with ASTM C1397-13.
 - .2 Maximum gap between board joints: 1.6 mm (1/16").

3.6 INTERIOR TILE BACKER BOARD APPLICATION

- .1 *Install* in accordance with manufacturer's specifications.
- .2 Section 09 31 00 – Tiling to install tile setting material over tape installed by this Section. Install mesh tape centred over tile backer board joints.
- .3 Apply tile backer board full height unless otherwise indicated in the Contract Documents and in accordance with manufacturer's installation instructions. Install water barrier sheeting over gypsum board substrates, where applicable.
- .4 Fastener spacing:
 - .1 Walls: fasten at 150 mm (6") on centre at vertical butt joints and 210 mm (8") on centre in field.

- .2 Ceilings: fasten at 150 mm (6") on centre.
- .5 Maintain 6 mm (1/4") gap between board and tub or shower base as applicable.

3.7 INTERIOR CEMENT BOARD

- .1 Apply cement board with rough side towards interior, as and with ends applicable, and edges over supports. Fit ends and edges closely, but not forced together. Stagger end joints in successive courses.
- .2 Fasten cement board to framing with specified fasteners. Drive fasteners in field of cement board first, working toward ends and edges. Hold cement board in firm contact with framing while driving fasteners. Space fasteners along framing with perimeter fasteners at least 9.5 mm (0.374") and less than 15.9 mm (5/8") from ends and edges. Drive fasteners so bottom of heads are flush with surface of cement board to *Provide* firm board contact with framing. Do not drive fastener heads below panel surface.
 - .1 Maximum fastener spacing as follows:
 - .1 Walls: 200 mm (8").
 - .2 Ceiling: 150 mm (6").
 - .3 Perimeters: minimum 9.5 mm (3/8") and maximum 15.9 mm (5/8") from ends and edges.

3.8 ACOUSTIC WALL ASSEMBLIES

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

3.9 FINISHING

- .1 *Provide* levels of gypsum board finish for locations as follows, in accordance with GA- 214.

- .1 Level 1: Ceiling plenum areas and concealed areas, except *Provide* higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
- .2 Level 2: Gypsum board substrate at applied hard surfaces, except remove tool marks and ridges.
- .3 Level 4: Exposed gypsum board surfaces, except where another finish level is indicated the in the *Contract Documents*.
- .4 Level 5: Exposed gypsum board surfaces where indicated in the *Contract Documents*.
- .2 Interior gypsum board:
 - .1 Prefill:
 - .1 Use setting-type joint compound. Mix joint compound according to manufacturer's directions.
 - .2 Fill joints between boards flush to top of eased or beveled edge.
 - .3 Fill joints of gypsum board above suspended ceilings in fire rated partitions.
 - .4 Wipe off excess compound and allow compound to harden.
 - .5 Joint gaps not greater than 3.2 mm (1/8") shall be prefilled with either ready- mix or setting type joint compound; joint gaps greater than 3.2 mm (1/8") shall be prefilled with setting-type joint compound.
 - .2 Taping (Level 1):
 - .1 Butter taping compound into inside corners and joints.
 - .2 Center tape over joints and press down into fresh compound.
 - .3 Remove excess compound.
 - .4 Tape joints of gypsum board above suspended ceilings.
 - .3 First coat (Level 2):
 - .1 Use taping or all-purpose drying-type compound.
 - .2 Immediately after bedding tape, apply skim coat of compound and allow to dry completely in accordance with manufacturer's instructions.
 - .3 Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.
 - .4 Fastener heads and accessories shall be covered with 1 coat of joint compound.
 - .4 Second coat (Level 3): After first coat treatment is dried, apply second coat of compound over tape and trim, feathering compound 50 mm (2") beyond edge of first coat.
 - .1 Fastener heads and accessories shall be covered with total of two separate coats of joint compound.
 - .5 Third coat (Level 4):
 - .1 After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 50 mm (2") beyond edge of second coat.

- .2 Allow third coat to dry. Apply additional compound, and touch-up and sand, to *Provide* surface free of visual defects, tool marks, and ridges, and ready for application of finish.
- .3 Finished joints will be accepted with a camber not greater than 1 mm (1/32") and shall be seamless, plumb, true and flush and with square, neat corners.
- .4 Fastener heads and accessories shall be covered with total of three separate coats of joint compound.
- .6 Skim coat (Level 5):
 - .1 After the fourth coat has dried, apply skim coat of topping or all-purpose drying-type compound over exposed surfaces of gypsum board.
 - .2 After skim coat has dried, touch-up and sand to *Provide* surface free of visual defects, tool marks, and ridges, and ready for application of finish.
- .3 Water-resistant gypsum board: Treat fastener heads and joints with setting-type joint compound.
 - .1 For joints to be covered with tile, apply tape and joint compound bedding coat and skim coat only; do not apply finish coats.
 - .2 Do not crown joints or leave excess compound on panels.
 - .3 Remove tool marks and ridges.
 - .4 For fastener heads to be covered with tile, apply one coat of joint compound.
- .4 Interior tile backer board: Prepare and finish joints in accordance with manufacturer's instructions.
- .5 Cement board: Prepare, tape, and finish joints in accordance with manufacturer's instructions.
- .6 Joint compound:
 - .1 Apply finish coat of compound feathering 75 to 100 mm (3" to 4") beyond tape edges.
 - .2 Feather coats onto adjoining surfaces so that camber is maximum 0.79 mm (1/32").
- .7 Trim:
 - .1 Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by the trim manufacturer.
 - .2 *Install* metal corner beads at external corners.
 - .3 *Install* metal casing bead trim whenever edge of gypsum base would otherwise be exposed or semi exposed, and where gypsum base terminates against dissimilar material.
 - .4 Erect beads plumb or level, with minimum joints.
- .8 Control joints:
 - .1 *Provide* control joints set in board facing. Support control joints with studs or furring channels on both sides of joint.
 - .2 *Provide* control joints in required locations.
 - .1 Review control joint locations with the *Consultant* prior to installation.
 - .3 *Install* control joints where a partition, wall, or ceiling traverses a construction joint (expansion, seismic or building control element) in the building structure.

- .4 *Install* control joints where a wall or partition runs in an uninterrupted straight plane exceeding 9100 mm (30 linear feet).
- .5 *Install* control joints in interior ceilings:
 - .1 With perimeter relief:
 - .1 Linear dimensions between control joints shall not exceed 15000 mm (50 ft) and total area between control joints shall not exceed 230 m² (2500 ft²).
 - .2 Without perimeter relief:
 - .1 Linear dimensions between control joints shall not exceed 9100 mm (30 ft) and total area between control joints shall not exceed 84 m² (900 ft²).
- .6 *Install* control joints where ceiling framing members change direction.
- .7 Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 16 mm (5/8") type X gypsum panel products, mineral fibre, or other tested equivalent. Construct through-wall control joints at fire-rated assemblies in accordance with assembly listing requirements.
- .8 Line up control joints with joints in other construction or with centre lines of mullions, columns, piers, or similar building elements, where accepted by the *Consultant*.
- .9 *Install* control joints straight and true.
- .10 Ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners. If control joints are not used, additional reinforcement is required at corners to distribute concentrated stresses.
- .11 Board joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.

3.10 FIRE SEPARATIONS

- .1 *Install* fire-rated assemblies in accordance with assembly listing requirements in order to obtain fire ratings indicated and as required by the *Authorities Having Jurisdiction*.
- .2 Vertical bulkheads in ceiling spaces over fire rated partitions, doors and the like shall have same fire rating as the partition over which they occur. Such bulkheads shall be of gypsum board construction unless otherwise indicated in the *Contract Documents*.
- .3 Use fire rated gypsum wallboard as specified in the *Contract Documents*.
- .4 Where lighting fixtures, diffusers, and the like are recessed into fire rated ceilings or bulkheads, *Provide* enclosure to maintain required fire rating. Form removable panel to give access to fixture outlet box.
- .5 Where fire hose cabinets or other fixtures or equipment are recessed in fire rated walls or partitions, *Provide* gypsum board enclosure or backing to maintain required fire rating, unless otherwise detailed in the *Contract Documents*.

3.11 ACCESS DOORS

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

- .2 Access doors shall be as supplied by Divisions 21, 22, and 23 and Divisions 26, and 28. Locations to be reviewed and confirmed by the *Consultant*.
- .3 Install access panels in locations to be determined by coordination with trades installing mechanical, electrical and other building services and consultation with the *Consultant*.
- .4 Rigidly secure frames to furring or framing systems.

3.12 ADJUSTING AND CLEANING

- .1 Remove debris and rubbish from wall and ceiling cavities before enclosing with board.
- .2 Clean up and remove surplus materials and rubbish resulting from the work of this Section upon completion.
- .3 Clean off beads, casings, joint compound droppings and the like, leave the work of this Section ready for painting trades.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Closeout Submittals
- .7 1.7 Quality Assurance
- .8 1.8 Field Conditions
- .9 1.9 Extended Warranty
- .10 2.1 Performance/Design Requirements
- .11 2.2 Tile Materials
- .12 2.3 Grout and Adhesives
- .13 2.4 Accessories
- .14 3.1 Examination
- .15 3.2 Preparation
- .16 3.3 Mixing
- .17 3.4 Installation - General
- .18 3.5 Setting
- .19 3.6 Waterproofing Membrane Installation
- .20 3.7 Crack Suppression Membrane (Crack Isolation Membrane) Installation
- .21 3.8 Mortar-Bed Tiling
- .22 3.9 Thin-Set Method
- .23 3.10 Control Joints
- .24 3.11 Grouting or Pointing
- .25 3.12 Installation Tolerances
- .26 3.13 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes
 - .1 Hard surface tiling.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing and Scheduling

- .1 Coordinate installation of tile work with related work.
- .2 Proceed with tile work only after curbs, vents, drains, piping, and other projections through substrate have been installed and when substrate construction and framing of openings have been completed.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
 - .2 Submit manufacturer's installation instructions for *Products* proposed for use in the work of this Section.
- .3 Samples:
 - .1 Submit full size samples of each type of tile specified.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Maintenance materials:
 - .1 *Provide* minimum 2% of each type and colour of tile required for the *Work* for maintenance use.
 - .2 Maintenance material to be of same production run as installed material.

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors:
 - .1 Execute work of this Section only by a *Subcontractor* who has adequate plant, equipment, and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past five years.
 - .2 The *Contractor* shall ensure that the *Subcontractor* is a member company in good standing of the Terrazzo, Tile and Marble Association of Canada or equivalent certification acceptable to the *Consultant* and have been a member for at least the past five years.

1.8 FIELD CONDITIONS

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

- .2 Protect work of this Section against damage by work of other Sections for a minimum of 72 hours after application of grouting by prohibiting passage of traffic over tile. Do not immerse in water and protect tilework from freezing for at least 28 *Days* after installation.
- .3 For concrete floor substrates subject to moisture sensitive materials, conduct the following tests in accordance with the following:
 - .1 Test for moisture vapour transmission in accordance with ASTM F710-11 and ASTM F1869-11 or ASTM F2170-11 in accordance with manufacturer's written installation instructions. Results must not exceed the written recommendations of the *Product* manufacturer.
 - .2 Test for surface Potential of Hydrogen (pH). Levels of pH shall not exceed the written recommendations of the *Product* manufacturer. Test in accordance with ASTM F710-11.
 - .3 For each test type: Conduct three tests for flooring applications up to 93 m² (1000 square feet) in area, and one additional test for each additional 93 m² (1000 square feet) of flooring area.

1.9 EXTENDED WARRANTY

- .1 Warrant work of this Section for a period of two years in accordance with Article A-15 of the Agreement Between *Owner* and *Contractor*.

PART 2 – PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Terrazzo, Tile and Marble Association of Canada ("TTMAC") Specification Guide 09 30 00 Tile Installation Manual 2012-2014.

2.2 TILE MATERIALS

- .1 Tile company, size and color as noted on the *Drawings*.

2.3 GROUT AND ADHESIVES

- .1 Acceptable manufacturers:
 - .1 Ardex Canada.
 - .2 Flextile Ltd.
 - .3 LATICRETE International, Inc.
 - .4 MAPEI Corp.
 - .5 TEC Specialty Products, Inc.
 - .6 Or Equivalent.
- .2 Setting adhesives; interior applications:
 - .1 Portland cement/sand/latex mixture, in accordance with ANSI A108/A118/A136.1-2013 and with minimum Shear Bond (Porcelain Tile, immersion and dry 28 *Day* cure tests) of 2.3 MPa (340 psi) when tested to ANSI A108/A118/A136.1-2013.
 - .1 Acceptable *Products*:
 - .1 Ardex 'X 77 Microtec Fibre Reinforced'.

- .2 Flextile '51' mixed with Flextile '44'.
 - .3 Laticrete 'Laticrete 4237 Latex Thin Set Liquid' with 'Portland 211 Crete Filler Powder'.
 - .4 Mapei 'KERALASTIC' mixed with 'KERABOND'.
 - .5 TEC Specialty Products, Inc. 'Super Flex Latex-Modified Thin Set Mortar'.
 - .6 Or Equivalent.
- .2 Metal substrate conditions: Epoxy mortar setting mix in accordance with ANSI A108/A118/A136.1- 2013.
- .1 Ardex Canada 'S 16 Rapid Setting Thin Set'.
 - .2 Flextile Ltd. '100 Flex-Epoxy'.
 - .3 Laticrete International Inc. 'Latapoxy 210 Modified Epoxy Adhesive'.
 - .4 Mapei Corp. 'Kerapoxy 9931'.
 - .5 Or Equivalent.
- .3 Grout:
- .1 TEC Specialty Products, Inc. '100% Solids Epoxy Mortar and Grout 470' or *Equivalent*.
 - .1 Sanded, polymer-modified, latex-modified, non-shrink, ANSI A108/A118/A136.1- 2013 and ANSI A108/A118/A136.1-2013.
 - .1 Ardex Canada 'FL Rapid Set, Flexible Sanded'.
 - .2 Flextile Ltd. '600'.
 - .3 Laticrete International Inc. '1500 Series' mixed with '1776 Grout Admix'.
 - .4 Mapei Corp. 'Keracolour S'.
 - .5 TEC Specialty Products, Inc. 'AccuColour Premium Sanded'.
 - .6 Or Equivalent.
 - .2 Unsanded, polymer-modified, latex-modified, non-shrink, ANSI A108/A118/A136.1-2013 and ANSI A108/A118/A136.1-2013.
 - .1 Ardex Canada 'FG-C Microtec (unsanded)'.
 - .2 Flextile Ltd. '500'.
 - .3 Laticrete International Inc. '1600 Series' mixed with '1776 Grout Admix'.
 - .4 Mapei Corp. 'Keracolour U'.
 - .5 TEC Specialty Products, Inc. 'AccuColour Premium Unsanded'.
 - .6 Or Equivalent.
 - .3 Epoxy, to ANSI A108/A118/A136.1-2013.
 - .1 Ardex Canada 'WA Epoxy Grout and Adhesive'.

- .2 Flextile Ltd. '100 Flex-Epoxy 100% Solids Epoxy Grout'.
 - .3 Laticrete International Inc. 'SpectraLOCK™ PRO Grout'.
 - .4 Mapei Corp. 'Kerapoxy' and Kerapoxy CQ'.
 - .5 TEC Specialty Products, Inc. '100% Solids Epoxy Mortar and Grout'.
 - .6 Or Equivalent.
- .4 Scratch coat (by volume): 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used in accordance with manufacturer's instructions. Adjust water volume depending on moisture content of sand to obtain consistency and workability.
 - .5 Slurry bond coat: mix Portland cement and water to a creamy paste consistency. Include latex additive where required by TTMAC Detail.
 - .6 Mortar bed for walls (by volume): 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used in accordance with manufacturer's instructions. Adjust water volume depending on moisture content of sand to obtain consistency and workability.
 - .7 Leveling coat (by volume): 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used in accordance with manufacturer's instructions.
 - .8 Mortar bed for floors; where applicable: 1 part cement, 4 parts sand, 1 part water. Water volume may be adjusted depending on water content of sand.

2.4 ACCESSORIES

- .1 Waterproofing membrane: in accordance with Section 07 13 26 – Sheet Waterproofing.
- .2 Cleavage membrane: 0.11 mm (0.004") thick polyethylene film, to CAN/CGSB 51.34 - M86 (amended 1988).
- .3 Reinforcing wire fabric: galvanized welded wire fabric, 50 mm (2") x 50 mm (2"), WO.3 x WO.3 (16 ASW gauge or 1.6 mm (0.0625") diameter, in accordance with ASTM A1064/A1064M-15 and ASTM A1064/A1064M-15, except for minimum wire size.
- .4 Sealant: in accordance with CAN/CGSB 25.20-95 and tile and grout manufacturers' recommendations, colour selected by the *Consultant*.
- .5 Transition strips: purpose made metal extrusion, anodized aluminum.
- .6 Reducer strips: purpose made extrusions, anodized aluminum, maximum slope of 1:2.
- .7 Prefabricated movement joints: purpose made, having a Shore A Hardness of not less than 60 and elasticity of $\pm 40\%$ when used in accordance with TTMAC Detail 301EJ- 2002.
- .8 Floor sealer and protective coating: to tile and grout manufacturers' recommendations.
- .9 Water vapour reduction system:
 - .1 100% solids epoxy one coat system, 0 Volatile Organic compound (VOC), suitable for application to 100% Relative Humidity (RH) floors per ASTM F2170-11, designed to protect moisture sensitive adhered flooring systems from elevated moisture and alkalinity levels,

- warranted by manufacturer to cover subsequent flooring materials and labour, compatible with finish flooring products.
- .2 ASTM E96/E96M-10 water vapour transmission (wet methods) performance shall be documented by independent testing laboratory at a minimum 97% for water vapour transmission reduction compared to untreated concrete.
 - .3 ASTM E96/E96M-10 perm rating shall not exceed a 0.10 Perm rating.
 - .4 ASTM D1308-02(2013) insensitivity to alkaline environment up to, and including, pH 14 in a 14 Day bath test.
 - .5 Ensure manufacturer certifies acceptance and exposure to continuous topical water exposure after final cure.
 - .6 Water vapour reduction system shall be a single coat, stand alone system with no requirements for additional components such as sand broadcast for adhesion of flooring systems.
 - .7 System shall reduce Calcium Chloride readings of up to 25lbs/1000 ft²/24 hrs by 97% in one coat. System must be able to perform as required with RH Probe readings of 100%.
- .10 Edge Protection and Transition Profiles for Floors
- .1 At Same Height Transitions:
 - .1 Schluter-SCHIENE: L-shaped profile with 1/8 inch (3 mm) wide visible surface integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - .1 Anchoring Leg: Straight anchoring leg.
 - .2 Anchoring Leg: Radius anchoring leg for radius applications.
 - .3 Profile Height: As required to coordinate with tile selection and setting system.
 - .4 Material and Finish:
 - .1 AE: Satin Anodized Aluminum.
 - .5 Or equivalent.
 - .2 At Sloped Transitions:
 - .1 Schluter-RENO-RAMP-K: Anodized aluminum profile with textured, sloped exposed surface, tapered leading edge, and integrated grout joint spacer.
 - .1 Material and Finish: AE: Satin Anodized Aluminum.
 - .2 Profile Height: 1/2 inch (13 mm).
 - .3 Ramp Length: 2-1/2 inch (64 mm).
 - .4 Or equivalent.
- .11 Finishing and Edge-Protection Profiles for Walls
- .1 At Corners and Tile Edges (unless noted otherwise):

- .1 Schluter-JOLLY: L-shaped profile. 9/64 inch (3.5 mm) wide top and vertical wall sections that together form the visible surface. Integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - .1 Corners: Matching inside corners.
 - .2 Corners: Matching outside corners.
 - .3 Anchoring Leg: Straight anchoring leg.
 - .4 Profile Height: As required to coordinate with tile selection and setting system.
 - .5 Material and Finish:
 - .1 AE: Satin Anodized Aluminum.
 - .6 Or equivalent.
- .2 At Corners and Tile Edges (where noted):
 - .1 Schluter-SCHIENE: L-shaped profile with 1/8 inch (3.2 mm) wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - .1 Anchoring Leg: Straight anchoring leg.
 - .2 Anchoring Leg: Radius anchoring leg for radius applications.
 - .3 Profile Height: As required to coordinate with tile selection and setting system.
 - .4 Material and Finish:
 - .1 AE: Satin Anodized Aluminum.
 - .5 Or equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Ensure compatibility of *Products* supplied under this Section, and which bear contact with substrate.
- .2 Before work of this Section commences, examine the areas to be covered and report any flaw or adverse conditions in writing to the *Consultant*. Do not proceed with the tile work until surfaces and conditions comply with the requirements indicated in the manufacturer's instructions and in ANSI A108/A118/A136.1-2013) specification.
- .3 Miscalibrated tiles, tiles with chipped corners, tiles with holes, shall not be accepted by the *Contractor* for installation.
- .4 Carefully inspect the tiles for colour variation. Tiles presenting noticeable variations shall be carefully selected, set aside and used in areas where they fit in the pattern homogeneously. *Provide* for appropriate lighting equipment in addition to existing lighting in the immediate area where the installation is being performed so that any shade differences which are normally very slight can be identified easily.

3.2 PREPARATION

.1 Water vapour reduction system:

- .1 Where concrete substrate exhibits higher than permitted moisture and alkalinity levels, *Provide* water vapour reduction system to protect moisture sensitive flooring system from elevated moisture and alkalinity levels.
 - .1 Shot blast floors to an International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) #3 or #4 and clean surfaces with an industrial vacuum cleaner and remove residues from the substrate. Grinding is allowed only in areas not accessible by shot blasting. Remove defective materials, and foreign matter such as dust, adhesives, levelling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, and other deleterious substances. Repair cracks, expansion joints, control joints, and open surface honeycombs and fill in accordance with water vapour reduction system manufacturer's recommendations.
 - .2 Reinforcing fibres, if applicable, that are visible after shot blasting shall be removed and vacuumed leaving no fibres left on the concrete surfaces.
 - .3 Repair concrete prior to moisture vapour reduction system installation by using water vapour reduction system manufacturer's recommended bonding emulsion with approved concrete repair materials. Comply with requirements as listed in water vapour reduction system manufacturer's technical data information. Consult with vapour reduction manufacturer.
 - .4 Shot blast a small test area and review surface profile with the finished flooring applicator. As the water vapour reduction system is not a levelling material, *Provide* feather finish or levelling material to "flatten" or level the water vapour reduction system treated concrete prior to the flooring installation.
 - .5 Apply moisture vapour reduction system monolithically to manufacturer's recommended spreading rate in number of coats to achieve manufacturer's recommended thickness.
 - .6 Consult with vapour reduction manufacturer and comply with requirements as listed in water vapour reduction system manufacturer's technical data information.
 - .7 Review surface profile with the finished flooring applicator. As the water vapour reduction system is not a levelling material, *Provide* feather finish or levelling material to "flatten" or level the water vapour reduction system treated concrete prior to the flooring installation. Flooring installation shall not show telegraphing of substrate. Flooring installation shall be homogenous free of substrate lines, pockets, bumps and unevenness.
 - .8 Verify proper adhesion of flooring adhesives, coatings, and levelling compounds to the final vapour reduction coating system for acceptability.
 - .9 Do not proceed with finished flooring installation if moisture vapour transmission exceeds maximum permitted rates.

.2 Wall surfaces:

- .1 Roughen surfaces with previously painted glossy finishes by sandpaper or other abrasive medium, and completely remove finishes which are not compatible with products specified under this Section.
- .2 Completely remove contaminants and deleterious substances and debris which may prevent, reduce, and affect adhesion or performance or may act as bond breaker.

- .3 Prime gypsum, wood or porous concrete with primer, brush or roller applied at full strength in accordance with adhesive manufacturer's recommendations.
- .3 Floor surfaces:
 - .1 Completely remove contaminants and deleterious substances and debris which may prevent, reduce, and affect adhesion or performance or may act as bond breaker.
 - .2 Concrete shall be minimum of 120 *Days* old.
- .4 Wire brush steel substrates to remove deleterious substances and rust, to promote full adhesion to steel.

3.3 MIXING

- .1 Mix mortars, additives and grouts in accordance with manufacturer's requirements.
- .2 Rotating blade mechanical mixer: Pour latex additive, start mixer and add sand first, followed by Portland cement. Mix no mortar in same mixer as a dissimilar type of mortar unless the mixer is first thoroughly washed clean.
- .3 Pail batch mixing with low revolution drill mixers as follows:
 - .1 Premix separately prior to adding to the latex additive.
 - .2 Pour latex additive into clean mixing vessel and add dry materials slowly while mixing into a homogeneous and smooth consistency.

3.4 INSTALLATION - GENERAL

- .1 *Install Products* in accordance with manufacturer's specifications and as indicated in this Section.
- .2 *Install* in accordance with TTMAC Specification Guide 09 30 00 Tile Installation Manual 2012-2014, except where specified otherwise in the Contract Documents.
- .3 *Install* in accordance with ANSI A108/A118/A136.1-2013 and ANSI A108/A118/A136.1- 2013.
- .4 Lay out tile work as indicated on the *Drawings*, and where lay-out not indicated, lay-out tiles so tiles less than 1/2 the least dimension do not occur and with minimum amount of cutting.
- .5 Make joints even, straight, plumb and of uniform width.
- .6 *Provide* uniform positive slope to floor drains, to minimum allowable slope of 20 mm/m (1/4 inch/ft).
- .7 *Provide* edge protection at tile edges and corners, unless otherwise indicated in the Contract Documents, using maximum length pieces.
- .8 *Provide* edge protection and transition strips at tile transitions, unless otherwise indicated in the Contract Documents, using maximum length pieces.
- .9 Lap tile at inside corners and seal around doors. Apply sealant in accordance with Section 07 92 00 – Joint Sealants and manufacturer's instructions. Sealant colour to later selection by the *Consultant*.
- .10 Install flooring to entire area indicated or scheduled, including coverplates occurring within finished floor areas. Maintain overall continuity of colour and pattern with pieces of flooring installed on cover plates. Tightly butt edges to perimeter of floor around cover plates and to cover plates. Do not install flooring to floor drains occurring within finished floor areas.

- .11 Review locations of tile accessories with the *Consultant* prior to setting tile and comply with directions of the *Consultant*.

3.5 SETTING

- .1 Using a damp towel, wipe off the back side of floor tile to remove any dust or other residue that may be left over from the manufacturing process.
- .2 Place as much tile as possible in one operation before setting bed reaches initial set. Clean back and remove bed when it has set before tile is laid.
- .3 Prime materials and by methods specified by manufacturer of bond coat.
- .4 Line up joints between tile installed on stairs from tread to tread.
- .5 Except where tiles have setting tabs, and except for expansion, control and isolation joints, maintain joint widths as selected by the *Consultant*.
- .6 Back up tile coves, curbs and other shaped pieces solid with mortar. Rigidly set, reinforce or otherwise make firm and secure such pieces.
- .7 Beat tiles in thoroughly and sufficiently to cause mortar ribs or notches to come together into a continuous void free bed and allow the mortar to flow up partially into the joint space to maximum of 1/3 the thickness of the tile. Sound floor tiles by tapping and reset all tiles with voids in setting bed.
- .8 Tile shall contact setting materials for minimum of 95% coverage.
- .9 Obtain 100% mortar coverage with applicable requirements for back buttering of tile in referenced TTMAC and ANSI A108/A118/A136.1-2013 series of tile installation standards for the following:
 - .1 Tile in wet areas:
 - .2 Tile installed with chemical resistant mortars and grouts.
 - .3 Tile having tiles 300 mm (12") or larger in any direction.
 - .4 Tile having tiles with raised or textured backs.
 - .5 Tile having tile installation rated for Heavy or Extra Heavy Duty.
 - .6 Porcelain tiles with more than 20% of the tile backs covered with firing release dust back buttered so that 100% of the back is covered with adhesive mortar rated for C627, Extra Heavy Duty rating.
- .10 Remove any excess setting material from the joint area so that 2/3 of the depth of the tile is available for grouting.
- .11 Remove smudges or smears of setting material from the tile surface with a damp sponge or cloth immediately after final adjustment and beat-in while the mortar is fresh.
- .12 Do necessary cutting and drilling of fixtures, fittings, and built-in or penetrating units without marring the tile. Replace all cracked or damaged tile.
- .13 Form external angles with round edge tile extending over edge of square edge adjacent tile. Internal angles shall be formed square, carrying one flat tile past edge of other.
- .14 Extend tile into recesses at windows, doors, or other openings.

- .15 Extend tiles 100 mm (4") behind mirrors, and fully behind cabinets, cupboards and other fixed objects at walls.
- .16 Cut tiles to conform to irregularities in wall lines and vertical planes along outer edges. Smooth cut edges with carborundum block or by other means to *Provide* clean straight edge.
- .17 At floor drains in mortar bed: *Provide* minimum setting bed of 10 mm (3/8"), sloped to drain at 6 mm (1/4") in 305 mm (12").

3.6 WATERPROOFING MEMBRANE INSTALLATION

- .1 *Install* waterproofing membrane in shower areas in accordance with manufacturer's instructions and Section 07 13 26 – Sheet Waterproofing.

3.7 CRACK SUPPRESSION MEMBRANE (CRACK ISOLATION MEMBRANE) INSTALLATION

- .1 *Install* membrane in accordance with manufacturer's instructions.
- .2 Prepare substrate in accordance with manufacturer's instructions.
- .3 *Install* crack suppression membrane to substrates for tile flooring installations located on suspended structural floor assemblies. Treat substrate with full coverage of crack isolation membrane and reinforcement in accordance with crack isolation membrane manufacturer's installation instructions.

3.8 MORTAR-BED TILING

- .1 Verify 25 mm (1") nominal bed thickness has been allowed. Apply latex-Portland cement thin bed mortar with flat trowel as a slurry bond coat approximately 1.5 mm (1/16") thick over clean concrete slab in compliance with current revision of ANSI A108/A118/A136.1-2013 (A-1 through A-3; A-4.1a.5.2).
- .2 Place latex-Portland cement thick bed mortar over slurry bond coat while bond coat is wet and tacky. Omit reinforcing wire fabric and fully compact bed by tamping.
- .3 Spread latex-Portland cement thin bed mortar with flat trowel over surface of "green"/fresh mortar bed as a slurry bond coat approximately 1.5 mm (1/16") thick.
- .4 Apply latex-Portland cement thin bed mortar slurry bond coat to back of tile or threshold and place each piece/sheet while slurry bond coats are wet and tacky. Beat with a hardwood block or rubber mallet to level/imbed pieces before mortar bed takes initial set.
- .5 Clean excess mortar/adhesive from finished surfaces.
- .6 For installation of tile over cured (pre-floated) latex-Portland cement thick bed mortar, follow Thin Bed Method.

3.9 THIN-SET METHOD

- .1 *Install* thin-set mortar in compliance with current revisions of ANSI A108/A118/A136.1- 2013) (A-1 through A-3) and ANSI A108/A118/A136.1-2013) (A-4.3).
- .2 Use the appropriate trowel notch size to ensure full bedding of the tile.
- .3 Work thin-set mortar into good contact with the substrate and comb with notched side of trowel.
- .4 Beat each piece/sheet into the thin-set mortar with a beating block or rubber mallet to insure full bedding and flatness.

- .5 Allow installation to set until firm.
- .6 Clean excess thin-set mortar from tile face and joints between pieces.
- .7 Do not cover, bridge or fill tile joints located over expansion joints with adhesive.

3.10 CONTROL JOINTS

- .1 Carry substrate control and movements joints through to tile work.
- .2 *Install* control joints around the perimeter of tiled areas, around columns and where tile abuts other hard materials, also incorporate control joints over all building expansion joints.
- .3 Cut tiles or stones on both sides along the edges of control or expansion joints.
- .4 *Provide* control joints equal to width of interior tile joints in floors and walls at perimeters of floor and within 4800 mm to 6100 mm (16 ft to 20 ft) centre to centre by raking out joints to full depth of tile and cleaning joints for application of sealant in accordance with Section 07 92 00 – Joint Sealants. In areas subject to sunlight or exposed to exterior *Provide* control joints within 2400 mm to 3500 mm (8 ft to 12 ft) centre to centre.
- .1 Review locations with the *Consultant* prior to setting tile and comply with instruction given by the *Consultant*.

3.11 GROUTING OR POINTING

- .1 *Install* grout to comply with ANSI A108/A118/A136.1-2013 and ANSI A108/A118/A136.1- 2013) unless otherwise specified in the Contract Documents and in accordance with manufacturer's printed instructions.
- .2 Allow tile installation to cure a minimum of 24 hours at ambient temperature of 21°C prior to grouting.
- .3 Verify grout joints are free of dirt, debris, water or tile spacers and face of tiles are clean
- .4 Apply grout release to face of absorptive, abrasive, non-slip or rough textured tile units that are not hot paraffin coated to facilitate cleaning.
- .5 Spread using a sharp edged, hard rubber float and work grout into joints using 45° diagonal strokes.
- .6 Pack joints full and free of voids/pits. Stroke diagonally to remove excess grout and to avoid pulling grout out of filled joints.
- .7 Once excess grout is removed, begin cleaning grout haze before grout is fully cured. Using a circular motion, lightly scrub grouted surfaces with the damp sponge to dissolve grout film/haze. Drag sponge diagonally over scrubbed surfaces to remove froth. Rinse sponge frequently and change rinse water at least every 2 m² (200 ft²). Repeat cleaning sequence again if grout haze is still present.
- .8 Allow grout joints to become firm. Buff surface of grout with clean coarse cloth. Inspect joint for pinholes/voids and repair them with freshly mixed grout. Within 24 hours, check for remaining haze and remove it with warm soapy water and a nylon scrubbing pad, using a circular motion, to lightly scrub surfaces and dissolve haze/film.
- .9 Chemical resistant, water cleanable tile-grouting epoxy (ANSI A108/A118/A136.1-2013):
 - .1 *Install* chemical epoxy resistant grout in compliance with current revisions of ANSI A108/A118/A136.1-2013 and ANSI A108/A118/A136.1-2013.

- .2 Once excess grout is removed, begin cleaning grout haze approximately 20-30 minutes after grouting depending on temperature. Using a circular motion, lightly scrub grouted surfaces with the damp sponge to dissolve grout film/haze. Drag sponge diagonally over scrubbed surfaces to remove froth. Rinse sponge frequently and change cleaning solution at least every 4.7 m² (50 ft²).
- .3 Within 1 hour of finishing first cleaning, clean the same area again following the same procedure but utilizing a clean white scrub pad and fresh cleaning solution. Rinse scrub pad frequently. Drag a clean sponge diagonally over scrubbed surfaces to remove froth. Use each side of sponge only once before rinsing and change cleaning solution at least every 4.7 m² (50 ft²). Allow cleaned areas to dry and inspect tile surface. Rinse with clean water and allow surface to dry. Inspect grout joint for pinholes/voids and repair them with freshly mixed grout.
- .10 Grout joint width to be 1.5 mm (1/16") unless otherwise indicated in the *Contract Documents*.
- .11 Grout joint width to be 3.2 mm (1/8") unless otherwise indicated in the *Contract Documents*.
- .12 Use caution when using sanded grouts to prevent scratching of tile or other material surfaces.
- .13 Do not cover bridge or fill any expansion joints in tile with grout.
- .14 Do not cover bridge or fill any expansion joints in tile with grout.

3.12 INSTALLATION TOLERANCES

- .1 Maximum allowable lippage:
 - .1 Tile up to 152 mm x 152 mm (6" x 6") in size: 0.79 mm (1/32").
 - .2 Tile greater than 152 mm x 152 mm (6" x 6") in size: 1.5 mm (1/16").
- .2 Finish planes shall be straight and plumb to within 6 mm in 3 m (1/4" in 10 feet).

3.13 ADJUSTING AND CLEANING

- .1 Clean installed tile surfaces after grouting has cured.
- .2 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.
- .3 Prohibit traffic during installation and for minimum 48 hours after installation.
- .4 Protect floors from impact and vibration for a minimum of 48 hours after installation.
- .5 *Install* floor protection in areas where other work, repairs and installation of equipment, and foot traffic will occur.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Closeout submittals:
- .7 1.7 Quality Assurance
- .8 1.8 Delivery, Storage, and Handling
- .9 1.9 Field Conditions
- .10 2.1 Performance/Design Requirements
- .11 2.2 General
- .12 2.3 Acoustical Tiles
- .13 2.4 Metal Suspension Systems
- .14 2.5 Miscellaneous Materials
- .15 2.6 Metal Finish
- .16 3.1 Installation - General
- .17 3.2 Installation - Suspension System
- .18 3.3 Installation - Tiles
- .19 3.4 Installation - Tolerances
- .20 3.5 Field Quality Control
- .21 3.6 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes
 - .1 Acoustical tile ceiling systems.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination
 - .1 Cooperate with mechanical and electrical *Subcontractors*.
 - .2 Coordinate layout and installation of acoustic ceiling units and suspension systems components with other work supported by or penetrating through ceilings, including light fixtures, Heating Ventilation and Air Conditioning (HVAC) equipment, partition system, fire suppression system components and other work required to be incorporated in or coordinated with the ceiling system.

1.5 SUBMITTALS

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

1.6 CLOSEOUT SUBMITTALS:

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Maintenance data:
 - .1 Submit maintenance and cleaning instructions for acoustical ceiling systems for incorporation into the maintenance manuals.
- .3 Maintenance materials:
 - .1 Deliver for maintenance use, 2% of each type and colour of suspension components and acoustical tiles used in the work.
 - .2 Pack panels in suitable containers, clearly dated and identified as to type and location of installation in the *Work*, and store where directed by the *Owner*.

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors:
 - .1 *Provide* work of this Section, executed by competent installers with a minimum of five years' experience in application of *Products*, systems and assemblies specified in the Contract drawings and with approval and training of *Product* manufacturers.
- .2 Mock-ups:

- .1 Construct in locations acceptable to the *Consultant* a typical sample ceiling installation 10 m² in area, complete with perimeter wall trim, and cut tegular tile demonstrating rectified edge. Modify sample as required to obtain Consultant's approval. Upon acceptance retain sample as standard of quality for acoustical ceiling.
- .2 Do not begin fabrication and erection of remainder of ceiling system until sample installation has been reviewed and accepted by the *Consultant*. Accepted sample may become a part of the final *Work*, subject of approval of the *Consultant*.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 FIELD CONDITIONS

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

PART 2—PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Design suspension systems for a maximum mid-span deflection not exceeding L/360 in accordance with ASTM C635/C635M-13a deflection test.
- .2 Design suspension system to support safely, and without distortion, the superimposed loads of:
 - .1 Air supply diffusers and return grilles.
 - .2 Lighting fixtures.

2.2 GENERAL

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

2.3 ACOUSTICAL TILES

- .1 ACT-1; Lay-in acoustical tiles:
 - .1 Classification: Type III, Form 2, Pattern C E in accordance with ASTM E1264- 08e1.

- .2 Size: to suit metal suspension system.
- .3 Noise Reduction Coefficient (NRC): 0.50.
- .4 Material: wet formed mineral fibre.
- .5 Surface texture: Fine.
- .6 Edge: Square.
- .7 Colour: White.
- .8 Flame Spread: Class A Flame Spread 25 or under, in accordance with CAN/ULC S102.
- .9 Acceptable *Products*: Armstrong World Industries 'Dune Square Lay-in 1773' or *Equivalent*.

2.4 METAL SUSPENSION SYSTEMS

- .1 Hanger anchorage devices: Screws, clips, bolts, concrete inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3 times calculated load supported except size direct pull-out concrete inserts for 5 times calculated loads.
- .2 Concrete hanger anchors; post installed: Steel eye bolts and nuts to suit ceiling hangers with capability to sustain, without failure, a load equal to 4 times that imposed by ceiling construction, as determined by testing per ASTM E488/E488M-15, conducted by a qualified independent testing laboratory.
 - .1 ITW Ramset Dynabolt Sleeve Anchor 'TW-1614' or Readi-Tie-Drive 'TD4-112' tie wire anchor by ITW Construction Products Canada or *Equivalent*.
 - .2 Kwik-Bolt II 'HCKB 1/4' tie wire anchor by Hilti Corporation or *Equivalent*.
 - .3 Fasteners exposed to weather, condensation, and corrosion: Zinc-plated or stainless steel fasteners in applicable *Product* lines specified in preceding subsections.
- .3 Hangers and tie wire: Galvanized wire, recommended by manufacturer of suspension system, minimum 2.66 mm (0.1") (12 gauge).
- .4 Suspension system accessories:
 - .1 Splices, clips, and perimeter moulding, of manufacturer's standard type to suit the applicable conditions unless special conditions and access area are shown or specified in the *Contract Documents*.
 - .2 Angle wall mouldings; hemmed with prefinished exposed flanges:
 - .1 For 24 mm (15/16") grid applications; angle moulding with exposed bottom flange of 22 mm (7/8").
 - .1 Armstrong World Industries '7803' or equivalent.
 - .2 CGC Inc. 'M7' or *Equivalent*.
- .5 Standard suspension system, non fire-rated:
 - .1 Intermediate duty in accordance with ASTM C635/C635M-13a, 24 mm (15/16") interlocking tee system, designed to support acoustical panels in patterns indicated with deflection of

main tees less than L/360, consisting of main tees and cross tees. The system shall *Provide* lock joint intersections of cross and main tees.

.2 Acceptable *Products*:

- .1 Armstrong World Industries 'Prelude XL 15/16" Exposed Tee Systems'.
- .2 CGC Inc. 'DX'.
- .3 Or *Equivalent*.

2.5 MISCELLANEOUS MATERIALS

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

2.6 METAL FINISH

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

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

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

3.2 INSTALLATION - SUSPENSION SYSTEM

- .1 *Install* suspension system rigid, secure, square, level and plumb, framed and erected to maintain dimensions and contours indicated, and in accordance with ASTM C636 / C636M - 13, CISCA installation standards and any other applicable national or local Building code requirements. Make allowance for thermal and structural movement.
- .2 Attach hangers to structure with inserts and hanger supports. Do not use powder activated fasteners.
- .3 Support hangers for suspended ceiling grid independent of walls, columns, pipes and ducts.
- .4 Space hangers for ceilings at maximum 1220 mm (48") on centre in both directions. *Provide* additional hangers as required to comply with manufacturer's written installation instructions.
- .5 Locate hangers at not more than 150 mm (6") from ends of main tee members.
- .6 Install exposed tee members to pattern indicated on the Contract drawings. Securely attach hangers to main tee members.
- .7 Exposed tees shall be as long as possible to minimize joints. Make joints square, tight, flush and reinforce with splines. Distribute joints to prevent clustering in one area.

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

3.3 INSTALLATION - TILES

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

3.4 INSTALLATION - TOLERANCES

- .1 Allowable tolerances: in accordance with ASTM C636 / C636M - 13.
- .2 *Install* suspension systems level to tolerance of 1:1200.
- .3 *Install* edge mouldings level to tolerance of 3 mm in 3660 mm (1/8" in 12'-0").

3.5 FIELD QUALITY CONTROL

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

3.6 ADJUSTING AND CLEANING

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

1.2 SECTION INCLUDES

- .1 PART 1 – GENERAL
- .2 1.1 General Instructions
- .3 1.2 Section Includes
- .4 1.3 Summary
- .5 1.4 Submittals
- .6 1.5 Closeout Submittals
- .7 1.6 Quality Assurance
- .8 1.7 Field Conditions
- .9 1.8 Extended Warranty
- .10 PART 2 - PRODUCTS
- .11 2.1 Materials
- .12 PART 3 - EXECUTION
- .13 3.1 Examination
- .14 3.2 Preparation
- .15 3.3 Installation of Tile Flooring
- .16 3.4 Field Quality Control
- .17 3.5 Adjusting and Cleaning
- .18 3.6 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 Rubber tile flooring.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- .3 Samples:
 - .1 Submit samples of each pattern and colour of rubber tile flooring proposed for use in the *Work*.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00.

- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Maintenance materials:
 - .1 Deliver 2% of each colour, pattern and type of flooring material required for this project for maintenance use. Store where directed. Clearly identify each box.
 - .2 Maintenance materials to be same production run as installed materials.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors: *Provide* work of this section, executed by competent installers with minimum 5 years experience in application of Products, systems and assemblies specified and with approval and training of *Product* manufacturers.
- .2 Mock-up:
 - .1 Prior to commencing flooring installation for this section, prepare full room mock- up (room size at least 10 m² (100 ft²) in area) for acceptance by the *Consultant*.
 - .2 Do not proceed flooring specified in this section until mock-up has been accepted by *Contractor* and *Consultant*.

1.7 FIELD CONDITIONS

- .1 Install materials of this section only when surfaces and air temperatures have been maintained between 18°C and 24°C for 48 hours preceding installation and will be so maintained during installation and for 48 hours thereafter. Maintain a minimum temperature of 13°C after above period.
- .2 Ensure that adequate ventilation is provided during installation and curing of materials of this section.
- .3 Concrete floors are to be dry, and exhibit negative alkalinity, carbonization, or dusting, and be free of curing/sealing compounds, residue from paint and adhesives.
- .4 Conduct the tests in accordance with ASTM F710-11 and the following:
 - .1 Test for moisture vapour transmission in accordance with ASTM F710-11 and ASTM F1869-11 or ASTM F2170-11 in accordance with manufacturer's written flooring installation instructions. Results must not exceed 170 µg/m² (3 lb per 1,000 ft²) in 24 hours when tested to ASTM F1869-11 or exceed 75% when tested to ASTM F2170-11.
 - .2 Test for surface pH. Levels of pH shall not exceed the written recommendations of the flooring manufacturer and adhesive manufacturer. Test in accordance with ASTM F710-11.
 - .3 For each test type: Conduct 3 tests for flooring applications up to 93 m² (1000 ft²) in area, and 1 additional test for each additional 93 m² (1000 ft²) of flooring area.
 - .4 Testing shall be completed prior to application of water vapour reduction system, if applicable, and after application of water vapour reduction system in accordance with floor finish specifications.

- .5 In areas that are exposed to intense or direct sunlight, Products shall be protected during the conditioning, installation, and adhesive curing periods, by covering the light source.

1.8 EXTENDED WARRANTY

- .1 Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Rubber tile flooring:
 - .1 Resilient rubber tile flooring composed of 100% recycled elastomers, 9.5 mm thick x 686 mm 686 mm.
 - .2 Acceptable material: Spartus 934 Rouge, as manufactured by Tuflex.
- .2 Adhesive: Low VOC type as recommended by flooring manufacturer.
- .3 Sealant: Low VOC type, clear silicone, as manufactured by Tremco, Momentive, or Dow Corning.
- .4 Water vapour reduction system:
 - .1 100% solids epoxy one coat system, 0 VOC, suitable for application to 100% RH floors per ASTM F2170-11, designed to protect moisture sensitive adhered flooring systems from elevated moisture and alkalinity levels, warranted by manufacturer to cover subsequent flooring materials and labour, compatible with finish flooring products.
 - .2 ASTM E96/E96M-10 water vapour transmission (wet methods) performance shall be documented by independent testing laboratory at a minimum 97% for water vapour transmission reduction compared to untreated concrete.
 - .3 ASTM E96/E96M-10 perm rating shall not exceed a 0.10 Perm rating.
 - .4 ASTM D1308-02(2013) insensitivity to alkaline environment up to, and including, pH 14 in a 14-day bath test.
 - .5 Manufacturer certifies acceptance and exposure to continuous topical water exposure after final cure.
 - .6 Water vapour reduction system shall be a single coat, stand alone system with no requirements for additional components such as sand broadcast for adhesion of flooring systems.
 - .7 System shall reduce Calcium Chloride readings of up to 25lbs/1000 ft²/24 hrs by 97% in one coat. System must be able to perform as required with RH Probe readings of 100%.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrate to ensure clean lines, correct level and freedom from cracks, ridges, dusting, scaling and carbonation.
- .2 Examine walls in advance of application of base to ensure that surfaces are protected against entry of water and moisture. Perform compatibility test with primer/adhesive and substrate.
- .3 Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

- .4 Failure to call attention to defects or imperfections will be construed as acceptance and approval of the substrate. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

- .1 Comply with recommendations of ASTM F710-11.
- .2 Water vapour reduction system:
 - .1 Where concrete substrate exhibits higher than permitted moisture and alkalinity levels, *provide* water vapour reduction system to protect moisture sensitive flooring system from elevated moisture and alkalinity levels.
 - .1 Shot blast floors to a International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) #3 or #4 and clean surfaces with an industrial vacuum cleaner and remove residues from the substrate. Grinding is allowed only in areas not accessible by shot blasting. Remove defective materials, and foreign matter such as dust, adhesives, levelling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, and other deleterious substances. Repair cracks, expansion joints, control joints, and open surface honeycombs and fill in accordance with water vapour reduction system manufacturer's recommendations.
 - .2 Reinforcing fibres, if applicable, that are visible after shot blasting shall be removed and vacuumed leaving no fibres left on the concrete surfaces.
 - .3 Repair concrete prior to moisture vapour reduction system installation by using water vapour reduction system manufacturer's recommended bonding emulsion with approved concrete repair materials. Comply with requirements as listed in water vapour reduction system manufacturer's technical data information. Consult with vapour reduction manufacturer.
 - .4 Shot blast a small test area and review surface profile with the finished flooring applicator. As the water vapour reduction system is not a levelling material, *Provide* feather finish or levelling material to "flatten" or level the water vapour reduction system treated concrete prior to the flooring installation.
 - .5 Apply moisture vapour reduction system monolithically to manufacturer's recommended spreading rate in number of coats to achieve manufacturer's recommended thickness.
 - .6 Consult with vapour reduction manufacturer and comply with requirements as listed in water vapour reduction system manufacturer's technical data information.
 - .7 Review surface profile with the finished flooring applicator. As the water vapour reduction system is not a levelling material, *provide* feather finish or levelling material to "flatten" or level the water vapour reduction system treated concrete prior to the flooring installation. Flooring installation shall not show telegraphing of substrate. Flooring installation shall be homogenous free of substrate lines, pockets, bumps, and unevenness.
 - .8 Verify proper adhesion of flooring adhesives, coatings, and levelling compounds to the final vapour reduction coating system for acceptability.
 - .9 Do not proceed with finished flooring installation if moisture vapour transmission exceeds maximum permitted rates.

- .3 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- .4 Alkalinity and adhesion testing: Perform tests and proceed with installation only after substrates pass testing. Document tests performed and submit in writing to *Consultant*.
- .5 Fill cracks, holes, and depressions in substrates with trowel-applied levelling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- .6 At door opening locations where finished flooring is adjacent to weather-stripping or automatic door bottoms *Provide* trowel-applied levelling compound to *Provide* full contact between finished flooring and weather-stripping or automatic door bottoms. Taper trowel-applied levelling compound to transition with adjacent flooring substrate to be *Provide* smooth and seamless transition at maximum slope of 3:1000 (height to distance) ratio.
- .7 Do not install floor coverings until they are same temperature as space where they are to be installed.
 - .1 Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- .8 Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.
- .9 Remove chalking and dusting from concrete surfaces with wire brushes.
- .10 Where flooring adjoins thicker floor materials, apply epoxy levelling screed, feather out to make up difference in level between materials.

3.3 INSTALLATION OF TILE FLOORING

- .1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .2 Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, and the like. Extend flooring into toe spaces, door recesses, closets, and similar openings.
- .3 Maintain continuity of colour and pattern.
- .4 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
- .5 Install flooring to entire area indicated or scheduled, including coverplates occurring within finished floor areas. Maintain overall continuity of colour and pattern with pieces of flooring installed on cover plates. Tightly butt edges to perimeter of floor around cover plates and to cover plates. Do not install flooring to floor drains occurring within finished floor areas.
- .6 Roll tile with a 45.36 kilogram (100-pound) 3-section roller prior to adhesive hardening. Refer to specific rolling instructions of the tile manufacturer. Telegraphing of adhesive marks not permitted. Perform second rolling 2 to 3 hours after first rolling.
- .7 Cut tile and fit neatly around fixed or excessively heavy objects.
- .8 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

3.4 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00.
- .2 Manufacturer's field review to be in accordance with Section 01 45 00.

3.5 ADJUSTING AND CLEANING

- .1 Remove excess adhesive from surfaces of the sheet flooring and base as work progresses.
- .2 Wash surfaces using non-phosphate detergent to remove silicone, wax, dirt and dust using rotary scrubbing machines fitted with nylon brushes. Wash with neutral mild detergent (pH of 7 - 8) and water, thoroughly buff dry with smooth wool pad. Do not apply any other compounds.
- .3 Thoroughly clean surfaces in accordance with manufacturer's recommendations.

3.6 PROTECTION

- .1 Protect new floors from time of final set of adhesives until final inspection. Install suitable protection sheeting, lap joints of material by 150 mm (6") and seal with non-asphaltic tape.
- .2 Prohibit traffic on floor for 48 hours after installation. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.
- .3 Install floor protection in areas where other work, repairs and installation of equipment, and foot traffic will occur.
- .4 Protect exposed edges of flooring, where finished and unfinished areas adjoining, by means of a transition strip butting to and flush with the finished surface of the flooring covering material and securely adhered to the substrate material.
- .5 Install transition strips where flooring terminates. Set flush with adjacent floor finishes.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Site Conditions
- .7 1.7 Delivery, Storage, and Handling
- .8 2.1 General
- .9 3.1 Examination
- .10 3.2 Preparation
- .11 3.3 Application
- .12 3.4 Site Tolerances
- .13 3.5 Repair
- .14 3.6 Cleaning
- .15 3.7 Protection

1.3 SUMMARY

- .1 Labour, *Products*, equipment and services necessary for epoxy flooring work in accordance with the *Contract Drawings*.

1.4 SUBMITTALS

- .1 *Product* data: Submit manufacturer's *Product* data in accordance with Section 01 33 00 – Submittal Procedures including:
 - .1 Two copies of manufacturer's *Product* data on characteristics, performance criteria, and limitations.
 - .2 Preparation, installation requirements and techniques, *Product* storage, and handling criteria.
- .2 Samples: Submit duplicate samples of each type and colour of epoxy flooring mounted on 10" x 8" hardboard in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Reports: Submit manufacturer's acceptance of substrate prior to installation in writing. Submit verification of moisture content of floor prior to installation.
- .4 Close-out submittals: Submit maintenance data for incorporation into Operations and Maintenance manuals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.

1.5 QUALITY ASSURANCE

- .1 Perform work of this Section by a company that has a minimum of five years proven experience in installations of a similar size and nature and that is approved by manufacturer. Submit to the *Consultant*, the applicator's current certificate of approval by the material manufacturer as proof of compliance.
- .2 Mock-up:
 - .1 Construct one 32 ft² mock-up of each type and colour of epoxy flooring in location acceptable to the *Consultant*.
 - .2 Arrange for the *Consultant's* review and acceptance, allow 48 Hours after acceptance before proceeding with work.
 - .3 Mock-up may remain as part of *Work* if accepted by the *Consultant*. Remove and dispose of mock-ups which do not form part of *Work*.
 - .4 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the work of this Section.
- .3 Pre-installation meetings: Arrange with manufacturer's representative and the *Consultant* to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.6 SITE CONDITIONS

- .1 Do not *Install* the work of this Section outside of the following environmental ranges without *Product* manufacturer's written acceptance:
 - .1 Ambient air and surface temperature: 59°F to 86°F.
 - .2 Relative Humidity: In accordance with manufacturers' requirements.
 - .3 When no dust is being raised.
 - .4 In well-ventilated and broom clean areas.
- .2 Do not apply epoxy flooring over materials that contain over 4% moisture.
- .3 *Install* temporary protection and facilities to maintain the *Product* manufacturer's, and the above specification subsection 1.7.1, environmental requirements for 24 hours before, during, and 24 h after installation.
- .4 Post do not enter and appropriate warning signs at conspicuous locations.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Package, seal and label each epoxy flooring material to show manufacturer's and *Product* name, and colour.
- .2 Store materials at site in an area specifically set aside for purpose that is locked, ventilated, and maintained at a minimum temperature of 60.8°F.
- .3 Ensure that health and fire regulations are complied with in storage area, and during handling and application.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 All materials under work of this Section, including but not limited to, primers and epoxy flooring are to have low Volatile Organic Compound (VOC) content limits.
- .2 Each material used in the application of each flooring system shall be as recommended or manufactured by the *Supplier* of the flooring system.
- .3 Epoxy flooring and base: Trowelled system, silica sand filled 100% epoxy binder, minimum 6 mm thick, with one coat of 100% solids chemical free resistant epoxy topcoat.
- .4 Colours and finishes from manufacturer's full colour range; 'MasterTop 1245CLAD' by Master Builders Solutions or 'Sikafloor Morritex Trowel System' by Sika Canada Inc. or *Equivalent*.
- .5 Refer to schedule on *Drawings* for colors and finishes.
- .6 Primer: As recommended by manufacturer.

PART 3 - EXECUTION

PART 1– GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Closeout Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage, and Handling
- .8 1.8 Field Conditions
- .9 1.9 Extended Warranty
- .10 2.1 Performance/Design Requirements
- .11 2.2 Materials
- .12 3.1 Examination
- .13 3.2 Preparation
- .14 3.3 Application - Primers
- .15 3.4 Installation
- .16 3.5 Mechanical and Electrical Items
- .17 3.6 Field Quality Control
- .18 3.7 Patching
- .19 3.8 Adjusting and Cleaning
- .20 3.9 Schedules
- .21 3.10 Schedule - Interior Finishes
- .22 3.11 Schedule - Exterior Finishes
- .23 3.12 Schedule – Colours

1.3 SUMMARY

- .1 Section includes
 - .1 Interior painting.
 - .2 Exterior painting.
- .2 Extent of *Work*
 - .1 Paint and finish "paintable" surfaces for area of the *Work* indicated in the *Contract Documents*.

- .2 The following surfaces are considered "non-paintable" for purposes of this *Contract*. Omit painter's finishes from following items:
 - .1 Material and equipment furnished completely prime and finish painted by manufacturer;
 - .2 Internal surfaces of steel tanks and stacks;
 - .3 Sprayed fire-resistant materials;
 - .4 Exterior concrete including building walls, building floors and pavements, except as otherwise indicated in the Contract Drawings.
 - .5 Stainless steel, weathering steel, copper, bronze, chromium plate, nickel, anodized or lacquered aluminum, and monel metal;
 - .6 Exposed insulation, glass, plastic, brick, stone, resilient floors, treads and bases, tile and hardware;
 - .7 Prefinished metals, unless required to be colour coded.
 - .8 Metallic and mastic insulation finishes;
 - .9 Abrasive material finishes on floors, stair treads, stair nosings and landings;
 - .10 Insulated electric cables;
 - .11 Machined parts of machinery and equipment.
 - .12 Concealed surfaces.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data and list of *Products*:
 - .1 At least 60 *Days* before the work of this Section commences, submit name of paint manufacturer whose *Products* are proposed for use in the *Work* along with a complete list of *Products* intended for use in *Work*, prepared by paint manufacturer. Indicate manufacturer's official certification that *Products* listed thereon are the top quality made by the company unless otherwise indicated in this Section.
 - .2 The list must indicate the name of paint manufacturer, the catalogue number, grade, and quality of the *Products* proposed for use, and be correlated to the schedule furnished by the *Consultant*.
 - .3 The list must be accompanied by manufacturer's *Product* data sheets for each *Product* listed.
 - .4 *Products* delivered to the *Place of the Work* must conform to the reviewed list of *Products*.
- .3 Samples:
 - .1 Submit samples of various finishes for the *Consultant's* approval, at least 30 *Days* before materials are required.
 - .2 Sample surfaces:
 - .1 Use 50 mm (2") concrete block for finishes over concrete or concrete masonry surfaces.
 - .2 Use 3.2 mm (1/8") thick plate steel for finishes over metal surfaces.

- .3 Use 12.7 mm (1/2") thick birch plywood for finishes over wood surfaces.
- .4 Use 12.7 mm (1/2") gypsum board for finishes over gypsum board and other smooth surfaces.
- .3 Where possible identify each sample as to *Project*, finish, formula, colour name, number, sheen name and gloss values, date and name of the *Contractor* and painting *Subcontractor*.
- .4 Resubmit as required until colours and gloss value are approved.
- .4 Colours:
 - .1 Prior to beginning painting work, the *Contractor* will be furnished with paint colour numbers and copies of colour schedule for surfaces to be painted. Colours will be selected by the *Consultant*.
- .5 Master Painters Institute (MPI) Architectural Painting Specification Manual (MPI Manual):
 - .1 Submit 1 copy of MPI Manual – latest edition and maintain at *Site* office for reference.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Maintenance materials
 - .1 *Provide* two sealed containers, each of four litres (one gallon) capacity of each paint *Product* in each colour used in the work for the *Owner's* maintenance use. Containers must be new, clearly labelled with manufacturer's name, type of paint, colour and colour number. Store at the *Place of the Work* where directed by the *Owner*.

1.6 QUALITY ASSURANCE

- .1 Qualifications
 - .1 Installers / applicators / erectors:
 - .1 The *Contractor* shall ensure that applicators have minimum of five years proven satisfactory painting experience of projects of similar size and class subject to the *Consultant's* approval.
- .2 Mock-ups:
 - .1 *Provide* full finished mock-up installation of each paint colour, for indicated surfaces and mock-up size, showing colour and finish selected by the *Consultant*, under lighting conditions matching final area lighting, for acceptance by the *Consultant*. Locate at the *Place of the Work* as part of finished installation if accepted.
 - .1 Concrete block, concrete and gypsum board: 9.3 m² (100 ft²).
 - .2 Hollow metal doors and frames: one door and frame for each finish specified.
 - .3 *Site* painted structural steel.

- .2 Upon completion and approval by the *Consultant*, sample finishes shall serve as a standard for the balance of the work of this Section. Subsequent work carried out and not in the *Consultant's* opinion equal to the standard must be repainted at no cost to the *Owner*.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to the *Place of the Work* in sealed original containers with labels intact and store in space directed by *Consultant*. Keep stored materials covered at all times. The presence of any unauthorized material or containers for such at the *Place of the Work* shall be sufficient cause for rejection of all paint materials at the *Place of the Work* at that time.
- .2 Exercise extreme caution in the storage of materials to prevent fire or that may create fire hazards. Thinners and solvents shall be stored in Canadian Standards Association (CSA) approved metal safety containers in accordance with City of Markham fire and safety regulations.
- .3 In areas of storage, protect floor and wall surfaces from paint drips. Protect floors with sheets or clean plywood or metal pans where mixing is being carried out. *Provide* and maintain fire extinguishers, accessible in storage and mixing areas.
- .4 Leave storage areas clean and free from evidence of occupancy when these are required for intended use.
- .5 Keep waste rags in metal drums containing water and remove from the *Place of the Work* at the end of each *Working Day*.
- .6 *Provide* labels on each container, correlated to the reviewed list of *Products*, with the following information
 - .1 Name of title of *Product*.
 - .2 Manufacturer's stock number.
 - .3 Manufacturer's name.
 - .4 Contents by volume, for major pigment and vehicle constituents.
 - .5 Thinning instructions.
 - .6 Application instructions.

1.8 FIELD CONDITIONS

- .1 Comply with environmental requirements of Master Painting Institute (MPI) Manual.
- .2 Areas shall be clean and dust free before painting is commenced.
- .3 Make thorough examination of the complete the *Contract Documents* to determine intent, extent, materials, types of surfaces, and locations requiring painting and be fully cognizant of requirements.
- .4 Use sufficient clean drop cloths and protective coverings for full protection of floors, furnishings and work not being painted. Protect mechanical, electrical and special equipment and all other components of building which do not require painting from paint spotting and other soiling during painting process. Mask adjoining work adjacent to work being painted or carefully cut in without overlaps. Clean surfaces soiled by spillage of paint and paint spatters. If cleaning operations damage the surface, repair or replace damaged work at no extra cost to the *Owner*.
- .5 Do not paint over dust, rust, scale, grease, moisture, scuffed surfaces or conditions otherwise detrimental to the formation of a durable paint film.

- .6 The *Contractor* shall be responsible for damage to the work of this Section until the building is complete and accepted by the *Consultant*. In cases of damage, surfaces shall be cleaned and repainted, at the *Contractor's* expense, to the *Consultant's* approval.
- .7 Do not paint exterior surfaces at temperatures below 10°C for latex *Products* and below 10°C for solvent based *Products*, nor in rainy conditions or high humidity (maximum relative humidity shall be 85%). Avoid applying paint to surfaces when exposed to direct sunlight. Do not paint interior surfaces at temperatures under 10°C, nor on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation.
- .8 *Provide* ventilation to remove odours, evaporating solvents and moisture.
- .9 Check moisture content of surfaces to be painted using electronic moisture meter approved by paint manufacturer and the *Consultant*, or other approved method directed by the Consultant. Maximum moisture contents shall be in accordance with manufacturer's recommendations and as follows:
 - .1 Concrete and concrete masonry: Maximum 12% to 14% for solvent coatings, and as recommended by manufacturer for water-based coatings.
 - .2 Gypsum board and plaster: Maximum 12% to 14%.
 - .3 Wood: Maximum 15%.

1.9 EXTENDED WARRANTY

- .1 Warrant work of this, in accordance with Section 01 78 36 - Warranties.
- .2 Throughout the warranty period, painting systems shall remain free from failure due to causes including: material failure; surface preparation less than that specified; and paint film thickness less than that specified, or when not specified, less than that coverage recommended by manufacturer.
- .3 Presence of any of following during the warranty period shall constitute failure: visible corrosion; film peeling, blistering, checking, scaling, embrittling or general film disintegration; and poor adhesion as determined by tape "peel-off" test procedures.

PART 2 - PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Except where more stringent requirements are specified, the following reference standard shall govern the work of this Section:
 - .1 Master Painters Institute (MPI) Architectural Painting Specification Manual (MPI Manual), including Identifiers, Evaluation, Systems, Preparation and Approved *Product* List, latest edition, and referenced herein as the MPI Manual, as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- .2 CAN/CGSB 85.100 Painting.
- .3 Materials, preparation and workmanship shall conform to requirements of latest edition of Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local Master Painting Institute (MPI) Accredited Quality Assurance Association having jurisdiction.

2.2 MATERIALS

- .1 Acceptable *Products*:
 - .1 *Products* by ICI Paints, Benjamin Moore Co. Ltd., Sherwin-Williams Co., or Pratt & Lambert Ltd. or *Equivalent* shall be used in the *Work*.
- .2 Paints and coatings materials used within the weatherproofing system shall not exceed the Volatile Organic Compound (VOC) content limits of the following criteria.
 - .1 Interior paints and coatings: in accordance with Green Seal GS-11 VOC limits:
 - .1 Flat coating type: 50 gm/L.
 - .2 Non-flat coating type: 100 gm/L.
 - .2 Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates: Green Seal Standard GC-03, Anti-Corrosive Paints.
 - .3 Clear wood finishes, floor coatings, stains, and shellacs applied to interior elements: South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings.
- .3 Paint and finishing materials shall be highest grade, manufacturer's first line quality (not "*Contractor's*" first line).
- .4 Paint and coating materials for each system shall be *Products* of a single manufacturer.
- .5 *Provide* safe and adequate equipment, scaffolding, ladders, plant, tools, brushes, rollers, clean drop cloths and other items required for the completion of the work.
- .6 Undercoatings and primers shall be made for the purpose of the finishing materials being used.
- .7 Brushes, rollers, and the like shall be the best of their respective kinds, clean and suitable for the work.
- .8 Joint sealants: in accordance with Section 07 92 00 – Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Prior to commencement of work of this Section, thoroughly examine surfaces scheduled to be painted.
- .2 Check surfaces with electric moisture meter and do not proceed if reading is higher than 12-15% or as otherwise required by paint or coating manufacturer.
- .3 Check surfaces to determine if pH of surfaces meet manufacturer's requirements.
- .4 Inspect surfaces to be coated for gouges, marks, nibs, and other defects and properly prepare patching, filling, smoothing or other surface preparation necessary to ensure satisfactory finish.
- .5 Report in writing any condition adversely affecting the work under this Section.
- .6 Proceed with work only when surfaces and conditions are satisfactory. Remove dust, grease, rust, scale and extraneous matter, tool and machine marks and insects from all surfaces which could be detrimental to a satisfactory and acceptable finish.

3.2 PREPARATION

- .1 Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- .2 Prepare existing surfaces to be repainted in accordance with Article 6.2 of CAN/CGSB 85.100-93.
- .3 Clean floors, adjacent surfaces and surfaces to be painted before work is commenced.
- .4 Before commencement of work, remove electric plates, surface hardware, canopies of lighting fixtures, and other escutcheons and appurtenances. Mask adjacent items that are not removable. Replace items removed, when paint is dry and clean them. Use cleaning methods that will not damage finish.
- .5 Use sufficient drop cloths and protective coverings for the full protection of work not to be painted or coated.
- .6 Keep waste rags in covered metal drums containing water and remove from building at end of each *Day*.
- .7 Shut down motors, fans, and mechanical ventilation systems during spray painting. Shut down air intakes in affected areas and ventilate to exterior, when applying noxious smelling or Volatile Organic Compound (VOC) containing paints and coatings.
- .8 Exposed concrete and concrete block walls which are scheduled to be painted or sealed shall not be painted or sealed until the sealant has been applied at control joints and joints with hollow metal frames.
- .9 Materials shall be thoroughly mixed before application and applied without cutting or admixture except as indicated in writing by the manufacturer.
- .10 Metal:
 - .1 Clean unpainted and shop primed metal to *Provide* satisfactory surfaces to receive overcoats and *Provide* permanent adhesion of coatings. Remove rust and scale with emery paper and wire brushes. Prime bare metal, make good shop primed metal where abraded, feather out edges to make touch-up patches inconspicuous. Thoroughly clean metal surfaces including piping and ductwork of oil and grease with mineral spirits.
 - .2 Remove loose paint and scale from shop primed metal work.
- .11 Concrete and Masonry:
 - .1 Thoroughly clean from oil, parting compounds, curing compounds and other incompatible materials from concrete surfaces.
 - .2 Thoroughly clean masonry and concrete surfaces to be painted free of mortar droppings, concrete spotter and extraneous matter.
 - .3 Check concrete and masonry surfaces to be painted for alkalinity with pink litmus paper or other recognized method. Where extreme alkalinity occurs (6.8 - 8.0 range) wash surface with tetra potassium solution where latex base paint is to be used and with zinc sulphate solution where oil base paints are to be used. Rinse with clean water and allow to dry thoroughly prior to application of primer.
- .12 Gypsum Board:

- .1 Ensure that gypsum board joints are smooth and board is clean and free of jointing compound spatter.
- .2 Test surfaces for alkalinity with pink litmus paper or other recognized method.
- .13 Metal Surfaces; Galvanized:
 - .1 Apply cold phosphate surface treatment in accordance with SSPC-PT2-82 to unpassivated zinc-coated metal.
 - .2 For passivated zinc-coated metal ("white rusted"), power wire brush or vigorously hand wire brush to scuff galvanize thoroughly, and solvent clean in accordance with SSPC-SP1-82.
 - .3 Prepare exterior exposed galvanized steel and galvanized steel at wet areas in accordance with SSPC-SP7 – Sweep Blast.
- .14 Woodwork:
 - .1 Sand wipe off dust and grit before prime coat application. Putty nail holes and minimal cracks after primer has dried; sand between primer and top coats with No. 300 sandpaper and remove dust.

3.3 APPLICATION - PRIMERS

- .1 Completely prime surfaces of exterior wood to receive paints or coatings.
- .2 Apply primer coats to steel and galvanized steel surfaces that have and have not received shop coat or primer.
- .3 Finish and back prime wood components prior to their installation.
- .4 When primer sealer is dry, touch up visible suction spots before the next coat is applied and do not proceed with the work until suction spots are sealed.
- .5 Use high-build type primer/sealers at glass mat finished gypsum board substrate.

3.4 INSTALLATION

- .1 Apply to surfaces scheduled to be finished. Apply materials in accordance with manufacturer's printed directions.
- .2 Paint and coating finishes shall be free of defects in materials and workmanship affecting appearance and performance. Defects shall include but not be limited to improper cleaning and preparation of surfaces, entrapped dust and dirt, alligators, blisters, peeling, drips, runs, uneven coverage, misses, poor cutting in, improper use or application of materials.
- .3 Paint shall be applied by means of brushes, except for wall and ceiling surfaces that shall be applied by rollers or spray application. Apply varnish by brush. Apply stain by wiping.
- .4 The *Consultant* shall have the right to prohibit the use of spray painting for such reasons during application as carelessness, poor masking or protective measures, drifting paint fog, disturbance to other trades or failure to obtain a dense even opaque finish.
- .5 Apply coats only when the previous coat is dry/cured, in accordance with manufacturer's printed installation instructions.
- .6 Apply materials evenly, in full coats free from brush and roller marks, sags, runs, crawls, ridges, and other defects. Completed paint or coating shall be uniform in finish, sheen, colour, and texture.

- .7 Areas exhibiting incomplete or unsatisfactory coverage shall have the entire plane painted. Where cutting and patching work has been performed, shall have the entire plane painted. Patching will not be acceptable.
- .8 Permit paint to dry before applying succeeding coats, touch up suction spots and prepare previous coats in accordance with manufacturer's printed instructions. Remove dust of sanding.
- .9 Arrange to have traffic barred from completed areas wherever possible or *Provide* adequate protection to prevent contamination of paints or coatings with foreign substances.
- .10 Tint filler to match wood to receive clear finishes, where filler is required. Work filler well into grain and before it has set wipe excess from surface.
- .11 Prime woodwork designed for painting immediately after woodwork is delivered to *Site*. Prime surfaces of such woodwork, exposed and semi-exposed, before installation. Back-prime woodwork indicated to receive transparent finish with one coat of specified transparent finish reduced 25%.
- .12 Sand semi-gloss, medium and high gloss finishes lightly between coats. Sand and dust between each coat to remove defects visible from distance of 1.5 m (5 ft).
- .13 Reseal cut edges of wood doors and seal unfinished tops and bottoms of wood doors with three coats of polyurethane sealer.
- .14 Finishes and number of coats indicated are the minimum required. Apply further coats until complete uniform coverage is achieved to suit paint *Products* and colours.
- .15 Priming coat shall be colour toned lighter than second coat and the second coat shall be toned lighter than finish coat. Only the finish coat shall match the colour of the accepted samples.
- .16 Paint inside surfaces of light coves white unless otherwise indicated in the *Contract Documents*.
- .17 Grilles and perforated items shall be spray painted. Do not block perforations and apply evenly to present consistent appearance free from defects visible from distance of 1.5 m (5 ft)
- .18 Do not apply paints and coating over fire rating labels.
- .19 Do not apply paints and coatings over identification labels on mechanical and electrical equipment.
- .20 Paint removable and operable items, such as access panels and doors, grilles, and similar items, while the item is removed or open, so as to not create a paint seal at the juncture of the opening or removable item and its fixed frame or substrate.
- .21 Keep sprinkler heads, fire detection equipment, and smoke detection equipment free of paint.
- .22 Repaint existing surfaces and finishes where scheduled, where alterations or renovations have been carried out, and where surfaces have been disturbed by the alterations or renovations. Repaint surfaces entirely between changes of plane.
- .23 Paint both sides and edges of plywood backboards for equipment before installation.

3.5 MECHANICAL AND ELECTRICAL ITEMS

- .1 Finish paint primed mechanical and electrical items with two coats of paint. Include for the following list unless otherwise indicated in the *Contract Documents*:
 - .1 Conduit

- .2 Ductwork
- .3 Hangers
- .4 Stacks
- .5 Vents
- .2 Prime and paint exposed insulated and bare pipes. Prime and paint exposed conduits and electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items. Use heat resistant epoxy paint on pipes and surfaces where operating surface temperature exceeds 65°C.
- .3 Coordinate the painting of pipes, and coverings with mechanical *Subcontractor* applying colour banding, flow arrows and pipe identification after the painting of pipes and coverings.
- .4 Paint work to match adjacent walls and ceilings unless directed otherwise in the Contract Document.
- .5 Paint interior surfaces of air ducts and pipe trenches including heating pipes and elements that are visible through grilles and louvres with one coat of flat metal paint to limit of sight-line. Paint to be black or white as directed by the *Consultant*.
- .6 Gas pipes, whether concealed or exposed, shall be painted in yellow-orange colour, in accordance with Ontario gas utilization code.
- .7 Paint fire protection piping for sprinklers with self priming rust paint, Para Paint colour 1133 Red or *Equivalent* in the following locations:
 - .1 Apparatus bays.
 - .2 Utility room.
 - .3 Generator room.
 - .4 Elsewhere where exposed.
- .8 Paint gas piping with self priming rust paint, yellow colour in the following locations:
 - .1 Apparatus bays.
 - .2 Utility room.
 - .3 Generator room.
 - .4 Elsewhere where exposed.

3.6 FIELD QUALITY CONTROL

- .1 Field quality control shall be in accordance with Section 01 45 00 – Quality Control, as supplemented in this Section.

3.7 PATCHING

- .1 Do retouching to ensure that the work is handed over to the *Owner* in proper condition, free of runs, spatter, finger marks, rust, watermarks, scratches, blemishes or other disfiguration, with full, even coverage.
- .2 After fully painting, retouching and finishing a room or area, notify the *Consultant*. After review and acceptance by the *Consultant*, post sign "Painting Complete - No Admittance Without Permission".

3.8 ADJUSTING AND CLEANING

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

3.9 SCHEDULES

- .1 Finish Schedule:
 - .1 Assume full responsibility for painting and varnishing of all materials of the *Contract* exposed in the finished work which do not already have finished surfaces and that normally require paint or varnish finish. Inspect surfaces over which the work of this Section is dependent for unevenness, cracks, surface defects, moisture, cleanliness, roughness and other irregularities detrimental to the application and performance of the work. Confirm conditions satisfactory before proceeding. Failure in complying with this section or failure to have unsatisfactory conditions corrected before proceeding, shall not relieve the *Contractor* of responsibility for required results.
 - .2 Exposed means visible in complete work including interiors of cupboards and closets, tops of doors, trim, and the like, whether in sight line or not, including behind surface mounted fixtures and heating units.
 - .3 In instances where materials specified are not suitable for particular application or are contrary to manufacturer's recommendations for use on particular surface, immediately bring to attention of the *Consultant* for clarification and instructions.
 - .4 Where finishing formula for surfaces requiring paint is not specified, follow recommendations of MPI Manual as follows:
 - .1 Interior painting: Custom Grade.
 - .2 Exterior painting: Custom Grade.
 - .5 The *Consultant* shall have right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to the *Owner*.
 - .6 Unless otherwise noted or scheduled in the *Contract Documents*, walls shall be painted the same colour within a given area.
 - .7 Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels shall be painted to match adjacent surfaces in terms of colour, texture and sheen, unless otherwise indicated in the *Contract Documents*.
- .2 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI values:

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

G6	Gloss finish	70 to 85	
G7	High-Gloss finish	> 85	

3.10 SCHEDULE - INTERIOR FINISHES

- .1 System references listed are based on MPI Manual and are Custom Grade, Low VOC (Green Seal GS-11), unless otherwise indicated in the *Contract Documents*:

- .1 Formula 1: for concrete block walls, except those noted for Professional Wood Finish (PWF):

- .1 One coat latex block filler.
- .2 Two coats latex semi-gloss.

- .2 Formula 2: for concrete block walls noted to receive PWF gloss finish coat:

- .1 One coat latex block filler.
- .2 Two coats high build epoxy coating.

- .3 Formula 3; for gypsum board walls apply:

- .1 One coat latex primer sealer.
- .2 Two coats latex semi-gloss.

- .4 Formula 4: for gypsum board ceilings apply:

- .1 One coat latex primer sealer.
- .2 Two coats latex semi-gloss.

- .5 Formula 5: for wood to receive paint finish apply:

- .1 One coat stain blocking/adhesion promoting primer (waterborne).
- .2 Two coats latex semi-gloss.

- .6 Formula 6: for primed ferrous metal surfaces apply:

- .1 One coat latex dryfall.
- .2 High traffic surfaces – custom system:
 - .1 One coat high performance primer (waterborne).
 - .2 Two coats latex

- .7 Formula 7: for galvanized and zinc coated metal apply:

- .1 One coat galvanized primer (waterborne).
- .2 Two coats latex
- .3 For ceiling and ductwork areas apply:
 - .1 One coat galvanized primer (waterborne).
 - .2 One coat latex dryfall.

- .8 Formula 8: for woodwork to receive stained finish apply custom system:

- .1 One coat stain.
- .2 Three coats waterborne polyurethane clear.
- .9 Formula 9: for woodwork to receive natural finish apply:
 - .1 Three coats waterborne polyurethane clear.
- .10 Formula 10: for insulation covering apply:
 - .1 One coat latex primer sealer.
 - .2 Two coats latex

3.11 SCHEDULE - EXTERIOR FINISHES

- .1 System references listed are based on MPI Manual and are Custom Grade, unless otherwise indicated in the *Contract Documents*:
 - .1 Formula 11 (Alkyd): for pavement markings (parking lines and symbols) on asphalt concrete pavement:
 - .1 Alkyd traffic paint, number of coats according to manufacturer's recommendations.
 - .2 Formula 12 (Alkyd): for shop primed ferrous exterior metal surfaces noted for paint, apply:
 - .1 Touch-up with shop primer as provided by fabricator.
 - .2 One coat oil alkyd metal primer.
 - .3 Two coats exterior alkyd enamel.
 - .3 Formula 13 (Alkyd): for galvanized and zinc coated exterior metal surfaces noted for paint:
 - .1 One coat cementitious primer.
 - .2 Two coats exterior alkyd enamel.

3.12 SCHEDULE – COLOURS

- .1 Refer to the *Drawings* for painting color and location.
- .2 All exposed exterior and interior Steel shall be painted. The *Contractor* shall confirm color with the *Consultant*.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Closeout Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage, and Handling
- .8 1.8 Extended Warranty
- .9 2.1 Design/Performance Requirements
- .10 2.2 Tackboards
- .11 2.3 Marker Boards (Whiteboards)
- .12 2.4 Trim Components
- .13 2.5 Fastenings
- .14 3.1 Examination
- .15 3.2 Installation - Tackboards
- .16 3.3 Installation –Marker Boards
- .17 3.4 Installation – Trim Components
- .18 3.5 Installation Tolerances
- .19 3.6 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section Includes
 - .1 Tackboards.
 - .2 Marker boards (whiteboards).
 - .3 Related trim, adhesives, and fastenings.

1.4 SUBMITTALS

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

- .1 Show proposed system of anchorage and materials being supplied on *Shop Drawings* submitted to the *Consultant* for review.
- .2 Show dimensional layouts, hardware items, anchorage devices, dimensions, description of materials and finishes, and all other pertinent information.
- .4 Samples:
 - .1 Submit 305 mm x 305 mm (12" x 12") samples of each *Product* specified, diagonally cut to show cross section through assembly, complete with accessories and trim.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 - Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors:
 - .1 The *Contractor* shall ensure that the erection of materials is carried out by competent workers supervised by a foreperson with at least 10 years' experience in this specialized field and approved in writing by manufacturer for installation of their *Product*.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Section 01 78 36 – Warranties for a period of 10 years from the date of Substantial Performance.

PART 2 - PRODUCTS

2.1 DESIGN/PERFORMANCE REQUIREMENTS

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

2.2 TACKBOARDS

- .1 Krommenie cork tackboard: 12.7 mm (1/2") factory prelaminated consisting of 6 mm (1/4") thick Forbo 'Bulletin Board' linoleum cork laminated to 6 mm (1/4") particle board substrate under mechanical pressure in maximum panel sizes of 1219 mm x 2438 mm (4'-0" x 8'-0"). Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.
 - .1 Colour of tackboard to be selected by the *Consultant* from manufacturer's standard colour range.

- .2 Acceptable manufacturers:
 - .1 Architectural School Products (a.s.p.).
 - .2 Delta Products Ltd.
 - .3 Or *Equivalent*.

2.3 MARKER BOARDS (WHITEBOARDS)

- .1 Porcelain enamel board with porcelain enamel writing surface on 0.8 mm (.03") (22 gauge) high quality enameling steel base, 11.1 mm (0.44") impregnated fibreboard core and 0.4 mm (0.02") (28 gauge) stretcher levelled zinc coated back sheet. Writing surface and back sheet laminated in one piece under mechanical or hydraulic pressure to core.
 - .1 White colour writing surface, designed for long lasting heavy duty marker writing surface, free of permanent marker staining.
 - .2 Joints shall be absolutely flush and level, plumb true with edges finished square and fitted as closely as possible. Concealed mechanical joining system: integral, slotted, Polyvinyl Chloride (PVC) insert laminated into ends of panels and 25 mm (1") wide, 2 mm (0.08") thick, galvanized steel spline.
 - .3 Particle board backing to CAN3-0188.1-M78, 6 mm (1/4") thick, with sanded faces.
 - .4 Porcelain writing surface: 0.076 mm (0.003") thick porcelain enamel to Porcelain Enamel Institute Standards PEI 104. Gloss factor: 6-8 as measured by 45° glossmeter.
 - .5 Aluminum trim: in accordance with Trim Components paragraph below.
 - .6 Acceptable manufacturers:
 - .1 Architectural School Products (a.s.p.).
 - .2 Delta Products Ltd.
 - .3 Global School Products Inc.
 - .4 Or *Equivalent*.
 - .7 Magnetic Markerboard: Skyline design 'Vitracolor Magnetic Markerglass' or equivalent.
 - .8 Substitutions: In accordance with Section 01 25 00 – Product Substitution Procedures.
 - .9 Dimensions: Refer to the *Drawings*.
 - .10 Options:
 - .1 Use screws of galvanized steel.

2.4 TRIM COMPONENTS

- .1 Extruded aluminum components, AA6063 T5.
- .2 Tackboards:
 - .1 Aluminum trim and accessories:
 - .1 Perimeter: a.s.p. No. 505. or *Equivalent*.
- .3 Marker boards:

- .1 Acceptable Products:
 - .1 Perimeter: a.s.p. No. 505.
 - .2 Chalktray: a.s.p. No. 521.
 - .3 Or *Equivalent*.

2.5 FASTENINGS

- .1 Reinforcing anchor plates to be galvanized steel plates conforming to CSA G4-09(2014).
- .2 Use screws, bolts of galvanized steel or aluminum.
- .3 Ferrous metal not specified must be plated or baked enamel and treated with primer conforming to CAN/CGSB 1.140-M91.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Prior to commencement of erection by the installing *Subcontractor*, the *Contractor* shall ensure that the installing *Subcontractor* checks surfaces for irregularities, trueness and rigidity and projections and defects and immediately report any in writing to the *Contractor*.
- .2 Commencing installation implies acceptance of surface conditions.

3.2 INSTALLATION - TACKBOARDS

- .1 Secured from behind and mounted in accordance with manufacturer's written instructions to the satisfaction of the *Consultant*.
- .2 *Install* secure, plumb and square.
- .3 Secure wall brackets to blocking in stud walls, or with zinc plated metal expansion type anchors at masonry back-up.
- .4 Locate seams as directed by the *Consultant*.

3.3 INSTALLATION –MARKER BOARDS

- .1 *Install* in accordance with manufacturer's written installation instructions.
- .2 Secure wall brackets to blocking in stud walls, or with zinc plated metal expansion type anchors at masonry back-up.
- .3 Join panels together by use of 14 gauge x 25.4 mm (1") wide steel spline and extruded polyvinyl slotted insert for flush butt joints, with a hairline appearance.
- .4 Locate seams as directed by the *Consultant*.

3.4 INSTALLATION – TRIM COMPONENTS

- .1 *Install* in accordance with manufacturer's written installation instructions.
- .2 Attach aluminum trim, where applicable, in such a manner that fastenings shall be concealed. Fastening shall be accomplished by the use of #10 x 25.4 mm (1") steel wood screws with rawl plugs, attached to walls.

- .3 Leave trim and surfaces clean and free of stains or marks and completely cover finished surfaces with "Plioform" or equivalent immediately after installation and remove only at time of final inspection.

3.5 INSTALLATION TOLERANCES

- .1 *Install* plumb, level, tight and secured. Comply with the following maximum tolerances:
 - .1 Plumb and level: 3 mm (1/8").
 - .2 Variation from indicated position in the Contract Drawings: plus/minus 3 mm (1/8").

3.6 ADJUSTING AND CLEANING

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 References
- .4 1.4 Shop Drawings
- .5 1.5 Closeout Submittals
- .6 2.1 Description
- .7 2.2 Materials
- .8 2.3 Finishes
- .9 3.1 Installation
- .10 3.2 Protection

1.3 REFERENCES

- .1 ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-16a: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A307-14e1: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- .4 ASTM A563M-07(2013): Standard Specification for Carbon and Alloy Steel Nuts (Metric).
- .5 ASTM A1008/A1008M-16: 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.
- .6 ASTM B456-11e1: Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .7 ASTM F436M-11: Standard Specification for Hardened Steel Washers.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings as specified in Section 01 33 00.
- .2 Shop Drawings: Project-specific drawings, illustrating sign design and layout, materials, sizes, thicknesses, methods of attachment, and special details.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals as specified in Section 01 78 00.

- .2 Maintenance Data: Manufacturer's standard installation and maintenance instructions, sufficient quantity for inclusion in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- .1 Traffic and Emergency Signage: Sheet steel, conforming to local municipality standards; reflective baked enamel finish; sufficient quantity to conform to the requirements of the Authorities Having Jurisdiction; styles and designs as indicated on Drawings.

2.2 MATERIALS

- .1 Sheet Steel: Cold-rolled steel sheet to ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; galvanized.
- .2 Bolts: Carbon and alloy steel, to ASTM A307, Grade A; hot dipped galvanized.
- .3 Nuts: Carbon and alloy steel, to ASTM A563M, Grade A, Hex Style; hot dipped galvanized.
- .4 Washers: Hardened steel washers, to ASTM F436M, Type 1 for interior applications, Type 3 for exterior applications; circular, beveled and clipped types as required.
- .5 Sign Posts: Galvanized steel, square-shaped stakes; complete with regularly spaced drilled holes for attachment of signage; suitable length to accommodate buried depth of not less than 1.0 metre and sign mounting height in accordance with the authority having jurisdiction; eg. Telespar Sign Post by Unistrut Service Company.
- .6 Adhesive: As recommended by sign manufacturer.

2.3 FINISHES

- .1 Chrome/Nickel Plating on Metal Components: To ASTM B456, Type SC 2, Polished finish.
- .2 Galvanized Coating on Steel Components: Hot dipped, zinc alloy coating, to ASTM A123/A123M, Z275 coating designation.
- .3 Galvanized Coating on Steel Hardware: Hot dipped, zinc alloy coating, to ASTM A153/A153M, Class B2.
- .4 Reflective Coating on Metal Components: Clean and degrease metal surface; apply one coat of zinc oxide primer sprayed and baked; two coats of semi-gloss reflective enamel sprayed and baked; symbols and colours as required by authorities having jurisdiction.
- .5 Powder Coating on Metal Components: Electrostatic spray-applied polymer powder coating, minimum 0.05 mm dry film thickness; symbols and colours as required by authorities having jurisdiction.

PART 3- EXECUTION

3.1 INSTALLATION

- .1 Conform to requirements of the authority having jurisdiction.
- .2 Provide routing or mortising as required.
- .3 Bury support stakes minimum 1.0 metre below finished grade.
- .4 Replace Products that are bent, scratched or otherwise damaged.

- .5 Properly install and tighten fasteners to the full required complement.

3.2 PROTECTION

- .1 Refer to Section 01 76 00.
- .2 Protect surfaces with removable protective coverings until Owner occupancy.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Delivery, Storage, and Handling
- .6 2.1 General
- .7 2.2 Corner Guard Protection
- .8 3.1 Installation

1.3 SUMMARY

- .1 Section Includes
 - .1 Corner guards.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples:
 - .1 Submit three samples, 300 mm (12") long or 300 x 300 mm (12 x 12") in size as applicable, for each *Product* in specified finish.
- .3 Shop drawings:
 - .1 Submit *Shop Drawings*, and colour and finish samples for work of this Section in accordance with Section 01 33 00 – Submittal Procedures .
 - .2 Clearly indicate fabrication details, plans, elevations, hardware and installation details.
- .4 Templates:
 - .1 The *Contractor* shall ensure that its *Subcontractors* submit templates for use by installers and fabricators as required for proper location and installation of hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Package or crate, and brace *Products* to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.
- .2 The *Contractor* shall ensure that its *Subcontractors* deliver *Products* to location at the *Place of the Work*.

PART 2- PRODUCTS

2.1 GENERAL

- .1 Incorporate reinforcing, fastenings and anchorage required for building-in of *Products*.
- .2 Heights of corner guards are to be to top of HM door frames.
- .3 Where end walls exposed two gypsum board corners *Provide* custom size wrap around corner guards.

2.2 CORNER GUARD PROTECTION

- .1 Surface mounted, 90 mm x 90 mm (3.5" x 3.5"), 1.3 mm thick (0.05") (16 gauge) stainless steel angle in accordance with ASTM A276-15(2015), Type 304, AISI No. 4 satin finish, radius edge.
 - .1 Acceptable Products: Type 1 - Construction Specialties Acrovyn Model CO-8
 - .2 Acceptable Products: Type 2 - Construction Specialties Acrovyn Model SCO-8
 - .3 Or *Equivalent*

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 *Install* work to meet manufacturer's recommended specifications, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.
- .2 Clean substrates to remove dirt, debris and loose particles prior to installation.
- .3 Fit joints and junction between components tightly and in true planes.
- .4 *Install* units on solid backing as indicated in the Contract Drawings, and erect with materials and components straight, tight and in alignment.
- .5 Corner guards:
 - .1 Corner guard edges shall be smooth.
 - .2 Mechanically fasten corner guards in accordance with guard manufacturer's written instructions.
 - .3 *Install* corner guard shall be tightly fitted without gaps.
 - .4 Corner Guard Height: Full height.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Delivery, Storage, and Handling
- .6 2.1 Accessories
- .7 2.2 Fabrication
- .8 3.1 Installation
- .9 3.2 Barrier Free Installation Heights
- .10 3.3 Installation of Washroom Accessories
- .11 3.4 Installation Tolerances
- .12 3.5 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section Includes
 - .1 Washroom accessories.
 - .2 Janitor room accessories.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 Samples:
 - .1 Submit duplicate samples of each finish specified.
- .4 *Shop Drawings*:
 - .1 Clearly indicate fabrication details, plans, elevations, hardware and installation details.
- .5 Templates:
 - .1 The *Contractor* shall ensure that its *Subcontractors* submit templates for use by installers and fabricators as required for proper location and installation of hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Package or crate, and brace *Products* to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.
- .2 The *Contractor* shall ensure that its *Subcontractors* deliver *Products* to location at the *Place of the Work*

PART 2 - PRODUCTS

2.1 ACCESSORIES

- .1 Incorporate reinforcing, fastenings and anchorage required for building-in of *Products*.
- .2 Specified manufacturer's catalogue references are the minimum acceptable standards for work of this Section. Where two manufacturers or *Products* are specified for a given accessory, select one or the other for installation in the *Work*, but not both.
 - .1 Acceptable *Product* manufacturers: Subject to compliance with Contract requirements, *Provide Products* by one of the following:
 - .1 ASI Watrous Inc.
 - .2 Bobrick Washroom Equipment, Inc.
 - .3 Swish Maintenance Ltd.
 - .4 Uline Canada
 - .5 Frost Products Ltd.
 - .6 Or Equivalent
 - .3 Lettering: for identification of accessories and operation instructions shall be silk screened using international symbols unless otherwise specified in the Contract Documents.
 - .4 Washroom Accessory Schedule; locations as indicated or scheduled in the *Contract Documents*. Exact locations determined by the *Consultant*:
 - .1 Stainless steel hat and coat hook:
 - .1 Shall be Bobrick Washroom Equipment of Canada Ltd. B-6827 Hat and Coat Hook or *Equivalent*.
 - .2 Grab bars:
 - .1 Horizontal: 38mm diameter stainless steel grab bars with concealed mounting and peened gripping surface as manufactured by Bobrick Washroom Equipment of Canada Ltd. or *Equivalent*.
 - .2 L-shaped: 38mm diameter stainless steel grab bars with concealed mounting and peened gripping surface as manufactured by Bobrick Washroom Equipment of Canada Ltd. or *Equivalent*. Grab bars to have 900mm long horizontal and vertical components.
 - .3 130 mm diameter stainless steel grab bars with concealed mounting and peened gripping surface, Model B-5806.99x24 as manufactured by Bobrick Washroom Equipment of Canada Ltd. or *Equivalent*.
 - .4 290 degree grab bar, model B-816722.99 as manufactured by Bobrick Washroom Equipment of Canada Ltd. or *Equivalent*.

All other accessories as specified on drawings.

- .3 Surface-mounted shelves:
 - .1 Surface Mounted Stainless Steel Shelf, model B-295x18, as manufactured by Bobrick Washroom Equipment of Canada Ltd. or *Equivalent*. Refer to the *Drawings* for locations.
- .4 Soap Dispenser: Swish Maintenance Ltd - GOJO FMX12 Foam Dispenser Grey 1250ml or *Equivalent*.
- .5 Towel Dispenser and Waste Receptacle: Bobrick Semi-Recessed Convertible Paper Towel Dispenser and Waste Receptacle, B-3942 or *Equivalent*.
- .6 Toilet Tissue Dispenser: Swish Maintenance Ltd Wagon Wheel 4 Roll Toilet Tissue Dispenser – 884 or *Equivalent*.
- .7 Recessed Soap Holder:
 - .1 Bobrick Washroom Equipment of Canada Ltd. B-4380 Recessed Heavy-Duty Soap Dish or *Equivalent*.
- .8 Recessed Shampoo Holder:
 - .1 Zitta Brushed Stainless Steel Niche 12" x 16" or *Equivalent*.
- .9 Folding shower seat:
 - .1 Bobrick Washroom Equipment of Canada Ltd. B-5191 Folding Shower Seat or *Equivalent*.
- .10 Folding Bench:
 - .1 Bobrick Washroom Equipment of Canada Ltd. B-5181 Reversible Folding Shower seat or *Equivalent*.
- .11 Shower rod and curtain:
 - .1 American Standard 1204-C Rod & 1200-V Curtain or *Equivalent*.

2.2 FABRICATION

- .1 Fabricate *Products* with materials and component sizes, metal gauges, hardware, reinforcing, anchors, and fastenings of adequate strength to ensure that washroom accessories will remain free of warping, buckling, opening of joints and seams, and distortion within limits of intended use.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 *Supply* manufacturer's handling instructions, anchorage information, roughing-in dimensions, templates and service requirements for installation of the work of this Section, and assist or supervise, or both, the setting of anchorage devices and construction of other work incorporated with *Products* specified in this Section in order that they function as intended.
- .2 *Install* work to meet manufacturers' recommended specifications, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.
- .3 Include reinforcing, anchorage and mounting devices required for the installation of each *Product*.

- .4 Fit joints and junction between components tightly and in true planes, conceal and weld joints where possible.

3.2 BARRIER FREE INSTALLATION HEIGHTS

- .1 Install accessories to permit operable parts and controls to be accessed at 1100 mm (43") maximum above finished floor, unless otherwise indicated in the Contract Documents.

3.3 INSTALLATION OF WASHROOM ACCESSORIES

- .1 *Install* and secure fixtures rigidly in place using expansion shields in solid masonry or concrete, toggle bolts in hollow masonry or sheet metal screws at metal studs.
- .2 Insulate surfaces to prevent electrolytic action due to contact with dissimilar metals, or concrete or masonry if required. Use bituminous paint or other approved means.
- .3 *Install* in accordance with manufacturer's installation instructions, on built-in concealed solid backing materials. Grab bar installation shall be able to withstand 250 kg downward force.
- .4 Verify locations and mounting heights with the *Consultant* before roughing-in.
- .5 *Install* plumb, level, straight, tight and secured, centred between joints on masonry and tile walls.

3.4 INSTALLATION TOLERANCES

- .1 *Install* plumb, level, tight and secured. Comply with the following maximum tolerances:
 - .1 Plumb and level: 3 mm (1/8").
 - .2 Variation from indicated position: 3 mm (1/8").

3.5 ADJUSTING AND CLEANING

- .1 Verify under work of this Section that installed *Products* function properly, and adjust them accordingly to ensure satisfactory operation. Test mechanisms, hinges, locks, and latches and adjust and lubricate to ensure washroom accessories are in perfect working order.
- .2 Do not remove protective coatings until final cleaning, or earlier if directed by the *Consultant*.
- .3 Refinish damaged or defective work, at the *Contractor's* expense, so that no variation in surface appearance is discernible. Refinish work at the *Place of the Work* only if approved by the *Consultant*.

END OF SECTION

PART 1 – GENERAL**1.1 GENERAL INSTRUCTIONS**

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

1.2 Section Includes

- .1 Part 1 – General
- .2 1.1 General Instructions
- .3 1.2 Section Includes
- .4 1.3 Summary
- .5 1.4 Related Sections
- .6 1.5 Submittals
- .7 1.6 Quality Assurance
- .8 1.7 Delivery, Storage And Handling
- .9 Part 2 Products
- .10 2.1 Manufacturer
- .11 2.2 Turnout Gear Lockers
- .12 2.3 Accessories
- .13 2.4 Finish
- .14 Part 3 Execution
- .15 3.1 Examination
- .16 3.2 Installation

1.3 SUMMARY

- .1 Design, fabrication and installation of wall mounted turnout gear lockers as specified herein.

1.4 RELATED SECTIONS

- .1 Section 10: Metal Lockers
- .2 Sections of Division 16: electrical as applicable.

1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's product data and installation instructions.
- .2 Shop Drawings: Submit manufacturer's shop drawings for each individual run of lockers.
- .3 Samples: Submit manufacturer's standard color samples.
- .4 Owner's Manual: Provide maintenance manual at closeout.
- .5 Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- .1 Manufacturer shall have a minimum of five years' experience in the direct manufacture of lockers.

- .2 Installer shall have experience in locker installation.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery: Deliver materials to site in manufacturer's original, unopened containers with labels identifying product and manufacturer's name.
- .2 Storage: Store materials in a clean dry area.
- .3 Handling: Protect materials and finish during installation and handling to prevent damage.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- .1 Mid-Minnesota Wire (GearGrid Product Line), 670 SW 15th Street, Forest Lake, MN 55025. Toll-free 888-643-6694. Phone 651-464-4468. Fax 651-464-4780. Web site www.geargrid.com. Email sales@geargrid.com.

2.2 TURNOUT GEAR LOCKERS

- .1 Model:
 - .1 GEARGRID Wall Mounted Storage System – where indicated on drawings.
 - .2 GEARGRID Tubular Frame Mounted Storage System – where indicated on drawings.
- .2 Locker Sizes:
 - .1 Standard 24" Opening: Overall dimension-79" high x 25.25" wide x 20" deep.
 - .2 Clear Opening Width: 22.75"
- .3 Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.
- .4 Vertical Dividers:
 - .1 Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
 - .2 Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
- .5 E. Back Panel:
 - .1 Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
- .6 Shelves: (1) Top, (1) Bottom. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Top shelf includes a 20 gauge steel bracket to accept a 2" x 16" name placard.
- .7 Apparel Hooks: (3) per opening. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed.

2.3 ACCESSORIES

- .1 Horizontal Hang Bar:
 - .1 Tube: 1.25"O.D. x 16 gauge 304 stainless steel tubing.

- .2 Brackets: Attach to side mesh, powder coated.
- .2 Coat Drying Hanger:
 - .1 .25" diameter 304 stainless steel wire cold formed and resistance welded.
 - .2 Black vinyl coating on hook end.

2.4 FINISH

- .1 General: All system components excluding assembly and mounting hardware and stainless steel components are to receive the standard finish.
- .2 Standard Finish: Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable TGIC powder coating.
- .3 Color: Red Baron

Part 3 – EXECUTION

3.1 EXAMINATION

- .1 Examine areas to receive lockers. Notify architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

- .1 Install lockers in accordance with manufacturer's instructions.
- .2 Use manufacturer's hardware for assembly.
- .3 Anchor to mounting surface with proper hardware.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 2.1 Materials
- .6 3.1 Installation
- .7 3.2 Installation Tolerances

1.3 SUMMARY

- .1 Section Includes
 - .1 Prefinished metal lockers.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 *Shop Drawings*:
 - .1 Indicate thicknesses of metal, fabricating methods, assembled banks of lockers, bases, trim, numbering, filler panels, end panels and sloped tops.
- .4 Samples:
 - .1 Submit sample of colour and finish on actual base metal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Lockers: in accordance with CAN/CGSB 44.40-2001 AMEND.
 - .1 Type: Single tier full-height locker.
 - .2 Size (width x depth x height): 457 mm wide x 610 mm deep x 1830 mm high.
 - .3 Locking system: suitable for padlocks.
 - .4 Metal materials: in accordance with ASTM A1008/A1008M-15, free of imperfections.
 - .5 Frame: 1.6 mm (0.06") thick (16 gauge).

- .6 Door: minimum 2.0 mm (0.07") 20 gauge outer panel and 24 gauge liner, hollow core or honeycomb.
- .7 Shelves: minimum 0.6 mm (0.02") thick (24 gauge)
- .8 Hooks: three single prong coat hooks.
- .9 Coat Rods for each locker
- .10 Jamb Trim: Refer to detail on the *Drawings*. Top trim and side trim.
- .11 Body: minimum 0.6 mm (0.02") thick (24 gauge).
- .12 Filler and end panels: minimum 2.0 mm (0.07") 20 gauge
- .13 Base: manufacturer standard base.
- .14 Number plates shall be inset into the chrome-plated door pull and numbered sequentially, in two sets each starting at "1" for each locker Type as required by the *Consultant*.
- .15 Locker finish; exposed and semi-exposed surfaces: baked on polymer powder or alkyd enamel, custom colour to later selection by the *Consultant*.
- .16 Acceptable manufacturers/*Products*:
 - .1 General Storage Systems Ltd.: 'Decor Tri-Lok'.
 - .2 Hadrian Manufacturing Inc.: 'Emperor Lockers'.
 - .3 Shanahan's Manufacturing: 'Deluxe Lockers'.
 - .4 Or *Equivalent*.

PART 3- EXECUTION

3.1 INSTALLATION

- .1 Assemble and *Install* lockers complete with metal base in accordance with manufacturer's printed installation instructions.
- .2 Securely fasten at least every third locker through to wall studs, masonry or concrete substrate.
- .3 *Install* trim and filler panels where required for continuous appearance and where obstructions occur. Specific conditions as indicated in the *Contract Documents*.
- .4 *Install* finished end panels to exposed ends of locker banks.

3.2 INSTALLATION TOLERANCES

- .1 *Install* plumb, level, tight and secured. Comply with the following tolerances:
 - .1 Plumb and level: 3 mm (1/8").
 - .2 Variation from indicated position: plus/minus 3 mm (1/8").

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Administrative Requirements
- .5 1.5 Submittals
- .6 1.6 Closeout Submittals
- .7 2.1 Manufacturers
- .8 2.2 Materials
- .9 2.3 Aluminum Finishes
- .10 2.4 Fabrication
- .11 3.1 Installation

1.3 SUMMARY

- .1 Section Includes
 - .1 Ground-set flagpoles.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination
 - .1 Coordinate with work of other Sections to ensure satisfactory and expeditious completion of the work of this Section.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* and equipment proposed for use in the work of this Section.
- .3 *Shop Drawings*:
 - .1 Indicate dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpoles.
- .4 Samples:
 - .1 Submit duplicate samples of each finish specified in the Contract Documents.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- .1 Ewing Flagpole Co. Inc.
- .2 Or *Equivalent* (substitutions in accordance with Section 01 25 00 – Product Substitution Procedures).

2.2 MATERIALS

- .1 Aluminum: Aluminum Association alloy AA 6063-T6 seamless extruded aluminum tubing.
- .2 Flagpole; cone tapered: seamless, uniform, straight line tapered section above cylindrical butt section.
 - .1 Height above mounting base:
 - .1 12192 mm (40'-0")
 - .2 Flagpole, bases and anchorage devices, complete with flag to resist minimum wind gust velocity of:
 - .1 145 km/h (90 mi/h)
 - .3 Acceptable *Product*:
 - .1 Flagpole; Ewing Flagpoles 'SCA-40NS2' Architectural Series or *Equivalent*.
 - .1 Base: Ewing Flagpoles Co. Inc. 'B5 Fixed' or *Equivalent*.
 - .2 Halyard: Ewing Flagpoles Co. Inc. 'External' System' or *Equivalent*.
 - .2 Substitutions: Refer to Section 01 25 00 – Product Substitution Procedures.
 - .4 Finish: Clear anodized in accordance with AA Designation AA-M12C22A31.
- .3 Finial; ball: ball of 1.6 mm (3/5") minimum thick, gold colour, 150 mm (6"), spun from aluminum with watertight seams and mounted to rod fitted to revolving truck.
- .4 Cleats: 230 mm (9") size, 2 per halyard, cast aluminum finish to match flagpole.
- .5 Halyard; internal: stainless steel gearless winch, mounted inside flagpole shaft, accessible by removable locking access door, self-locking winch, lockable at any point operable with a removable crank handle through access hole in shaft. Stainless steel cabling throughout, routed through shaft interior and wound on winch.
- .6 Swivel snaps: two per halyard; aluminum with neoprene or vinyl covers.
- .7 Cleat box: one per cleat; cast aluminum finish to match flagpole. Furnish hasp for padlock, hinged cover, and tamperproof screws. Include lockable cleat box.

- .8 Base cover: spun aluminum base cover, finish to match flagpole.
- .9 Lightning protection:
 - .1 Copper-plated steel with copper wire bolted to flagpole with stainless steel bolt and galvanized steel washer to insulate cable lug from flagpole.
 - .2 Steel ground spike welded to baseplate is an acceptable alternative.

2.3 ALUMINUM FINISHES

- .1 Finish exposed surfaces of aluminum components:
 - .1 Clear anodized in accordance with AA Designation AA-M12C22A31.

2.4 FABRICATION

- .1 *Supply* flagpole as complete unit including mounting brackets anchorage and fittings.
- .2 Fabricate mountings of same metal as flagpoles where exposed and of galvanized steel where concealed.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Submit manufacturer's information and templates required for installation of work of this Section, and assist or supervise, or both, the setting of anchorage devices, and construction of other work incorporated with *Products* specified in this Section in order that they function and perform as intended.
- .2 *Install* flagpoles, mounting brackets and fittings to reviewed *Shop Drawings* and manufacturer's written instructions.
- .3 Check and adjust installed fittings for smooth operation of halyards.
- .4 *Provide* ground stakes, for positive lightning ground for each ground set flagpole installation.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Closeout Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Delivery, Storage, and Handling
- .8 1.8 Extended Warranty
- .9 2.1 Acceptable Manufacturers
- .10 2.2 Hardware – Manual Controlled Shades
- .11 2.3 Assembly
- .12 2.4 Shade Mounting System
- .13 2.5 Aluminum Finish
- .14 2.6 Shade Fabric Types
- .15 2.7 Fabrication
- .16 3.1 Installation
- .17 3.2 Adjusting and Cleaning
- .18 3.3 Closeout Activities

1.3 SUMMARY

- .1 This Section includes:
 - .1 Roller window sunshades at interior locations.
 - .2 Roller window room darkening (black-out) shades at interior locations.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
 - .2 Submit manufacturers' installation instructions.
- .3 Shop drawings:
 - .1 Submit *Shop Drawings* or fully dimensioned catalogue cuts.

- .2 Window treatment schedule: Use same designations indicated on the *Contract Documents*.
- .3 Clearly indicate general construction, configurations, jointing methods and locations, fastening methods, handing of controls, required blocking locations, banding (tandem shades), and installation details.
- .4 Samples:
 - .1 Submit samples of each material and finish colour selected and each accessory.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacturers:
 - .1 The *Contractor* shall select a company specializing in manufacturing the *Products* specified in this Section, with a minimum of 10 years' experience.
 - .2 Installers / applicators / erectors:
 - .1 The work of this Section shall be by forces in the direct employ or under control of the system manufacturer, skilled, trained, and experienced in work of similar scope and complexity.
- .2 Mock-ups:
 - .1 Erect one full size mock-up each roller shade type at the *Place of the Work* for review. Completed and accepted mock-up shall act as the standard to which balance of the work of this Section will be judged.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Section 01 78 36 – Warranties for a period of two years from the date of Substantial Performance.

PART 2- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- .1 Subject to compliance with requirements, *Provide Products* by one of the following manufacturers:

- .1 MechoShade Systems, Inc.
- .2 Solarfective Products Ltd.
- .3 SunProject Inc.
- .4 Sun Glow
- .5 Or *Equivalent* (substitutions in accordance with Section 01 25 00 – Product Substitution Procedures)

2.2 HARDWARE – MANUAL CONTROLLED SHADES

- .1 Chain operated, with infinite positioning. Left or right hand operation and banding as applicable to suit *Place of the Work* condition.
 - .1 Drive assembly:
 - .1 Must allow finger tip control and include a built in shock absorber system to prevent chain breakage under normal operating conditions;
 - .2 Factory set for the size and travel of the shades;
 - .3 Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.
 - .4 Drive Chain: No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have passed a 40 kg (90 lb) load test. Chain may be positioned at either, or both, ends of the shade without disassembly of the shade unit.
 - .5 *Provide* counter balancing mechanism designed to offset the weight of the shade and give fingertip control.
 - .2 Control shades and room darkening shades independently.

2.3 ASSEMBLY

- .1 *Provide* fully factory assembled shade unit consisting of two shade brackets, shade tube, extruded aluminum fascia, hembar and fabric as specified.
- .2 Fabric shall hang straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.
- .3 Factory modify housings where necessary to bypass columns.
- .4 End brackets: a two piece molded ABS construction with nylon drive sprocket. Bracket colour shall coordinate with the fascia colour.
- .5 Shade tube: Minimum 1.52 mm (0.060") thick extruded aluminum with three equally spaced continuous stiffening fins, non-sag design, maximum deflection under full load of fabric L/700.
- .6 Fascia: Minimum 1.5 mm (1/6") thick extruded aluminum.
- .7 Hembar: Extruded aluminum with matching plastic end finials.
- .8 Mounting: Removal of shade system shall not require the disassembly of the shade unit.
- .9 Room darkening shade features: 13 mm (1/2") pile mounted in prefinished 38 mm x 28 mm (1-1/2" x 1-1/8") extruded aluminum side and bottom channels finished to match mullions. Include Dynamic hembar to allow for variance in window sill level.

2.4 SHADE MOUNTING SYSTEM

- .1 Extruded aluminum bracket designed to accept preassembled shade system.
 - .1 Brackets to be used to facilitate the alignment with shade opening.
- .2 Modular construction: Shades must be removable as a complete modular unit without any component disassembly required.

2.5 ALUMINUM FINISH

- .1 Exposed aluminum: Clear anodized AA-M12C22A31.
- .2 Unexposed aluminum: mill finish.

2.6 SHADE FABRIC TYPES

- .1 Sun control fabric; dimensionally stable shade fabric:
 - .1 Acceptable *Products*; 3% open area:
 - .1 Solarfective 'Solarblock 300 Series' or *Equivalent*.
 - .2 Colour: as selected by the *Consultant* from the manufacturer's full range.
- .2 Room darkening (black-out) fabric; dimensionally stable fabrics:
 - .1 Acceptable *Products*:
 - .1 Solarfective Products Limited 'SolarStop Blackout Fabric' or *Equivalent*.
 - .2 Colour: as selected by the *Consultant* from the manufacturer's full range.
- .3 Performance: Fabric shall hang flat, without buckling or distortion. Edge, where trimmed, shall hang true and straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.
- .4 Flammability:
 - .1 Certified by an independent Laboratory to pass CAN/ULC S109-03 Large Flame Test.

2.7 FABRICATION

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

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 *Install* shade systems in plumb, squared, adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane. Fabric shall not travel more than 3 mm (1/8") in either direction within channels after installation.
- .2 Fabric shall be pre-measured and manufactured off-*Site*.

- .3 Shades shall be snapped into place without screws or visible fasteners.
- .4 Incorporate reinforcing, fastening and anchorage required for installation of shades.
- .5 Securely attach installation fittings to their mounting surfaces with stainless steel or hardened aluminum screws of proper length and type, and durable anchors.
- .6 *Install* shade roller true and level, and with cloth to hang flat without buckling or distortion.
- .7 Room darkening shades (black-out) to be installed to eliminate passage of light from exterior.

3.2 ADJUSTING AND CLEANING

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

3.3 CLOSEOUT ACTIVITIES

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

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Definition
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 1.6 Delivery, Storage, and Handling
- .7 1.7 Project Conditions
- .8 1.8 Warranty
- .9 1.9 Maintenance
- .10 2.1 Manufacturers
- .11 2.2 Solid Surface Material
- .12 2.3 Accessories
- .13 3.1 Examination
- .14 3.2 Installation
- .15 3.3 Repair
- .16 3.4 Cleaning and Protection

1.3 DEFINITION

- .1 Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.4 SUBMITTALS

- .1 Submit under provisions of Section 01 3000 - Submittals.
- .2 Product Data:
 - .1 Submit product data for each specified product. Include manufacturer's technical data sheets and published instruction instructions.
 - .2 Submit Material Safety Data Sheets (MSDS) for adhesives and sealants.
- .3 Shop Drawings:
 - .1 Submit fully dimensioned shop drawings showing countertop and window sill layouts, joinery, terminating conditions, substrate construction, cutouts and holes. Show plumbing installation provisions. Include elevations, section details, and large scale details.
- .4 Samples:
 - .1 Submit selection and verification samples for each color, pattern, and finish required.

.5 Quality Assurance Submittals:

- .1 Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.
- .2 Warranty: Specimen copy of specified warranty.

.6 Maintenance Data:

- .1 Submit manufacturer's published maintenance manual with closeout submittals.

1.5 QUALITY ASSURANCE

.1 Qualifications:

- .1 Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

.2 Fabricator / installer qualifications:

- .1 Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

.3 Applicable standards:

- .1 Standards of the following, as referenced herein:

- .1 American National Standards Institute (ANSI)
- .2 American Society for Testing and Materials (ASTM)
- .3 National Electrical Manufacturers Association (NEMA)
- .4 NSF International

.2 Fire test response characteristics:

- .1 Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - .1 Flame Spread Index: 25 or less.
 - .2 Smoke Developed Index: 450 or less.

.4 Coordination drawings:

- .1 Shall be prepared indicating:

- .1 Plumbing work.
- .2 Electrical work.
- .3 Miscellaneous steel for the general work.
- .4 Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.

.2 Content:

- .1 Project-specific information, drawn accurately to scale.

- .2 Do not base coordination drawings on reproductions of the contract documents or standard printed data.
- .3 Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
- .4 Provide alternate sketches to designer for resolution of such conflicts.
 - .1 Minor dimension changes and difficult installations will not be considered changes to the contract.
- .5 Drawings shall:
 - .1 Be produced in 1/2-inch scale for all fabricated items.
- .6 Drawings must be complete and submitted to the Consultant within 60 days after award of contract for record only.
 - .1 Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.
- .7 Job mock-up:
 - .1 Prior to fabrication of architectural millwork, erect sample unit to further verify selections made under sample submittals and to demonstrate the quality of materials and execution.
 - .2 Build mock-up to comply with the contract documents and install in a location as directed by the Design-Builder
 - .3 Notify the architect two weeks in advance of the date of when the mock-up will be delivered.
 - .4 Should mock-up not be approved, re-fabricate and reinstall until approval is secured.
 - .1 Remove rejected units from project site.
 - .5 After approval, the mock-up may become a part of the project
 - .6 This mock-up, once approved, shall serve as a standard for judging quality of all completed units of work.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver no components to project site until areas are ready for installation.
- .2 Store components indoors prior to installation.
- .3 Handle materials to prevent damage to finished surfaces.
 - .1 Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7 PROJECT CONDITIONS

- .1 Field Measurements:
 - .1 Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings.

- .2 Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
- .2 Adhesive:
 - .1 Acclimatize adhesives to occupancy room temperatures with maximum temperature not to exceed 75 deg F

1.8 WARRANTY

- .1 Provide manufacturer's warranty against defects in materials.
 - .1 Warranty shall provide material and labor to repair or replace defective materials.
 - .2 Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
- .2 Warranty period:
 - .1 Two years from date of substantial completion.

1.9 MAINTENANCE

- .1 Provide maintenance requirements as specified by the manufacturer.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- .1 Acceptable Manufacturer:
 - .1 Caesarstone Quartz Surfacing
 - .2 or *Equivalent*.

2.2 SOLID SURFACE MATERIAL

- .1 Acceptable Product:
 - .1 CaesarStone Quartz Surfacing Classico Collection
 - .2 or *Equivalent*.
- .1 Composition: 93% crushed quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
- .2 Thickness: as indicated in the *Contract Documents*.
- .3 Colour Group: Whites
- .4 Colour: Caesarstone #2141.
- .5 Finish: Polished.
- .6 Edge Profile: Miter
- .7 Flame Spread Value (FSV): Maximum 25.
- .8 Smoke Developed Value (SDV): Maximum 50.
- .9 Performance Characteristics

PROPERTY	TEST STANDARD	RESULTS
Water Absorption	ASTM C97 & EN-14617-1	≤0.05%
Density	ASTM C97 & EN 14617-1	≥2.1 gr/cm ³
Flexural Strength	ASTM C880/C880M-15 EN14617-2	> 35 MPa > 40 MPa
Dimensional Stability	EN 14617-12	Class A
Impact Resistance	EN 14617-9	> 4.9L (J)
Compressive Strength	ASTM C170 EN 14617-15	Dry: 219-299 MPa; Wet: 203-274 MPa 157-243 MPa
Abrasion	ASTM C1243-93 EN 14617-4	Volume of chord: V<130 mm ³ Chord length: <25 mm
Freeze-Thaw Resistance	ASTM C1026	No obvious damage after 20 freeze-thaw cycles
Stain Resistance	ANSI Z 124.6	Pass
Chemical Resistance	ANSI Z 124.6 EN 14617-10	Pass Class C4
Linear Thermal Expansion	ASTM 372 EN 14617-11	<52 x 10 ⁻⁶ per C
Thermal Conductivity	EN 12664	<1 W/(m K)
Thermal Shock	EN 14617-6	No visual defects after 20 cycles %
Boiling Water Resistance	ANSI NEMA LD3-3.5	No effect
High Temperature Resistance	ANSI NEMA LD3-2005	No effect
Surface Burning	ASTM E84	Class A - FSI: 0-25 ; SDI: 0-450
Fire Performance	AS 1530.3:1999	Ignitability Index (0-20): 6-8 Spread of Flame Index (0-10): 0-3 Heat Developed Index (0-10): 2-3 Smoke Developed Index (0-10): 6-7
Fire Classification	EN 13501-1	Wall cladding: B-s1-d0 Flooring and stairs: B-fl-s1

2.3 ACCESSORIES

.1 Mounting Adhesives

- .1 Provide structural-grade silicone, or epoxy adhesives, as recommended by manufacturer for application and per conditions of use.
- .2 Acceptable Silicone Manufacturers
 - .1 Dow Corning®
 - .2 GE Sealants and Adhesives
 - .3 Or equivalent
- .3 Acceptable Epoxy Manufacturers
 - .1 Akemi North America
 - .2 Bonstone Materials Corporation
 - .3 Tenax U.S.A.
 - .4 Or equivalent
- .4 Provide spacers, if required, recommended by adhesive manufacturer

.2 Stone Adhesive

- .1 Provide epoxy, or polyester adhesive, recommended by manufacturer for application and conditions of use.
- .2 Acceptable Manufacturers
 - .1 Akemi North America
 - .2 Bonstone Materials Corporation
 - .3 Tenax U.S.A.
 - .4 or equivalent
- .3 Color: Adhesive that will be visible in finished work should be tinted to match quartz surfacing.
- .3 Joint Sealants
 - .1 Clear silicone sealant, as recommended by manufacturer for application and per conditions of use.
 - .2 Provide anti-bacterial type where required.
 - .3 Acceptable Manufacturers:
 - .1 Dow Corning®
 - .2 GE Sealants and Adhesives
- .4 Solvent: Product recommended by adhesive manufacturer to clean surface of quartz surfacing to assure adhesion of adhesives and sealants.
- .5 Cleaning Agents: Non-abrasive, low pH cleansers.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with manufactures installation guidelines and recommendations.
 - .1 Provide product in the largest pieces available.
 - .2 Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - .1 Exposed joints/seams shall not be allowed.
 - .3 Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
 - .4 Cut and finish component edges with clean, sharp returns.

- .5 Rout radii and contours to template.
- .6 Anchor securely to base cabinets or other supports.
- .7 Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
- .8 Carefully dress joints smooth, remove surface scratches and clean entire surface.
- .9 Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
- .1 Coved backsplashes and applied side splashes:
 - .1 Install applied side splashes using manufacturer's standard color- matched silicone sealant.
 - .2 Adhere applied side splashes to countertops using manufacturer's standard color- matched silicone sealant

3.3 REPAIR

- .1 Repair or replace damaged work which cannot be repaired to Consultants satisfaction.

3.4 CLEANING AND PROTECTION

- .1 Keep components clean during installation.
- .2 Remove adhesives, sealants and other stains.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Closeout Submittals
- .6 1.6 Delivery, Storage, and Handling
- .7 1.7 Extended Warranty
- .8 2.1 Acceptable Manufacturers
- .9 2.2 Foot Grilles
- .10 2.3 Fabrication
- .11 3.1 Preparation
- .12 3.2 Installation
- .13 3.3 Adjusting and Cleaning

1.3 SUMMARY

- .1 Section includes:
 - .1 Entrance floor grilles.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 -Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 Shop Drawings:
 - .1 Layout of floor grilles including grid and frame, direction of traffic, dimensions, fabrication details, splice locations, profiles, hardware, and accessories.
- .4 Samples:
 - .1 Submit duplicate samples of each finish and each insert specified.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:

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

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Package or crate, and brace *Products* to prevent damage during shipment and handling. Label packages and crates, and protect finish surfaces from environmental conditions where required.

1.7 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Section 01 78 36 – Warranties for a period of two years from the date of Substantial Performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- .1 KN Crowder
- .2 Or Equivalent.

2.2 FOOT GRILLES

- .3 Acceptable *Products*: KN Crowder – 2.2 FM-4 Vinyl Floor Mats
- .1 or *Equivalent*.
 - .1 Finish: standard mill finish. Aluminum c/w vinyl inserts. Include Aluminum 6063-T5 Hardware.
 - .2 Substitutions: In accordance with Section 01 25 00 – Product Substitution Procedures.

2.3 FABRICATION

- .1 Fabricate *Products* with materials and component sizes, metal gauges, hardware, reinforcing, anchors, and fastenings of adequate strength to ensure that foot grilles will remain free of warping, buckling, opening of joints and seams, and distortion within limits of intended use.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - .1 Do not proceed until unsatisfactory conditions have been corrected.
- .2 The *Contractor* shall ensure that the manufacturer offers assistance and guidance to *Provide* a template of irregular shaped grid assemblies where applicable to ensure a proper installation.

3.2 INSTALLATION

- .1 *Install* the work of this Section in accordance with the manufacturer's recommendations.
- .2 Mill finish frames in contact with concrete to be primer coated.
- .3 Set grid type at height recommended by manufacturer for most effective cleaning action.
- .4 Coordinate top of grid surfaces with bottom of doors that swing across to *Provide* ample clearance between door and grid.

- .5 *Install* work to meet manufacturer's written specifications and installation instructions, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.
- .6 Include reinforcing, anchorage and mounting devices required for the installation of each *Product*.
- .7 Fit joints and junction between components tightly and in true planes, conceal and weld joints where possible.
- .8 Back paint components where contact is made with building finishes to prevent electrolysis.

3.3 ADJUSTING AND CLEANING

- .1 Verify that installed *Products* function properly and adjust them accordingly to ensure satisfactory operation.
- .2 Refinish damaged or defective work, at the *Contractor's* expense, so that no variation in surface appearance is discernible.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. Related Work

- | | |
|--|------------------|
| 1. Site Grading | Section 31 23 13 |
| 2. Excavation, Trenching and Backfilling | Section 31 23 10 |
| 3. Granular Base | Section 32 11 23 |
| 4. Granular Sub-Base | Section 32 11 19 |
| 5. Asphalt Paving | Section 32 12 16 |

1.3. References

1. ASTM D4791-10, Test Method for Flat or Elongated Particles in Coarse Aggregate.
2. Ontario Provincial Standard Specification 1001.

1.4. Samples

1. Submit samples in accordance with Section 01 33 00.
2. Allow continual sampling by Consultant during production.
3. Provide Consultant with access to source and processed material for sampling.
4. Install sampling facilities at discharge end of production conveyor, to allow Consultant to obtain representative samples of items being produced. Stop conveyor belt when requested by Consultant to permit full cross section sampling.

2. PRODUCTS

2.1. 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.
 1. Greatest dimension to exceed five times least dimension.
3. Fine aggregates satisfying requirements of applicable section to be one, or blend of following.
 1. Natural sand.
 2. Manufactured sand.
 3. Screenings produced in crushing of quarried rock, boulders or gravel.
4. Coarse aggregates satisfying requirements of applicable section to be one of or blend of the following:

1. Crushed rock.
2. Gravel and crushed gravel composed of naturally formed particles of stone.

2.2. Source Quality Control

1. Inform Consultant of proposed source of aggregates and provide access for sampling at least four weeks prior to commencing production.
2. If, in opinion of 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 four 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.

3. EXECUTION

3.1. Preparation

1. Aggregate source preparation
 1. Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Consultant.
 2. Where clearing is required, leave screen of trees between cleared area and roadways as directed.
 3. Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
 4. When excavation is completed, dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
 5. Trim and dress slopes and leave site in neat condition.
2. 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. Use methods and equipment approved by Consultant.
 3. Wash aggregates to meet specifications. Use only approved equipment.
 4. When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
3. Handling
 1. Handle aggregates to avoid segregation, contamination and degradation.
4. Stockpiling
 1. Stockpile aggregates on site in locations as indicated unless directed otherwise by Consultant. Do not stockpile on completed surfaces.

2. Stockpile aggregates in sufficient quantities to meet project schedules.
3. Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support materials and handling equipment.
4. Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.
5. Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
6. Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Consultant within 48 h of rejection.
7. Stockpile materials in uniform layers of thickness as follows:
 1. Max. 1.5 m for coarse aggregate and base course materials.
 2. Max. 1.5 m for fine aggregate and sub-base materials.
 3. Max. 1.5 m for other materials.
8. Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
9. Do not cone piles or spill material over edges of piles.
10. Do not use conveying stackers.
11. During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2. Cleaning

1. Leave aggregate stockpile site in tidy, well drained conditions, free of standing surface water.
2. Leave any unused aggregates in neat stockpiles as directed by Consultant.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Definitions
- .4 1.4 Protection
- .5 1.5 Public Safety
- .6 3.1 Preparation
- .7 3.2 Grubbing
- .8 3.3 Removal and Disposal
- .9 3.4 Finished Surfaces

1.3 DEFINITIONS

- .1 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees and disposing of felled trees and debris.
- .2 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments, to not less than a specified depth below existing ground surface.

1.4 PROTECTION

- .1 Prevent damage to landscaping, buildings, pavements, and root systems of trees which are to remain. Repair any damaged items as directed by Consultant.
- .2 Replace any trees designated to remain, if damaged, as directed by Consultant.

1.5 PUBLIC SAFETY

- .1 Erect barricades to the approval of the Consultant such that all work of this section shall occur totally within areas not accessible to the public.

PART 2 – PRODUCTS

Section not used.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Inspect site and verify with consultant trees designated for removal and trees to remain.
- .2 Locate and protect all utility lines. Preserve in operating condition active utilities traversing site.
- .3 Drawings showing utilities cannot be guaranteed as to accuracy or completeness.
- .4 Notify utility companies and arrange for necessary stake outs and approvals before starting tree removal.
- .5 Ensure that all permits necessary to undertake the work are in place.

3.2 GRUBBING

- .1 Grub out stumps and roots to not less than 500 mm below ground surface.
- .2 Grub out visible rock fragments and boulders, greater than 50 mm in greatest dimension.

3.3 REMOVAL AND DISPOSAL

- .1 Remove felled and grubbed materials off site to the approval of the Consultant.
- .2 Felled timber becomes the property of the Contractor.

3.4 FINISHED SURFACES

- .1 Leave ground surface in condition suitable for stripping of topsoil and other stipulated operations.

END OF SECTION

1. **GENERAL**1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Related Work**

- | | |
|------------------------|------------------|
| 1. Site Grading | Section 31 23 13 |
| 2. Water System | Section 33 11 17 |
| 3. Storm Sewers | Section 33 44 00 |
| 4. Aggregates: General | Section 31 05 17 |

1.3. **Definitions**

1. Common excavation: excavation of materials of whatever nature, including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy hydraulic excavating equipment.
2. Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
3. Waste material: excavated material unsuitable for use in work or surplus to requirements.
4. Borrow material: Sub-soil material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work. This material shall be of residential/agricultural origin and shall meet or exceed the confined fill material criteria as per MOE "Fill Quality Guidelines for Lake Filling in Ontario" of June 1992. Contractor shall provide consultant with one chemical test per source prior to hauling material to the site.
5. Unsuitable materials:
 1. Weak and compressible materials under excavated areas.
 2. Frost susceptible materials under excavated areas.
 3. Frost susceptible materials:
 1. Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1
 2. Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
6. Un-shrinkable 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.

1.4. **Samples**

1. Submit samples of bedding or other granular backfill materials in accordance with Section 01 33 00.
2. Inform Consultant prior to commencing work, of proposed source of fill materials and provide access for sampling.

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 Consultant or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Consultant or authorities having jurisdiction shall clearly mark such locations to prevent disturbance during work.
 3. Confirm locations of buried utilities by careful test excavations.
 4. Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of Consultant before moving or otherwise disturbing utilities or structures.
 5. Record location of maintained, re-routed and abandoned underground lines.

2. **PRODUCTS**

2.1. **Materials**

1. Granular Base: to Section 32 11 23.
2. Granular Sub-Base: to Section 32 11 19.
3. Fill concrete: to Section 03 30 00 and following requirements:
 1. Minimum compressive strength at 28 days: 15 MPa.
 2. Maximum slump at time and point of discharge: 100 mm.
4. Unshrinkable fill: to the following requirements.
 1. Maximum compression strength at 28 days: 0.4 MPa.
 2. Maximum cement content: 25 kg/m³ of concrete mix.
 3. Slump at time and point of discharge: 150 to 200 mm.
 4. Air content: 4 to 6%
5. Sewer pipe embedment shall be mortar sand conforming to OPSS 1004 Granular D extending 150mm or ¼ of the pipe diameter, whichever is greater, around all sides of pipe.
6. Granular Backfill: Imported granular material conforming to a Granular 'B' Type I, as specified in OPSS 1010, or approved reclaimed granular materials free of organics.
7. Borrow material: See Part 1 – General, Definitions.

3. **EXECUTION**

- 3.1. All trenching, backfilling and compacting is to be completed in accordance with OPSS 514.

3.2. **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.

3.3. **Stockpiling**

1. Stockpile fill materials in areas designated by Consultant. Stockpile granular materials in manner to prevent segregation.
2. Protect fill materials from contamination.

3.4. **Dewatering**

1. Keep excavations free of water while work is in progress.
2. Protect open excavations against flooding and damage due to surface run-off.
3. Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.
4. Continuously dewater the excavations to control surface runoff or perched water table seepage for concreting and other work to be carried out in the dry condition.
5. Discharging into a geotextile bag should be placed on a relatively flat surface and at least 30m away from any natural water feature.
6. Submit for Consultant's review details of proposed dewatering methods, such as dikes or well points.

3.5. **Trench Excavation**

1. Excavate to lines, grades, locations, elevations and dimensions as indicated or directed by Consultant.
2. Remove excavated material and other obstructions encountered during excavation. Excavated trench material may be used as fill material on-site provided it is free from deleterious materials,
3. Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.
4. Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
5. Unless otherwise authorized by Consultant in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
6. Do not obstruct flow of surface drainage or natural watercourses.
7. Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
8. Notify Consultant when bottom of trench excavation is reached.
9. Obtain Consultant approval of completed excavation.
10. Remove unsuitable material from trench bottom to extent and depth as directed by Consultant.
11. Correct unauthorized over-excavation as follows:
 1. Fill under bearing surfaces and footings with concrete specified for footings.

2. Fill under other areas with Granular 'B' material specified in Section 32 11 19.
12. Hand trim, make firm and remove loose material and debris from 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 Consultant.

3.6. **Surplus Excavated Material and Removals**

1. The Contractor is to make his own arrangements for the disposal of all excavated materials, removals, grindings and all other debris not suitable for re-use in the construction. If the Contractor enters into an agreement with an individual for the use of land for the disposal of excavated materials or for any other reason, a copy of the said Agreement clearly stating the obligation of all concerned and signed by all parties shall be submitted to the Consultant. The Contractor shall comply with the requirements of all Federal, Provincial and Municipal Laws, Acts, Ordinances, Regulations, Orders-in-Council and By-Laws, which could in any way pertain to the work outlined in the Contract. The items in the Form of Tender include all costs for disposal of unsuitable or excess material off the site and the Contractor shall make the arrangements for the disposal of the materials removed in accordance with MOE Reg. 558.

3.7. **Bedding And Surround Of Underground Services**

1. Place and compact granular material for bedding and surround of underground services as indicated and as specified.
2. Place bedding and surround material in unfrozen condition.

3.8. **Backfilling**

1. Do not proceed with backfilling operations until Consultant has inspected and approved installation.
2. Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
3. Trench backfill is to consist of Granular B Type I as specified in OPSS 1010 or reclaimed granular materials free of organics.
4. Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer to 98% SPMDD.
5. Backfill around installations.
 1. Place bedding and surround material as specified elsewhere.
 2. Do not backfill around or over cast-in-place concrete within 24 hr. after placing of concrete.
 3. Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 0.3 m.
 4. Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 1. Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Consultant or;
 2. If approved by Consultant, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Consultant.
6. Backfill within municipal right of way:

1. Trench backfill for the storm, sanitary and water servicing connections to municipal servicing shall be un-shrinkable fill.

3.9. **Inspection And Testing**

1. Testing of materials and compaction will be carried out by testing laboratory designated by Consultant. Frequency of tests will be determined by Consultant.
2. The Owner will pay costs for inspection and testing.

3.10. **Restoration**

1. Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Consultant. Any disturbed grassed areas are to be restored to original condition or better with 150 mm depth of topsoil, and sod. Damaged concrete or asphalt areas are to be restored to original condition or better. Repaired asphalt areas are to be matched with adjacent asphalt and include a lab joint as per the drawing detail provided.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Description**

1. Provide all labour, materials, tools and equipment necessary for all excavation and backfill to the full extent of work shown on the plans and this specification, including but not limited to the following:
 1. Grading (cutting and filling) to subgrade elevations including compaction and fine grading of existing earth materials to +/- 25 mm of design subgrade elevations (not uniformly high or low) in accordance with OPSS 206.
 2. Proof rolling of subgrade with Geotechnical consultant present
 3. Excavation and disposal of all excess unsuitable materials off site.
 4. Supply and installation of earth borrow material as required to establish design subgrade elevations.

1.3. **Related Work**

- | | |
|--|------------------|
| 1. Excavating, Trenching and Backfilling | Section 31 23 10 |
| 2. Aggregates: General | Section 31 05 17 |

1.4. **Site Conditions**

1. Protection:
 1. Provide protection (i.e. shoring, cribbing, bracing and planking) to ensure no damage occurs to existing facilities and equipment situated on site. In certain areas only hand tools may be used.
 2. Provide adequate protection around bench marks, layout markers, survey markers, and geodetic monuments.
 3. Protect bottom of excavations from freezing.
 4. Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with lean concrete. Keep bottoms of excavations dry at all times.
 5. Direct discharge from pumps, when draining excavations, so that damage to site and adjacent property does not occur.
 6. Do not stockpile excavated material to interfere with site operation or drainage.
 7. Effect approved measures to minimize dust as a result of all grading work and all other construction activities related to this contract.
 8. Protect legal iron bars, bench marks, surface or underground utility lines which are to remain. If damaged, restore to original or better condition unless directed

otherwise.

9. Ensure sufficient quantities of wood sheeting, timbers, steel members and other materials are available at all times in order to support, brace or protect utilities, structure and properties near to or occurring within excavations.
2. The Contractor shall take all the necessary precautions to protect all utilities against damage. The Contractor shall carry out his work in a safe manner with due regard for roadway traffic to the satisfaction of the Consultant, and any authority having jurisdiction.
3. The Contractor shall have full and sole responsibility for the safety of all excavation performed under this Contract until final acceptance of the work.
4. Utility Lines:
 1. Before beginning work, establish location and extent of underground utility lines in area of excavation. Notify Consultant of all existing located services encountered, and do not continue with excavation without the Consultant's instructions. Repair and pay for damages to existing utility lines resulting from the work.
 2. Relocate existing lines in area of excavation which must remain active as indicated on the drawings.
 3. Remove abandoned utility lines, if any, to distance of 2 m from foundations. Cap lines at cut-off points.
 4. Record locations, if any, of maintained, re-routed and abandoned underground utility lines.
 5. Repair and pay for damage to existing underground lines as may result from this work.
5. Examination:
 1. Ensure in examination of the site that all possible factors concerning earthwork are investigated, and that the following are known in particular:
 1. Methods and means available for material handling, disposal, storage, and transportation.
 2. Physical conditions of site, including ground water table and drainage course, extent of removals and grading completed under a previous contract (demolition and site demolition).
 2. Unsatisfactory Soil Conditions:
 2. Any unsatisfactory or questionable soil conditions revealed during excavation shall be reported immediately to the Owner's Consultant and Geotechnical Engineer.
 3. All foundation and sub-structural work shall cease until the condition has been examined and approval to proceed has been issued.
6. Material Unsuitable for Backfill:
 1. The Contractor shall be responsible for all costs associated with the excavation and removal, off site, of all materials unsuitable for backfill or re-use.
7. Water:
 1. Keep excavation free from water at all times. Provide drainage trenches and sumps as necessary and pump water well away from excavation. Do not discharge water onto private property.
8. Inspection and Testing:

1. Testing of materials and compaction will be carried out by testing laboratory designated by the Consultant.

1.5. **Environmental Requirements**

1. Protect and repair exposed excavations where required to prevent adverse effects of rain, freezing weather and other weather conditions on subgrade of subsequent work.
2. Suspend construction operation at times when satisfactory results cannot be obtained on account of rain, snow, freezing weather or other unsatisfactory conditions.
3. Do not carry out filling or backfilling in freezing weather unless authorized by Consultant. Do not use frozen material nor place material where the material in place is already frozen.
4. Dispose of excess or unsuitable earth materials generated from the site grading in accordance with Ontario Reg. 558. The items in the Form of Tender include all costs for disposal of excess or unsuitable material off the site and the Contractor shall make the arrangements for the disposal of the materials removed in accordance with MOE Reg. 558.

2. **PRODUCTS**

2.1. **Materials**

1. Earth Borrow
 1. Earth borrow shall be earth material obtained from outside the project limits that meets the requirements of Ontario Provincial Standard Specification (OPSS) MUNI 212.
2. Backfill
 1. Site or imported material containing no organic or foreign matter, and which the subcontractor can demonstrate is compactable to a density of 98% SPMDD.

2.2. **Stockpiling**

1. Fill Materials
 1. Temporarily Stockpile fill materials in areas designated by Owner. Stockpile granular materials to prevent segregation.
2. Protection
 1. Protect fill materials from contamination and freezing.

3. **EXECUTION**

3.1. **Stripping of Topsoil**

1. Do stripping of topsoil in accordance with this Section and Geotechnical Consultant requirements.
2. Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Consultant.
3. Commence topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses and removed from site.
4. Strip all topsoil. Avoid mixing topsoil with subsoil.
5. Stockpile sufficient topsoil for restoration of all grassed areas impacted by the construction.
6. Remove and dispose of surplus topsoil, off site.
7. All silt fence and erosion control measures to be in place before start of topsoil stripping operation.

3.2. **Excavation/Grading**

1. Grade to subgrade levels (to a tolerance +/- 25 mm but not consistently high or low) allowing for surface treatment as indicated.
2. Do not place material which is frozen nor place material on frozen surfaces.
3. 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.
4. Excavation, placing and compacting of fill materials are to be carried out in accordance with Ontario Provincial Standard Specification (OPSS) MUNI 206.
5. Do not disturb soil within branch spread of trees or shrubs to remain.
6. If any soft areas are detected during the proof rolling process, and with the Consultant's direction, sub-excavate as per Geotechnical Consultant's recommendations. Sub-excavated areas are to be backfilled with suitable native material, or imported approved granular material.

3.3. **Proof Rolling**

1. Proof rolling shall be carried out on completed subgrade prior to installing granular sub-base materials.
2. Proof rolling shall be carried out using a roller with a minimum static weight of 5 tonnes, and shall consist of a minimum of four passes per unit area. Wet areas or deleterious materials identified during proof rolling shall be sub-excavated and be replaced with engineered fill, consisting of Granular B, Type I as per OPSS PROV 1010 or select native material, compacted to 98% SPMDD in maximum 200 mm lifts.

3.4. **Field Quality Control**

1. Inspection and testing of materials and compaction will be carried out by the Geotechnical Consultant engaged by the Owner for this project. Costs of tests will be paid by Owner.
2. Sieve Analysis
 1. Proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.
3. Reinstatement
 1. All disturbed areas must be reinstated to Consultant's and Owner's satisfaction.
 2. Any damage to the existing rail right-of-way, due to the Contractor's operations, shall be made good at the Contractor's expense.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work.

1.2. **Related Work**

1. Aggregates Section 31 05 17

1.3. **References**

1. ASTM D4791-10, Test Method for Flat or Elongated Particles in Coarse Aggregate.
2. Ontario Provincial Standard Specification 1001.

2. **PRODUCTS**

2.1. **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. Geotextile for siltation control fence shall be Class I non-woven geotextile fabric in accordance with OPSS PROV 1860.

2.2. **Source Quality Control**

1. Inform Consultant of proposed source of aggregates and provide access for sampling at least four weeks prior to commencing production.
2. If, in opinion of 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 four 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.

3. **EXECUTION**

3.1. **Installation**

1. Silt Control Fence
 1. Install silt control fence along construction site perimeter including tee bars, geotextile filter fabric, clear stone along the upstream side of the fence in the instance the ground is frozen.
2. Heavy Duty Tree Hoarding
 1. Install tree hoarding extending 1800mm MIN from dripline in accordance with DWG. ULA 110A

3.2. **Maintenance**

1. Maintain silt control fencing and tree hoarding for the duration of the construction and

replace as required until the site is stabilized.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

1.2 SECTION INCLUDES

- 1.1 GENERAL INSTRUCTIONS
- 1.2 SECTION INCLUDES
- 1.3 SUMMARY
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
- 2.1 MATERIALS
- 3.1 GEOTEXTILE FILTER CLOTH MEMBRANE ON SUBGRADE
- 3.2 PROTECTION

1.3 SUMMARY

- .1 Section includes:
 - .1 Geotextiles.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors: *Provide* work of this section, executed by competent installers with minimum 5 years' experience in application of Products, systems and assemblies specified, and with approval and training of *Product* manufacturers.

PART 2- PRODUCTS

2.1 MATERIALS

- .1 Geotextile filter cloth:
 - .1 Non-woven geotextile of polypropylene or polyester fibres, or combination of both.
 - .2 Permeability: 2.0 x 10⁻¹ K (cm/s) in accordance with CAN/CGSB 4.2 No. 11.1- 94(R2013).
 - .3 Grab tensile: 690 N in accordance with CAN/CGSB 148.1, No. 7.3-92.
 - .4 Mullen burst: 1.4 MPa in accordance with CAN/CGSB 4.2 No. 11.1-94(R2013).
 - .5 E.O.S.: 75 to 150 um.
 - .6 Acceptable Products:

- .1 'Terrafix 270R' by Terrafix Geosynthetics Inc.
- .2 'Mirafi P-150' by Mirafi Construction Products.
- .3 'Tytar 3341' by Tytar Geotextiles, or
- .4 Or equivalent.

PART 3- EXECUTION

3.1 GEOTEXTILE FILTER CLOTH MEMBRANE ON SUBGRADE

- .1 Do not cover final prepared subgrade surface until completion of quality control inspection.
- .2 Entire subgrade surface shall be covered with geotextile filter cloth membrane.
- .3 Install filter cloth in accordance with filter cloth manufacturer's written instructions.
- .4 Geotextile filter cloth shall be placed directly on the prepared subgrade and shall be in complete intimate contact with the prepared surface. Bridging of small hollows will not be permitted.
- .5 Place geotextile filter cloth on sloping surfaces in one continuous length.
- .6 Overlap filter cloth joints minimum 300 mm (12").
- .7 Secure and protect filter cloth against displacement.
- .8 After installation, cover with overlying layer within 4 hours of placement.
- .9 Replace damaged or deteriorated geotextile to approval of the *Consultant*.

3.2 PROTECTION

- .1 Do not permit construction equipment on installed geotextiles.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

1.2 SECTION INCLUDES

- 1.1 GENERAL INSTRUCTIONS
- 1.2 SECTION INCLUDES
- 1.3 SUMMARY
- 1.4 QUALITY ASSURANCE
- 2.1 MATERIALS
- 3.1 EXAMINATION
- 3.2 TREE PRUNING
- 3.3 TREE PROTECTION
- 3.4 TREE REPAIR AND REPLACEMENT
- 3.5 FIELD QUALITY CONTROL

1.3 SUMMARY

- .1 Section includes:
 - .1 This section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

1.4 QUALITY ASSURANCE

- .1 Qualifications: An experienced tree service firm, minimum 5 years experience, that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project and present at the Place of the Work during execution of tree protection and trimming.
- .2 Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and other Woody Plant Maintenance—Standard Practices (Pruning)."

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Products and remedial care for protection of the trees and plants as specified are to be as recommended by a qualified arborist, must comply with references above, with approval of the Consultant.
- .2 Provide tree protection barrier alternative where indicated on the drawings and subject to the approval by Urban Forestry Services:
 - .1 Snow fencing to be standard 1220 mm (48") high orange safety fence, and 'T' iron rail stakes (38 mm (1-1/2") x 38 mm (1-1/2") x 5 mm (13/64")) primed with one coat of black zinc rich paint.
- .3 Mulch: Clean, straw mulch from local sources free of weeds and hazardous materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine the Place of the Work before commencement of work and inform Consultant if site conditions will not permit completion of tree and plant protection work as in accordance with the Contract Documents.
- .2 No ground breaking activities or demolition should occur until all tree preservation requirements have been met.
- .3 All Subcontractors, Suppliers, and site personnel shall be informed of the tree and plant protection measures and guidelines prior to their commencing any activities at the Place of the Work.
- .4 The Tree Protection Zone (TPZ) shall be posted with signs.
- .5 Within the Tree Preservation Zone (TPZ) there shall be:
 - .1 No construction;
 - .2 No altering of grade by adding fill, excavating, trenching, scraping, dumping or disturbance of any kind.
 - .3 No storage of construction materials, equipment, soil, construction waste or debris.
 - .4 No disposal of any liquids (i.e.: concrete sleuth, gas, oil, paint).
 - .5 No movement of vehicles, equipment or pedestrians.
 - .6 No parking of vehicles or machinery.
 - .7 No activity of any kind without permission of the arborist
 - .8 Activity of any kind without permission of the arborist

3.2 TREE PRUNING

- .1 Prune trees and plants indicated to remain that are affected by temporary and permanent construction.
- .2 Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- .3 Pruning Standards: Prune trees according to ANSI A300.
 - .1 Type of Pruning: Cleaning, Raising, and Reduction.
- .4 Cut branches with sharp pruning instruments; do not break or chop.
- .5 Chip removed tree branches and dispose of off-site.

3.3 TREE PROTECTION

- .1 Protect trees to be preserved from damage during the Work in accordance with the following specifications and make good any damage at no expense to Owner.
- .2 The location of the tree preservation zone is clearly indicated on the Tree Preservation Plan. Trees to be protected will be confirmed by the Consultant.

- .3 Tree protection shall remain in place until all sitework has been completed, and may not be removed, relocated, or otherwise altered without the written permission of the Consultant.
- .4 The trees to be protected shall be fertilized with a deep root application of an approved fertilizer before construction commences on this project as well as a second fertilization in two years.
- .5 The trees to be protected shall be pruned in accordance with Tree Pruning paragraphs above in this section.
- .6 The arborist shall undertake proper root pruning when and if roots of retained trees are to be exposed, damaged or severed by construction activities. The arborist shall supervise the excavation of soil where roots are to be cut. All roots are to be cut cleanly at the excavation zone and backfilled with an appropriate soil mix. Exposed roots shall be covered with soil or mulch as soon as possible to prevent further damage and desiccation. Root pruning prior to excavation will help prevent unnecessary damage to tree roots.
- .7 In areas where mulch may remain following construction the trees shall have minimum 100 mm (4") of mulch installed over the root system before construction starts, and set back from the trunk by rodent guard. Mulch shall be spread evenly under the canopy to the dripline, to the limits of the protection fence, or as otherwise indicated in the Contract Documents.
- .8 There shall be a source of water provided to ensure that the trees get adequate water during the dry periods. It will be the responsibility of the Contractor to monitor for moisture content in the soil for the duration of the Work.
- .9 The protection zone shall not be breached in any way. There shall be no material stored in the preservation zones, no grade changes and no parking.
- .10 Ensure all trees are protected from compaction of roots or damage to trunk or limbs prior to receipt of permits for removal or remedial care as recommended by arborist.
- .11 Obtain necessary permits, reports, and approvals.
- .12 Proceed with execution of specified work, under direction of the Consultant.
- .13 No rigging cables will be wrapped around or installed in trees. Do not burn waste near trees and do not flush concrete trucks or cement mixing machines over root system.

3.4 TREE REPAIR AND REPLACEMENT

- .1 Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
- .2 Remove and replace trees indicated to remain that die or are damaged during construction operations that Consultant and arborist determine are incapable or restoring to normal growth pattern.
 - .1 Provide new trees of same size and species as those being replaced; plant and maintain as specified by Consultant.
 - .2 Provide new trees of 150 mm (6") calliper size and of a species selected by Consultant when damaged trees more than 150 mm (6") in calliper size, measured 305 mm (12") above grade, are required to be replaced. Plant and maintain new trees as specified by Consultant.
- .3 Aerate surface soil, compacted during construction, 3048 mm (10 ft) beyond drip line and no closer than 914 mm (36") to tree trunk. Drill 50 mm (2") diameter holes a minimum of 305 mm (12") deep at 610 mm (24") on centre. Backfill holes with an equal mix of augured soil and sand.

- .4 General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicative existing tree to be replaced. Comply with ANSI Z60.1-2014; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in lead and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - .1 Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk, crossing trunks; cut-off limbs more than 19 mm (3/4") in diameter; or with stem girdling roots will be rejected.
 - .2 Collected Stock: Do not use plants harvested from the wild, from native stands, from an established planting, or not grown in a nursery unless otherwise indicated.
- .5 Provide trees of sizes, grades, and all sizes complying with ANSI Z60.1-2014 for types and form of trees required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
- .6 Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1-2014. Root flare shall be visible before planting.

3.5 FIELD QUALITY CONTROL

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

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Related Work**

- | | |
|--|------------------|
| 1. Site Grading | Section 31 23 13 |
| 2. Excavation, Trenching and Backfilling | Section 31 23 10 |
| 3. Aggregates: General | Section 31 05 17 |
| 4. Granular Base | Section 32 11 23 |

1.3. **References**

1. ASTM C 117-17, Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.
2. ASTM C 131/C131M-14, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C 136/C136M-14, Method for Sieve Analysis of Fine and Coarse Aggregates.
4. ASTM D 422 (1990), Method for Particle-Size Analysis of Soils.
5. ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft-lbf/ft³ 600 kN-m/m³.
6. CAN/CGSB-81.-88, Sieves Testing, Woven Wire, Inch Series.
7. CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
8. Ontario Provincial Standard Specification 1010.

1.4. **Delivery, Storage and Handling**

1. Refer to Section 32 11 23.

2. **PRODUCTS**

2.1. **Materials**

1. Granular sub-base material: Granular 'B', Type I or Type II, OPSS 1010, Section 31 05 17 and following requirements.
 1. Crushed, pit run or screened stone, gravel or sand consisting of hard durable angular particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 2. Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

	% Passing
<u>Sieve Designation</u>	<u>Type I</u>

150 mm	100
26.5 mm	50-100
4.75 mm	20-100
1.18 mm	10-100
0.300 mm	2-65
0.075 mm	0-8

2. Other Properties as follows.

1. Plasticity Index ASTM D4318-84.0.
2. Crushed particles: at least 100% of particles by mass within each of the following sieve designation ranges to have at least 1 freshly fractured face for Type II. Not applicable for Type I material to be divided into ranges using methods of ASTM C135-84a.
3. Petrographic Number MTO LS609 Maximum 250.

	<u>Passing</u>	<u>Retained on</u>
26.5	4.75 MM	
4. Particles smaller than 0.02 mm AASHTO T88-78 maximum 3%.
5. Soaked CBR AASHTO T193-72 Min 40 when compacted to 100% of AASHTO T180.74 Method D.

Where indicated, **structural soil** is to be installed in lieu of granular sub-base. Structural soil as detailed later in this specification.

3. **EXECUTION**

3.1. **Placing**

1. Compact subgrade to 95% of SPMDD. Excavate all weak and soft spots as required and replace with granular sub-base compacted uniformly to 100% of SPMDD.
2. Place granular sub-base after subgrade is inspected and approved by Consultant.
3. Construct granular sub-base to depth and grade in areas indicated.
4. Ensure no frozen material is placed.
5. Place material only on clean unfrozen surface, free from snow or ice.
6. Place granular sub-base materials using methods which do not lead to segregation or degradation.
7. For spreading and shaping materials, use spreader boxes having adjustable templates or screens which will place material in uniform layers of required thickness.
8. Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
9. Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
10. Remove and replace portion of layer in which material has become segregated during spreading.

3.2. **Compaction**

1. Compaction equipment to be capable of obtaining required material densities.
2. Efficiency of equipment not specified to proved at least as efficient as specified equipment at no extra cost and written approval must be received from Consultant before use.

3. Equipped with device that records hours of actual work, not motor running hours.
4. Compaction in accordance with ASTM D698 and ASTM D1577.
 1. Pavement Sub-base: Compact to density of not less than 100% SPMDD.
 2. Backfill of subgrade weak or soft spots: Compact to density of not less than 98% of SPMDD.
5. Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
6. Apply water as necessary during compaction to obtain specified density.
7. In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.
8. Correct surface irregularities by loosening and adding or removing material unit surface is within specified tolerance.

3.3. **Site Tolerances**

1. Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.4. **Inspection and Testing**

1. Testing of materials and compaction will be carried out by testing laboratory designated by Owner. Frequency of tests will be determined by Consultant.
2. Owner will pay costs for inspection and testing.

3.5. **Protection**

1. Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Consultant.

SAMPLES AND SUBMITTALS

A. At least 30 days prior to ordering materials, the Contractor shall submit to the Engineer's representative samples, certificates, manufacturers literature and certified tests for materials specified below. No materials shall be ordered until the required samples, certificates, manufacturer's literature and test results have been reviewed and approved by the Engineer. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Engineer reserves the right to reject, on or after delivery, any material that does not meet these specifications.

1.02 DELIVERY, STORAGE AND HANDLING

A. Do not deliver or place soil in frozen, wet, or muddy conditions. Material shall be delivered at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698). Do not deliver or place materials in an excessively moist condition (beyond 2 percent above optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698)).

B. Protect soils and mixes from absorbing excess water and form erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Related Work**

- | | |
|--|------------------|
| 1. Site Grading | Section 31 23 13 |
| 2. Excavation, Trenching and Backfilling | Section 31 23 10 |
| 3. Aggregates: General | Section 31 05 17 |
| 4. Granular Sub-base | Section 32 11 19 |

1.3. **References**

1. ASTM C 117-17, Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.
2. ASTM C 131/C131M-14, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C 136/C136M-14, Method for Sieve Analysis of Fine and Coarse Aggregates.
4. ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft-lbf/ft³ 600 kN-m/m³.
5. CAN/CGSB-81.-88, Sieves Testing, Woven Wire, Inch Series.
6. CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
7. Ontario Provincial Standard Specification 1010.

1.4. **Delivery, Storage and Handling**

1. Deliver and stockpile aggregates in accordance with Section 31 05 17 – Aggregates General. Stockpile minimum 50% of total aggregate required prior to commencing operation.
2. Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each.

2. **PRODUCTS**

2.1. **Materials**

1. Granular base material: Granular 'A' Type I or Type II OPSS 1010, Section 31 05 17 and following requirements:

1. Crushed pit-run or screened stone, gravel or sand consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
2. Gradations to be within limits of specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation		% Passing	
26.5	mm		100
19	mm	85 -	100
13.2	mm	65 -	90
9.5	mm	50 -	73
4.75	mm	35 -	55
1.18	mm	15 -	40
0.300	mm	5 -	22
0.150	mm	-	
0.075	mm	2 -	8

3. Plasticity Index ASTM D4318-17e1.
4. Los Angeles Abrasion ASTM C131/C131M-14 Gradation 'A' Max. % loss by weight: 60.
5. Crushed particles: at least 50% of particles by mass within each of following sieve designation ranges to have at least 10 freshly fractured face. Material to be divided into ranges using methods of ASTM C136-84a.

Passing	Retained on
19 mm	26.5 mm
4.75 mm	19 mm

6. Petrographic number MTO LS 69, Maximum 250.
7. Soaked CBR: AASHTO T193-72 when compacted to 100% of AASHTO T180-774 Method D, Min 80 for use under Portland cement and Min 100 for use under asphalt concrete.

3. **EXECUTION**

3.1. **Sequence Of Operation**

1. Place granular base after finished sub-base surface or subgrade is inspected and approved by Consultant.
2. Placing
 1. Construct granular base to depth and grade in areas indicated.
 2. Ensure no frozen material is placed.
 3. Place material only on clean unfrozen surface, free from snow and ice.
 4. Place material using methods which do not lead to segregation or degradation of aggregate.
 5. Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 6. Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

7. Remove and replace that portion of layer in which material becomes segregated during spreading.
3. Compaction Equipment
 1. Compaction equipment to be capable of obtaining required material densities.
 2. Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Consultant before use.
 3. Equipped with device that records hours of actual work, not motor running hours.
4. Compacting in accordance with ASTM D 698 and ASTM D 1557.
 1. Compaction of Pavement Base: Compact to density of not less than 100% SPMDD.
 2. Compaction of Concrete Slab on Grade or Concrete Sidewalks Base: Compact to density of not less than 100% of SPMDD.
 3. Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 4. Apply water as necessary during compacting to obtain specified density.
 5. In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.
 6. Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2. **Site Tolerances**

1. Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3. **Proof Rolling**

1. For proof rolling use roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 915 mm maximum.
2. Consultant may authorize use of other acceptable proof rolling equipment.
3. Proof roll top of base upon completion of fine grading and compaction.
4. Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
5. Where proof rolling reveals defective areas:
 1. Remove base, sub-base and subgrade material to depth and extent directed by Consultant.
 2. Backfill excavated subgrade with sub-base material and compact in accordance with Section 31 23 10.
 3. Replace sub-base material and compact in accordance with Sections 31 23 10 and 32 11 19.
 4. Replace base material and compact in accordance with this Section.

3.4. **Inspection and Testing**

1. Testing of materials and compaction will be carried out under Cash Allowance by testing laboratory designated by Consultant. Frequency of tests will be determined by Consultant.

3.5. **Protection**

1. Maintain finished base in condition conforming to this section until succeeding material is applied or until acceptance by Consultant.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Related Work**

- | | |
|------------------------|------------------|
| 1. Site Grading | Section 31 23 13 |
| 2. Aggregates: General | Section 31 05 17 |
| 3. Granular Base | Section 32 11 23 |
| 4. Granular Sub-Base | Section 32 11 19 |

1.3. **Quality Assurance**

1. Plant requirements: Facilities for production and transportation or asphaltic mixture shall conform to OPSS Form 310.
2. Equipment Requirements: Self-powered mechanical pavers conforming to OPSS Form 310.
3. Rollers conforming to OPSS MUNI Form 310.

1.4. **Inspection**

1. Examine areas to receive the work of this Section and do not proceed until unsatisfactory conditions are corrected.
2. Notify the Consultant at least 24 hours prior to commencing work.
3. Do not commence work until the Consultant has inspected and approved surfaces to receive asphalt paving.

1.5. **Condition of Surfaces**

1. Prior to delivery of mixture, base surface shall be dry and free of all loose and foreign material.

1.6. **Temperature Requirements**

1. Prior to placing asphalt, air temperature at the base surface shall be a minimum of 7° C and rising.
2. Temperature of mixture shall not be less than 118° C immediately after spreading prior to initial rolling.
3. The asphalt cement shall be heated at the mixing plant only to the temperature required for satisfactory mixing and shall not exceed 162° C.

1.7. **Protection**

1. Conduct work without damaging other work. If other work is damaged, it shall be corrected to the approval of the Consultant without cost to the Owner.

2. **PRODUCTS**

2.1. **Materials**

1. Asphalt cement: conform to OPSS Form 1101.
2. Aggregates: conform to OPSS Form 1000 and 310.
3. Emulsified Asphalt: SS-1 emulsion conforming to OPSS Form 1103.

2.2. **Asphalt Mixes**

1. Asphalt Binding Course: HL8 conforming to OPSS Form 310.
2. Asphalt Surface Course: HL3 conforming to OPSS Form 310.

3. **EXECUTION**

3.1. **Preparation**

1. Clean surfaces of all loose and foreign materials.
2. Paint cold contact surfaces with emulsified asphalt.

3.2. **Installation**

1. Place asphalt paving in accordance with OPSS Form 310.
2. Compact asphalt to a minimum of 92% Maximum Theoretical Relative Density (MTRD).
3. Rolling shall continue until all roller marks are eliminated and no further compression is possible.
4. Hand tamp the asphalt with vibrating compactors adjacent to buildings, manhole covers and concrete curbs.
5. At the end of each day's work, or prolonged stoppage of asphalt paving, joints shall be formed by laying the asphalt and rolling it against a horizontal edge board of the proper thickness, placed across the entire width of the pavement.
6. Finished asphalt surfaces shall be straight and true to established levels, free from cracks, undrained areas or depressions exceeding 3 mm as measured with a 3 m straight edge in any direction. Asphalt thickness specified shall be maintained as minimum at any point.
7. Edges shall be neat and straight or properly curved as indicated, without broken, disintegrated or loose edges.
8. Backfill all curbs and pathways when complete in accordance with section 31 23 10

3.3. **Cleaning**

1. Remove asphalt stains from adjacent finished surfaces.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

1.2 SECTION INCLUDES

- 1.1 GENERAL INSTRUCTIONS
- 1.2 SECTION INCLUDES
- 1.3 SUMMARY
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
- 2.1 PERFORMANCE/DESIGN REQUIREMENTS
- 2.2 MATERIALS
- 2.3 CONCRETE MIXES
- 2.4 INSTALLATIONS
- 3.1 EXAMINATION
- 3.2 GRANULAR BASE
- 3.3 FORMS
- 3.4 CONCRETE
- 3.5 EXPANSION AND CONTRACTION JOINTS
- 3.6 FIELD QUALITY CONTROL
- 3.7 ADJUSTING AND CLEANING

1.3 SUMMARY

- .1 Section includes:
 - .1 Concrete *Site* work at exterior locations where not indicated on structural Drawings.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Mix designs:
 - .1 Well in advance of the first supply of concrete to the project submit, using the standard RMCAO form for "Concrete Mix Design Submission Form", project concrete mix designs for review. Include following information:
 - .2 Concrete strength.
 - .3 Exposure class.
 - .4 Water-cement ratio.
 - .5 Maximum aggregate size.
 - .6 Slump range.
 - .7 Plastic air range.

- .8 Describe in detail on the mix design summary and locations where each mix is to be placed in concrete *Site* work.

1.5 QUALITY ASSURANCE

.1 Qualifications:

- .1 Installers / applicators / erectors: execute the work of this section only by a *Subcontractor*, with a minimum of 5 years' experience, who has adequate equipment and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified.

.2 Mock-ups:

- .1 *Provide* 1500 mm x 1500 mm area selected by the *Consultant*, complete with finish and pigment, in each required colour and finish, to act as trial area for acceptance of remainder of work of this section. When acceptable, quality of workmanship of balance of work of this Section shall match or exceed quality of accepted mock-up area.

PART 2 - PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Construct municipal sidewalks in accordance with the requirements of the Authorities Having Jurisdiction.

2.2 MATERIALS

- .1 Cement: to CSA A3000-03, type 10, normal.
- .2 Water and aggregates: to CAN/CSA A23.1/A23.2-09.
- .3 Admixtures: to ASTM C494/C494M-11 for air entraining admixtures.
- .4 Free Draining Granular Fill: OPSS 1010 - April 2004, Granular 'A' with less than 5% passing the 75 um sieve.
- .5 Granular Fill: OPSS 1010 - April 2004, Granular 'B'.
- .6 Joint filler: 12.7 mm (1/2") thick asphalt impregnated fibreboard to ASTM D1751- 04(2013) e1.
- .7 Joint filler: 12.7 mm (1/2") thick sponge rubber to ASTM D1752-04a (2013).
- .8 Lumber: plywood and wood formwork to CAN/CSA A23.1/A23.2-09, free of defects where exposed.
- .9 Form stripping agent: colourless, mineral oil, free of kerosene, with viscosity minimum 70, maximum 110 second Saybolt Universal at 38 °C, flashpoint minimum 150 °C open cup.
- .10 Curing compound: chlorinated rubber type compound to ASTM C309-11, Type 2 (White), Class A.
- .11 Welded wire fabric: to ASTM A1064 / A1064M-14.
- .12 Billeted steel bars: to CAN/CSA G30.18-09.

2.3 CONCRETE MIXES

- .1 Comply with CAN/CSA A23.1/A23.2-09 and as follows; concrete exposed to chlorides shall be defined as concrete subject to pedestrian and vehicular traffic:

- .1 Structurally reinforced concrete exposed to chlorides with or without freezing and thawing conditions:
 - .1 Class of exposure (see Table 1): C-1.
 - .2 Minimum compressive strength (see Table 2): 35 MPa at 28 Days.
 - .3 Maximum water-to-cementing materials ratio (see Table 2): 0.40.
 - .4 Air content category (see Table 4): Category 1.
- .2 Non-structurally reinforced (i.e., plain) concrete exposed to chlorides and freezing and thawing:
 - .1 Class of exposure (see Table 1): C-2.
 - .2 Minimum compressive strength (see Table 2): 32 MPa at 28 Days.
 - .3 Maximum water-to-cementing materials ratio (see Table 2): 0.45.
 - .4 Air content category (see Table 4): Category 1.
- .3 Concrete in an unsaturated condition exposed to freezing and thawing but not to chlorides:
 - .1 Class of exposure (see Table 1): F-2.
 - .2 Minimum compressive strength (see Table 2): 25 MPa at 28 Days.
 - .3 Maximum water-to-cementing materials ratio (see Table 2): 0.55.
 - .4 Air content category (see Table 4): Category 2.
- .2 Accelerating admixtures may be used subject to approval in cold weather. If approved by the *Consultant*, use of admixture shall not relax cold weather placement requirements of CAN/CSA A23.1/A23.2-09. Use of calcium chloride is not permitted.

2.4 INSTALLATIONS

- .1 Cast-in-Place Concrete Curbs: Construct to dimensions and in locations as shown on the Drawings.
- .2 Cast-in-Place Concrete Sidewalks: *Provide* to extents indicated, 150 mm (6") thick, unless otherwise indicated.
- .3 Flag Pole Bases:
 - .1 FPB-1 - to be cast-in-place concrete, as indicated, with exposed formwork to be Classica 610R breakaway form as supplied by ArtFORMS International Inc., tel: 905- 642-3225 or equivalent.
- .4 Lamp Standard Bases:
 - .1 LSB-LOW - to be cast-in-place concrete, as detailed on the Drawings, with exposed formwork to be Newavea 510R – Low, as supplied by ArtFORMS International Inc., tel: 905-642-3225 or equivalent.
 - .2 LSB-HIGH - to be cast-in-place concrete, as detailed on the Drawings, with exposed formwork to be Newavea 510R – High, as supplied by ArtFORMS International Inc., tel: 905-642-3225 or equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Ensure that sub-grade of compacted fill conforms to elevations and sections before placing granular base material.

3.2 GRANULAR BASE

- .2 Place and compact fill materials in continuous horizontal layers not exceeding 200 mm (8") loose depth. Use methods to prevent disturbing or damaging buried services, foundation drainage system, waterproofing or dampproofing. Make good any damage.
- .3 Backfilling: Use granular material, either Granular 'B' or selected excavated material from the *Place of the Work* approved by a geotechnical Professional Engineer, to subgrade level. Compact to at least 98% of its SPMDD. Use free draining Granular 'B'; against foundation walls.
- .4 Place Granular 'A' base to minimum 150 mm (6") compacted thickness, unless otherwise indicated.
- .5 Compact granular bases to 98% SPMDD to ASTM D698-12(2014) e1 Standard Proctor Maximum Dry Density (SPMDD).

3.3 FORMS

- .1 Construct wood forms for unsupported concrete edges, to *Provide* straight lines and smooth flowing curved lines as indicated. *Provide* architectural grade formwork and concrete ties in pattern and design as indicated or as approved by the *Consultant*, for exposed concrete work. Apply form stripping agent to surfaces in contact with concrete. Remove forms when concrete fully cured.

3.4 CONCRETE

- .1 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .2 Screed concrete to required levels, to tolerance of 12.7 mm (1/2") in 3050 mm (10').
- .3 Finish concrete with consistent directional screeded broom finish.
- .4 Tooled crack control joints to walks at 1525 mm (5'0") centre/centre.
- .5 Apply curing compound to exposed concrete surfaces in accordance with manufacturer's installation instructions.

3.5 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals as indicated on the *Site* plan and in accordance with Section 03 30 53.
- .2 Install expansion joints, 12.7 mm thick, at a maximum of 5000 mm on centre for sidewalks, 3600 mm on centre maximum for cast-in-place curbs, and 3000 mm on centre in both directions on the exterior concrete slab on grade.
- .3 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .4 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

- .5 Place impregnated asphaltic expansion strips in expansion joints.

3.6 FIELD QUALITY CONTROL

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

3.7 ADJUSTING AND CLEANING

- .1 Clear away excess and waste materials and debris resulting from the work of this Section.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Related Work**

- | | |
|--|------------------|
| 1. Excavating, Trenching and Backfilling | Section 31 23 10 |
| 2. Granular Base | Section 32 11 23 |
| 3. Granular Sub-Base | Section 32 11 19 |
| 4. Asphalt Paving | Section 32 12 16 |

1.3. **References**

1. Canadian Standards Association (CSA)
 1. CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.
2. Canadian General Standards Board (CGSB)
 1. CAN/CGSB-1.2-M89, Boiled Linseed Oil
 2. CAN/CGSB-3.3-M89, Kerosene
3. American Society for Testing and Materials (ASTM).
 1. ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)
4. Ontario Provincial Standard Specification 353.

2. **PRODUCTS**

2.1. **Materials**

1. Concrete mixes and material shall conform to Ontario Provincial Standard Specifications 1301, 1302, 1303, 1305, 1306, 1308, 1315, and 1350. Concrete for curb and toe wall construction shall have a minimum compressive strength of 30 MPa after 28 days.
2. Granular Base and Sub-Base: to Section 32 11 23 and 32 11 19 respectively.
3. Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.
4. Fill material: to Section 31 23 10.
5. Boiled linseed oil: to CAN/CGSB-1.2.
6. Kerosene: to CAN/CGSB-3.3.

3. **EXECUTION**

3.1. **Grade Preparation & Sub-Base Course**

1. Grading: to Section 32 23 13.
2. Place sub-base course of OPSS Granular 'B', Type I in maximum 150 mm loose lifts and compact to a minimum of 100% of SPMDD.

3.2. **Granular Base**

1. Obtain Consultant's approval of subbase before placing granular base.
2. Place compacted OPSS Granular 'A' to depth, lines and widths as indicated.
3. Compact granular base to a minimum of 100% of SPMDD.

3.3. **Concrete**

1. Obtain Consultant's approval of granular base.
2. Do concrete curb construction in accordance with OPSS MUNI 353.
3. Provide 1.0m. wide depressions in curb where specified on the drawings as required to allow surface drainage to be conveyed to adjacent bio-swale areas.

3.4. **Tolerances**

1. Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5. **Expansion and Contraction Joints**

1. Joints are to be constructed in accordance with OPSS 353.07.07

3.6. **Curing**

1. Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1 to exposed finished surfaces for at least 1 day after placing or sealing moisture in by curing compound approved by Consultant.
2. Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
3. Apply curing compound evenly to form continuous film. In accordance with manufacturer's requirements.
4. Concrete curing is to be in accordance with OPSS MUNI 904.

3.7. **Linseed Oil Treatment**

1. After concrete has cured for specified curing time and when surface of concrete is dry, apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters.

3.8. **Backfill**

1. Allow concrete to cure for 7 days prior to backfilling.
2. Backfill to designated elevations with material approved by Consultant. Compact and shape to required contours as indicated or as directed by Consultant.

3.9. **Defective Concrete**

1. Concrete is defective when:
 1. Containing excessive honeycombing or embedded debris.
 2. Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
 3. Average 28-day strength of any three consecutive strength tests is less than specified minimum 28-day strength.
 4. Any 28-day strength test result is more than 3.5 MPa below the specified minimum

28-day strength.

2. Repair of defective concrete work:
 1. Repair defective areas while concrete is still plastic, otherwise wait until curing is completed. Use repair methods approved by Consultant.
 2. Grind off high surface variations where directed by Consultant.
3. Remove and replace defective concrete where directed by Consultant:
 1. Remove between joints by sawing through concrete across full width.
 2. Replace with new concrete to this Section as directed by Consultant.
 3. Construct contraction joint between sawn face of existing concrete and face of new concrete.
 4. Install tie bars between old and new concrete as directed by Consultant.

3.10. **Field Quality Control**

1. Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Consultant in accordance with CAN/CSA-A23.1.
2. Consultant may take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 2.1 Materials
- .7 3.1 Preparation
- .8 3.2 Application
- .9 3.3 Adjusting and Cleaning
- .10 3.4 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 Painted pavement markings and linework including:
 - .1 Parking stall and drive aisle linework.
 - .2 Symbols and markings for barrier free parking.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- .1 Qualifications: The *Contractor* shall *Provide* work of this Section, executed by competent installers with a minimum of five years' experience in application of *Products* specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint: in accordance with CAN/CGSB 1.74-2001 AMEND NO.1 Alkyd Traffic Paint - Amendment No. 1, low VOC alkyd traffic paint, in colours to the *Consultant's* selection.
 - .1 Maximum Volatile Organic Compound (VOC) limits; exterior:
 - .1 Flat paints: <100 g/L.

- .2 Non-flat paints: <200 g/L.

PART 3- EXECUTION

3.1 PREPARATION

- .1 Substrate surfaces to be free from surface water, frost, ice, dust, oil, grease and other foreign materials.

3.2 APPLICATION

- .1 Lay out pavement and slab markings.
- .2 Apply paint only when air temperature is above manufacturer's recommended temperature and no rain is forecast.
- .3 Symbols, numbers, letters, and text to conform to dimensions indicated, 150 mm (6") minimum. Apply letters, numbers, and text of legible size to parking stalls and drive aisles. Number sequence and text to the *Consultant's* selection.
- .4 Symbols and markings for barrier free parking in accordance with CAN/CSA B651-12, and to requirements of the *Authorities Having Jurisdiction*.
- .5 Paint lines to be of uniform colour and density with sharp edges, 100 mm (4") wide, unless otherwise indicated in the *Contract Documents*.

3.3 ADJUSTING AND CLEANING

- .1 Remove paint where spilled, splashed, splattered, or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 Remove combustible rubbish materials and empty paint cans each *Day* and safely dispose of same in accordance with requirements of the *Authorities Having Jurisdiction*.
- .4 Clean equipment and dispose of wash water/solvents as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, and the like), paints, thinners, paint removers/strippers in accordance with safety requirements of the *Authorities Having Jurisdiction*.

3.4 PROTECTION

- .1 Keep traffic off wet paint for period of time as recommended by paint manufacturer.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Closeout Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Field Conditions
- .8 2.1 Performance/Design Requirements
- .9 2.2 Materials
- .10 3.1 Installation
- .11 3.2 Field Quality Control
- .12 3.3 Adjusting and Cleaning
- .13 3.4 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 Tactile warning surfacing at locations indicated in the *Contract Documents*.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Product data sheets:
 - .1 Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
 - .2 Product data sheets shall include material test reports from qualified independent testing laboratories, current within a 24 month period preceding date of installation, indicating that materials proposed for use in the Work are in compliance with the requirements of the Contract Documents, and meet the properties specified or indicated.
- .3 Shop drawings:
 - .1 Submit shop drawings showing fabrication details, tile placement, and installation methods and materials.
- .4 Samples:
 - .1 Submit full size sample of each type and colour of tactile warning surfacing specified or required for the Work.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00.
- .2 Maintenance data:
 - .1 Submit manufacturer's maintenance instructions for inclusion in the operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers / applicators / erectors: Provide work of this section, executed by competent installers with minimum 3 years' experience in application of Products, systems and assemblies specified, and with approval and training of Product manufacturers.
- .2 Mock-ups:
 - .1 Provide a mock-up size and location as approved by Consultant.
 - .2 Locate at the Place of the Work as part of final installation.

1.7 FIELD CONDITIONS

- .1 Ambient conditions:
 - .1 Maintain minimum temperature of 5°C in spaces to receive tactile warning surfaces for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE/DESIGN REQUIREMENTS

- .1 Tactile warning surfacing, where required as a tactile attention indicator by the building code, shall conform to sentence (2) and Clauses 4.1.1 and 4.1.2 of ISO 23599, "Assistive Products for Blind and Vision-Impaired Persons – Tactile Walking Surface Indicators."

2.2 MATERIALS

- .2 Cast-in-place, tactile warning surfacing plates, exterior:
 - .1 Fabricated from grey cast iron, Class 35B to ASTM A48.
 - .2 Size: As indicated in Contract Documents.
 - .3 Color: Federal Yellow
 - .4 Basis of design:
 - .1 Kinesik 'Advantage Cast Iron Tactile Walking Surface Indicator'.
 - .2 Substitutions: in accordance with Section 01 25 00.

PART 3- EXECUTION

3.1 INSTALLATION

- .1 Install tactile warning surfacing in accordance with tactile warning surfacing manufacturer's instructions and recommendations, to locations indicated, scheduled, or required by authorities having jurisdiction.

3.2 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00.
- .2 Manufacturer's field review to be in accordance with Section 01 45 00.

3.3 ADJUSTING AND CLEANING

- .1 Clean tiles by method recommended by tile manufacturer not less than 4 days prior to inspection for Substantial Performance of the Work.

3.4 PROTECTION

- .1 Protect tiles and installation against damage during construction period in accordance with the tile manufacturer's instructions and recommendations.
- .2 Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood in accordance with tile manufacturer's instructions and recommendations.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Quality Assurance
- .6 2.1 Exterior Chain Link Fence
- .7 3.1 Preparation
- .8 3.2 Framework Installation
- .9 3.3 Chain Link Fabric Installation
- .10 3.4 Nuts and Bolts

1.3 SUMMARY

- .1 Section includes:
 - .1 Chain link fences.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Shop Drawings*:
 - .1 *Shop Drawings* to indicate materials, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, dimensions, details and accessories.

1.5 QUALITY ASSURANCE

- .1 Qualifications: The *Contractor* shall *Provide* work of this Section, executed by competent installers with a minimum of five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

PART 2– PRODUCTS

2.1 EXTERIOR CHAIN LINK FENCE

- .1 Refer to Chain Link Fence Detail on the *Drawings* for chain link fence materials.

PART 3- EXECUTION

3.1 PREPARATION

- .1 Clearing: surveying, clearing, grubbing, grading and removal of debris for the fence line or any required clear areas adjacent to the fence

- .2 Stake out: prior to proceeding with fence installation, obtain the approval of the *Consultant*, in writing, of fence location stake out.

3.2 FRAMEWORK INSTALLATION

- .1 Set posts in concrete footings to the height required in Sonotube or equivalent forms.
 - .1 *Provide* post footings according Chain Link Fence Detail on the *Drawings*.
- .2 Rails:
 - .1 Top rail: Install 6400 mm (21 ft.) lengths of rail continuous thru the line post or barb arm loop top. Splice rail using top rail sleeves minimum 152 mm (6 in.) long. The rail shall be secured to the terminal post by a brace band and rail end.
 - .2 Intermediate rail: Field cut and secured to the line posts using boulevard bands or rail ends and brace bands.
- .3 Terminal posts: End, corner, pull and gate posts shall be braced and trussed for fence 1830 mm (6 ft) and higher and for fences 1525 mm (60") in height not having a top rail. The horizontal brace rail and diagonal truss rod shall be installed in accordance with ASTM F567.
- .4 Tension wire: Shall be installed 100 mm (4") up from the bottom of the fabric. Fences without top rail shall have a tension wire installed 100 mm (4") down from the top of the fabric. Tension wire to be stretched taut, independently and prior to the fabric, between the terminal posts and secured to the terminal post using brace band. Secure the tension wire to the chain link fabric with a 9-gauge hog rings 450 mm (18") on centre and to each line post with a tie wire.

3.3 CHAIN LINK FABRIC INSTALLATION

- .1 *Install* fabric to side of the framework as per the *Drawings* or to later instruction by the *Consultant*.
- .2 Attach fabric to the terminal post by threading the tension bar through the fabric; secure the tension bar to the terminal post with tension bands and 8 mm (5/16") carriage bolts spaced no greater than 305 mm (12") on centre.
- .3 Small mesh fabric less than 25.4 mm (1"), attach to terminal post by sandwiching the mesh between the post and a vertical 50 mm (2") wide by 4.76 mm (3/16 in.) steel bar using carriage bolts, thru bolted thru the bar, mesh and post spaced 381 mm (15 in.) on centre.
- .4 Chain link fabric to be stretched taut free of sag. Fabric to be secured to the line post with tie wires spaced no greater than 305 mm (12") on centre and to rail spaced no greater than 450 mm (18") on centre.
- .5 Secure fabric to the tension wire with hog rings spaced no greater than 450 mm (18") apart. Excess wire shall be cut off and bent over to prevent injury.
- .6 Ensure space between bottom of fabric and solid surface is no greater than 50 mm (2") in any location.

3.4 NUTS AND BOLTS

- .1 Carriage bolts used for fittings shall be installed with the head on the secure side of the fence.
- .2 Bolts shall be peened over to prevent removal of the nut.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 References
- .5 1.5 System Description
- .6 1.6 Submittals
- .7 1.7 Delivery, Storage, and Handling
- .8 1.8 Warranties
- .9 2.1 Manufacturers
- .10 2.2 Composite wood for exterior fences:
- .11 3.1 Examination
- .12 3.2 Preparation
- .13 3.3 Installation
- .14 3.4 Cleaning
- .15 3.5 Protection

1.3 SUMMARY

- .1 Section Includes:
 - .1 Wood composite fences.
 - .2 Wood composite gates

1.4 REFERENCES

- .1 A. ASTM International (ASTM):
 - .1 C94 - Standard Specification for Ready-Mixed Concrete.
 - .2 C177-04 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - .4 D143-94(2000) - Standard Test Methods for Small Clear Specimens of Timber.
 - .5 D198-05 - Standard Test Methods of Static Tests of Lumber in Structural Sizes.
 - .6 D1037-06 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle
 - .7 Panel Materials.
 - .8 D1413-05 - Standard Test Method for Wood Preservatives by Laboratory Soil-Block Cultures.

- .9 D1761-06 - Standard Test Methods for Mechanical Fasteners in Wood.
- .10 D1929-96(2001) - Standard Test Method for Determining Ignition Temperature of Plastics.
- .11 D2047-04 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring
- .12 Surfaces as Measured by the James Machine.
- .13 D2394-05 - Standard Methods for Simulated Service Testing of Wood and Wood-Base Finish
- .14 Flooring.
- .15 D2395-06 - Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials.
- .16 D4761-05 - Standard Test Methods for Mechanical Properties of Lumber and Wood-Base
- .17 Structural Material.
- .18 E84-07 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .19 F1679-04 Standard Test Method for Using a Variable Incidence Tribometer (VIT).
- .2 American Wood Preservers Association (AWPA) E1-06 - Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites.

1.5 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design fence system to withstand 110 MPH steady wind and 130 MPH gusting wind tests.

1.6 SUBMITTALS

- .1 Submittals for Review:
 - .1 Product Data: Indicate sizes, profiles, surface finishes, and performance characteristics.
 - .2 Samples: 300mm long samples illustrating each size, profile, color, and surface finish.
- .2 Closeout Submittals:
 - .1 Maintenance Data: Manufacturer's instructions on care and cleaning of wood composite products.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle wood composite in accordance with manufacturer's instructions.
- .2 Do not stack wood composite over 12 feet high.
- .3 Cover wood composite with waterproof covering, vented to prevent moisture buildup.

1.8 WARRANTIES

- .1 Furnish manufacturer's 25 year commercial warranty providing coverage against checking, splitting, splintering, rotting, structural damage from termites, and fungal decay of wood composite.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- .1 Acceptable Manufacturer:
 - .1 TruNorth Composites, 490 Elgin St #3, Brantford, ON N3S 7P8
 - .2 Or equivalent

2.2 COMPOSITE WOOD FOR EXTERIOR FENCES:

- .1 Acceptable Product:
 - .1 Composite wood: TruNorth Solid Core
 - .2 Or equivalent.
 - .1 Colour: Ash Grey

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 Consultant 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.
- .2 Cut and drill wood composite using carbide tipped blades.
- .3 Space posts maximum as noted in Contract Documents.

3.4 CLEANING

- .1 Clean wood composite to remove stains:
 - .1 Mold, mildew, and berry and leaf stains: Clean surfaces with conventional deck wash containing detergent or sodium hypochlorite.
 - .2 Rust and ground-in dirt: Clean surfaces with cleaner containing oxalic or phosphoric acid.
 - .3 Oil and grease: Clean surfaces with detergent containing degreasing agent.

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

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 DESCRIPTION

- .1 This Section specifies the supply and installation of *Site* furnishings.

1.3 RELATED WORK

- .1 Section 32 13 16 - Concrete Paving:

1.4 SUBMITTALS

- .1 Submit detailed Shop Drawings of *Products* including overall dimensions and options for approval by the *Consultant*.
- .2 Submit samples of *Products* and/ or components upon request by the *Consultant*.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver *Products* to the *Site* in the manufacturer's original, unopened containers and packaging. Upon delivery, examine packages immediately to ensure all *Products* are complete and undamaged.
- .2 Store *Products* in a protected, dry area in manufacturer's unopened containers and packaging.
- .3 Protect *Product's* finish from damage during handling and installation.

1.6 COORDINATION

- .1 Coordinate installation of *Site* furnishings with *Site* work and other appropriate Sections of the *Specifications* to maintain proper provisions of the work specified.
- .2 All *Site* furnishings shall be laid out in the field by the *Contractor* and approved by the *Consultant* prior to installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Bench:

- .1 Manufacturer: Maglin Site Furniture Inc.
Model: MLB870-PC
Colour: silver
Slats: HDPC Charcoal
Mounting: Surface mount to concrete pad

- .2 Or *Equivalent*

- .2 Picnic Table:

- .1 Manufacturer: Maglin Site Furniture Inc.
Model: MTB-0210-00029
Colour: Cedar

Slats: HDPC Cedar
Mounting: Surface mount to concrete pad

.2 Or *Equivalent*

.3 Waste Receptacles:

.1 Manufacturer: Maglin Site Furniture Inc.
Model: MTR-1400-00009
Colour: Charcoal
Mounting: Surface mount to concrete pad

.2 Or *Equivalent*

.4 Recycling Receptacles:

.1 Dual Stream:
Manufacturer: Maglin Site Furniture Inc.
Model: MRR-1400-00018
Colour: Green
Mounting: Surface mount to concrete pad

.2 Or *Equivalent*

.3 Triple Stream:
Manufacturer: Maglin Site Furniture Inc.
Model: MRR-1400-00020
Colour: Green
Mounting: Surface mount to concrete pad

.4 Or *Equivalent*

.4 Bike Rack:

.1 Manufacturer: Maglin Site Furniture Inc.
Model: MBR-0400-00003
Colour: Charcoal
Mounting: Surface mount to concrete pad

.2 Or *Equivalent*

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Place *Site* furnishings for approval by the *Consultant* prior to installation.
- .2 Do not locate anchor bolts until *Site* furnishings are in place.
- .3 Surface mount *Site* furnishings to concrete pad or wall as per the *Drawings* and Details and/or the manufacturers' instructions and specifications.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 DESCRIPTION

- .1 This Section specifies the layout, loading, hauling, spreading, rolling and fine grading of topsoil and planting bed mixture.

1.3 RELATED WORK

- .1 Section 32 92 23 - Sodding
- .2 Section 32 93 00 – Trees, Shurbs, and Ground Cover Planting

1.4 SCOPE OF WORK

- .1 Topsoil and finished grading shall be applied to all areas of the *Site* designated on the Contract Drawings to receive sodding and planting.

1.5 SOURCE QUALITY CONTROL

- .1 Inspection and testing of topsoil will be carried out by a testing laboratory chosen and paid for by the *Contractor* and approved by the *Consultant*.
- .2 Acceptance of topsoil shall be subject to the soil analysis test results. Do not commence work until topsoil accepted by the *Consultant*.
- .3 Test topsoil for clay, sand and silt, N, P, K, Mg, soluble salt content, pH value, growth inhibitors and soil sterilants.
 - .1 Use 25 mm diameter sampling tube or spade to take a minimum of six samples. Mix samples together thoroughly before submitting for testing.
 - .2 Submit 0.5 kg sample of topsoil to testing laboratory and indicate present use, intended use, type of subsoil and quality of drainage. Prepare and ship sample in accordance with Ontario regulations and testing laboratory requirements.
 - .3 Determine required limestone treatment to bring pH value of soil 6.0 to 7.0 level.
 - .4 Submit two copies of soil analysis and recommendations for corrections to the *Consultant*.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Topsoil: Topsoil for fine grading shall conform to the following qualities: friable, neither heavy clay nor of very light sandy nature consisting of 45% sand, 35% silt, 20% clay and pH value of 6 - 7. Free from subsoil, roots, vegetation, debris, toxic materials, stones over 50 mm diameter.
- .2 On-Site Topsoil: Topsoil that is present on the *Site* can be re-used if it conforms to the above requirements and is approved by the *Consultant*.
- .3 Peat Moss:
 - .1 Derived from partially decomposed fibrous or cellular stems and leaves of species of sphagnum mosses.

- .2 Elastic and homogeneous, brown in colour.
- .3 Free of wood and deleterious material which could prohibit growth.
- .4 Shredded particle minimum size: 5mm.
- .4 Fertilizer:
 - .1 Complete commercial **organic** fertilizer.
 - .2 Bonemeal: finely ground with a minimum analysis of 20% phosphoric acid.
- .5 Bonemeal: Commercial raw bonemeal, finely ground, with minimum analysis of 2% nitrogen and 11% phosphoric acid.
- .6 Manure: well rotted, unbleached cattle manure, not less than eight months and not more than two years old, free of harmful chemicals and injurious substances, containing not more than 25% straw, leaves and other foreign matter.
- .7 Lime: agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve. Provide lime in the form of dolomitic limestone.
- .8 Aluminum Sulfate: Commercial grade, unadulterated.

PART 3 - EXECUTION

3.1 PREPARATION OF PLANTING BED MIXTURE

- .1 Thoroughly mix together five parts topsoil, two parts manure and one part peat moss. Shred to a fine, even texture.
- .2 Add bone meal at the rate of .58 kg per cubic metre and mix thoroughly.
- .3 Protect planting mixture to prevent deterioration.

3.2 SPREADING AND FINE GRADING

- .1 Prepare and compact sub-grade.
- .2 Have sub-grade approved by the *Consultant* prior to commencing topsoil placement.
- .3 Scarify sub-grade surface to a minimum depth of 75mm to facilitate bonding.
- .4 Do not spread topsoil/ planting bed mixture when it is frozen or wet.
- .5 Remove and dispose of all stones, sticks, sub-soil, lumps or other debris in excess of 50mm diameter and all surface litter and live weeds.
- .6 Spread soil to the following minimum depths:
 - 150mm topsoil in areas to be sodded
 - 450mm planting bed mixture in planting beds
- .7 Maintain soil 15mm below top of curb, finished grades of pavement, etc., to allow for sodding.
- .8 Manually spread topsoil around existing trees and shrubs.

- .9 Fine grade topsoil/ planting bed mixture to eliminate rough and low areas to ensure positive surface drainage, blend smoothly with adjacent finished grade elevations and conform to the specified levels and profiles.
- .10 Grade swales and ditches evenly to ensure positive runoff to drainage inlets, without ponding and with smoothly rounded, uniform side slopes.
- .11 Roll topsoil surface of all areas to be seeded or sodded to produce a smooth, uniform surface that is firm against deep foot prints and with a fine, loose texture.
- .12 Have finished surfaces inspected by the *Consultant* before placing seed or sod.
- .13 Dispose of surplus materials and debris off the *Site* and clean up soil from all paved surfaces. The *Contractor* shall ensure compliance with the On-Site and Excess Soil Management regulation made under the *Environmental Protection Act*, RSO 1990, c E.19 (O. Reg. 406/19). Refer to SC 5 of the Supplementary Conditions for further requirements.

3.3 SOIL AMENDMENTS

- .1 Apply soil amendments at rate as specified in the *Contract Documents* and as determined from soil sample test.
- .2 Mix soil amendments into full depth of topsoil prior to application of fertilizer.

3.4 APPLICATION OF FERTILIZER

- .1 Spread fertilizer uniformly over entire area of topsoil at rate determined on basis of soil sample test.
- .2 Mix fertilizer thoroughly to full depth of topsoil.

3.5 SURPLUS MATERIAL

- .1 Dispose of materials not required at an appropriate off-*Site* facility in accordance with O. Reg. 406/19 and SC 5 of the Supplementary Conditions.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Read and be governed by conditions of the Contract Documents, including Sections of Division 01.

1.2 DESCRIPTION

- .1 This Section specifies the installation of sod.

1.3 RELATED WORK

- .1 Section 32 91 19- - Topsoil Placement and Grading:

1.4 QUALITY ASSURANCE

- .1 The *Contractor* shall engage an experienced installer with a minimum of five years' experience on comparable projects.
- .2 The *Contractor* shall ensure that the installer maintains an experienced full-time supervisor on the *Site* during times that landscaping is in progress.

1.5 ACCEPTANCE

- .1 Sodded areas will be accepted at the date of *Substantial Performance of the Work* provided that:
 - .1 Sodded areas are properly established and in a vigorous growing condition.
 - .2 Sod is free of bare and dead spots and without weeds.
 - .3 No surface soil visible when grass has been cut to height of 50mm.
 - .4 Sodded areas have been cut twice.
- .2 Lawns sodded in fall will be accepted the following spring, one month after start of growing season, provided that the conditions of subsection 1.4 are fulfilled.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Topsoil: see section 32 91 19-- Topsoil Placement and Grading
- .2 Imported Topsoil: see section 32 91 19.-Topsoil Placement and Grading
- .3 Grass Sod: Shall be a certified No. 1 Grade Turfgrass Nursery Sod, as per Green Horizons Group Eco Solutions: Bluegrass/ Fescue Blend (or *Equivalent*), grown and sold in accordance with the classification of the Nursery Sod Growers Association of Ontario. At time of sale shall have a strong, fibrous root system and shall be free from stones and burned or bare spots.
- .4 Fertilizer: Organic fertilizer as per the soil analysis report provided by the *Contractor* (refer to Section 32 91 19 - Topsoil Placement and Grading). The *Contractor* shall be prepared to *Supply* all necessary fertilizers, to eliminate any chemical deficiencies as indicated by the soil analysis report of imported topsoil.
- .5 Wooden Pegs: Sod on steep slopes shall be secured with hardwood pegs, 225mm long minimum and approximately 25mm x 25mm square, or *Equivalent*. Pegs shall be of sufficient length to ensure satisfactory anchorage of the sod.

- .6 Water: Potable, free of impurities.

PART 3 - EXECUTION

3.1 CUTTING, HANDLING AND STORAGE

- .1 Sod shall be cut by approved methods in accordance with recommendations of the Nursery Sod Growers Association of Ontario or equivalent association acceptable to the *Consultant*.
- .2 Sod shall be rolled or folded prior to lifting in such a manner as to prevent tearing or breaking.
- .3 Sod shall be protected during transportation to prevent drying out and shall arrive at the *Site* in a fresh and healthy condition.
- .4 Sod shall be installed immediately after arrival. If there is any delay in installation the sod shall be kept moist and cool at all times until installation.
- .5 All commercial fertilizer shall be packed in standard containers, clearly marked with the name of the manufacturer, weight and analysis.
- .6 Fertilizer shall be stored in a weatherproof storage place and in such a manner that it will stay dry and its effectiveness is not impaired.

3.2 INSTALLATION

- .1 All rough grading, filling, spreading of topsoil and fine grading and other preparation work required, shall be executed and completed as described in the appropriate Sections of this Contract.
- .2 The specified fertilizer shall be applied to and well worked into the topsoil by discing, raking or harrowing, at the rate specified in the application manual. This shall be done 48 hours before laying sod.
- .3 The finished surface shall be smooth, firm against footprints, with a fine, loose texture before sod is placed.
- .4 Sodding operations shall take place during suitable weather conditions and on ground which is free from frost, snow and water. Sod shall be laid as soon as possible after delivery to prevent deterioration. Sod shall be laid closely knit together in such a manner that no open joints are visible, or pieces are overlapping. Sod shall be laid smooth and flush with adjoining grass areas and paving and top surface of curbs unless shown otherwise on the *Drawings*.
- .5 On any slopes of 3:1 and steeper, sod shall be laid perpendicular to the slope, and every row shall be pegged with wooden pegs at intervals of not more than 600mm. Pegs shall be driven flush with sod. For drainage swales place 5 pegs per square metre.
- .6 After installation of sod, the area shall be watered immediately with sufficient amounts to saturate the sod and upper 100mm of soil.
- .7 After sod and soil have dried sufficiently to prevent damage, the area shall be rolled with a roller providing 7325kg/m² pressure (1500 lbs./ft²), to ensure a good bond between sod and soil and to remove minor depressions and irregularities.
- .8 Protect all newly laid sod areas until vigorous, hardy, even growth is established to a growth height of 80mm.

3.3 MAINTENANCE

- .1 Maintenance for sodded areas shall begin immediately after sod has been installed and shall continue until the date of Acceptance by the Consultant.
- .2 Maintenance shall include all measures necessary to establish and maintain sod in a vigorous growing condition, including but not limited to:
 - .1 Mowing: Shall be at regular intervals as required, to maintain grass at a maximum height of 65mm. Not more than 1/3 of blade shall be cut at any one mowing. Edges of sodded areas shall be neatly trimmed and hand clipped where necessary. Heavy clippings shall be removed immediately after mowing and trimming.
 - .2 Watering: Shall be carried out when required and with sufficient quantities to prevent grass and underlying soil from drying out.
 - .3 Rolling: Shall be carried out when required to remove any minor depressions or irregularities.
 - .4 Weed control: Shall be carried out when required. When herbicides are used they shall be applied in accordance with manufacturer's recommendations. Any damage resulting from the *Contractor's* use of herbicides shall be remedied at the *Contractor's* expense.
 - .5 Erosion: Erosion occurring as a result of faulty workmanship and/or materials on the part of the *Contractor* shall be repaired at the *Contractor's* expense.
- .3 Any sodded areas which show deterioration or bare spots shall be repaired immediately by the *Contractor*.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- .1 This Section specifies the supply and planting of trees, shrubs and ground covers.

1.2 RELATED WORK

- .1 Section 32 91 19- Topsoil Placement and Grading

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 *Supply* manufactured items in standard containers, with contents, weight, component analysis, and the name of the manufacturer clearly indicated.
- .2 Store manufactured materials which are subject to deterioration in a weatherproof place on *Site* in such a manner that their effectiveness is not impaired.
- .3 Do not plant material on which the rootball has been cracked or broken preparatory to or during the planting process.
- .4 *Provide* rootballs of the following minimum sizes corresponding to tree size.

<u>Caliper</u>	<u>Height</u>	<u>Root Ball</u>
<u>Deciduous Trees</u>	<u>Coniferous Tree</u>	<u>Diameter</u>
-	1.75 m	60 cm
50 mm	2.00 m	70 cm
60-70 mm	2.25-2.5 m	80 cm
80-90 mm	2.75-3.0 m	90 cm
100 mm	-	1.00 m
125 mm	-	1.50 m

- .5 *Provide* a root ball depth of a minimum 60 per cent of diameter.
- .6 Cut all roots cleanly when digging plants. Split roots are not acceptable. Cut roots even with the edges of the rootball. Paint all cut roots over 13mm diameter with approved tree wound dressing.
- .7 Protect all plant material from damage and breakage. Protect all parts of the plant material from drying out from the time of digging until they are installed.

1.4 SUBSTITUTIONS

- .1 *Supply* and *Install* plant material as specified on the plant list in the Contract Drawings. Substitutions of other plant material will **not** be allowed unless approved in writing by the *Consultant*.

1.5 INSPECTIONS

- .1 Give 48 hours' notice for inspection of plant material and the stakeout of planting locations by the *Consultant*.
- .2 Partial acceptance will be given when planting would not be in accordance with best horticultural practices. If partial acceptance is desired, give notice to the *Consultant* in writing.
- .3 Final inspection of all plant material will be made at the end of the specified warranty period. All plants must be in a healthy growing condition at the time of this inspection.

1.6 WARRANTY

- .1 During the warranty period, replace all material that is dead or not in a satisfactory, healthy growing state or which does not meet the requirements of the *Specifications*, at no extra cost to the *Owner*.
- .2 All replacements must be plants of the same size and species as shown on the plant list, supplied and planted in accordance with the *Drawings* and *Specifications*.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- .1 All plant material must be nursery grown and meet the specifications set out in the latest Guide *Specifications* for Nursery Stock prepared by the Canadian Nursery Trade Association (C.N.T.A.) or equivalent association acceptable to the *Consultant* for size, height, spread, grading, quality and method of cultivation.
- .2 Nomenclature of specified plants shall conform to the International Code of Nomenclature for Cultivated Plants and the latest edition of Standardized Plant Names.
- .3 Plant Material shall be true to name and type, structurally sound, well branched; healthy and vigorous and free from disease, insect infestations and damage, and shall be densely foliated with a healthy, well developed root system. Pruning wounds must show vigorous bark on all edges and all parts must show live and green cambium tissue when cut.
- .4 All material must conform to the sizes shown on the plant list, except that larger material may be used when approved by the *Owner*. No extra will be paid for use of larger plants.
- .5 Plant material sizes must conform to the following standards:
 - a. caliper - diameter of the trunk measured 150mm above the normal grade around the plant.
 - b. height - measured from the normal grade around the plant to the top of the main foliage mass.
 - c. spread - the diameter of the main foliage mass, as its widest point.

2.2 OTHER MATERIALS

- .1 Topsoil: see Section Section 32 91 19 - Topsoil Placement and Grading
- .2 Planting Bed Mixture: see Section Section 32 91 19 - Topsoil Placement and Grading
- .3 Peat moss: partially decomposed fibrous form of cellular stems and leaves of sphagnum moss, free of woody substance and harmful mineral matter, having a pH range of 4.5 to 6.0.
- .4 Tree Wrap: 225g burlap supplied in strips 150mm minimum to 250mm maximum width or heavy, waterproof crepe paper 100mm to 150mm wide.
- .5 Anchor stakes: 50x50x3000mm spruce stakes
- .6 Rodent/ Trimmer Protection: Big 'O' drain tile 100mm dia. x 450mm long or equivalent
- .7 Landscape Fabric: Commercial grade Weed-X by Dalen Products Inc. or *Equivalent*.
- .8 Hemp Rope: 15mm diameter.
- .9 Mulch: Gro-bark SPM or *Equivalent*.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Apply planting bed mixture to minimum 450mm depth for shrub beds and ground covers.

3.2 INSTALLATION

- .1 Ensure all planting excavations are 150mm greater on all sides than the width of the rootball. **Do not leave tree pits open overnight.**
- .2 Place plant plumb in the centre of the planting pit with a minimum of 150mm of compacted planting soil mixture under the rootball. Face the plant to give the best appearance or relationship to adjacent structures. Cut away all ropes from the root ball at the base of tree.
- .3 Backfill with planting soil in 150mm layers and firmly tamp each layer to ensure the plant stays plumb. Ensure no air pockets remain around the roots.
- .4 Water thoroughly when hole is ½ full of tamped soil mixture, and again when the operation is complete.
- .5 Except for plants in planting beds, construct an earth saucer around each plant equal to the diameter of the rootball and 50mm minimum depth to retain water around the roots.
- .6 Cover all exposed soil with a 50mm minimum depth of shredded wood bark mulch.
- .7 Wrap all trees over 50mm calliper. Apply wrapping in a spiral manner from grade to above the second branch. Secure wrapping with suitable cord.
- .8 Secure all trees as outlined in the Contract *Drawings*.
- .9 Prune plants to remove dead or broken branches. Do not cut a leader. Use only clean and sharp tools.

3.3 CLEAN-UP

- .1 At the completion of planting operations, remove all surplus material from the *Site* at no extra cost to the *Owner*.
- .2 Make good all damage resulting from planting operations at no extra cost to the *Owner*.

3.4 MAINTENANCE PRIOR TO SUBSTANTIAL PERFORMANCE OF THE WORK

- .3 The *Contractor* shall be responsible for maintenance of plant material up to the point of *Substantial Performance of the Work*, and such maintenance shall be considered as part of the installation work.
- .4 Maintenance shall include all measures necessary to establish and maintain all plants in a vigorous and healthy growing condition, including but not limited to:
 - .1 Watering: Water as required to maintain sufficient soil moisture content.
 - .2 Weeding: Weed planting beds and tree pits.
 - .3 Cultivating: Cultivate planting beds and tree pits.
 - .4 Pruning: Prune all dead or broken wood from trees and shrubs.
 - .5 Pest control: Employ disease and insect/rodent control measures (chemical and/or mechanical) when required. Use chemical methods in accordance with the manufacturer's directions. Make good any damage resulting from improper use of pesticides at no extra cost to the *Owner*.
 - .6 Accessories: Keep all accessories in good condition and properly adjusted. Reset plants to proper grades or upright position and adjusting tree guards and guy wires (if used) as required.
- .5 At the time of *Substantial Performance of the Work*, all material must be in a healthy vigorous growing condition. Beds and tree pits must be freshly cultivated and free of weeds, rubbish, or debris.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Related Work**

- | | | | | |
|--|----|--|----|------------------|
| 1. Site Grading | | | | Section 31 23 13 |
| 2. Excavating, Trenching and Backfilling | | | | Section 31 23 10 |
| 3. Storm Sewers | | | | Section 33 44 00 |
| 4. Aggregates: General Section | 31 | | 05 | 17 |

1.3. **References**

1. ASTM A48/A48M-03 (2016), Specification for Gray Iron Castings.
2. ASTM C139-18 (1989), Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
3. ASTM C478M-90, Specification for Precast Reinforced Concrete Manhole Sections
4. CSA A3000, Portland Cement.
5. CSA A3000, Masonry Cement.
6. CAN/CSA-A23.1-M90, Concrete Materials and Methods for Concrete Construction.
7. CSA A82.56-M1976, Aggregate for Masonry Mortar.
8. CAN3-A165 Series-M85, CSA Standards on Concrete Masonry Units.
9. CAN/CSA-G30.18-M92, Billet Steel Bars for Concrete Reinforcement.
10. CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
11. Ontario Provincial Standard Specification 407.

2. **PRODUCTS**

2.1. **Materials**

1. Precast manhole units: to ASTM C478M, circular or oval. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by Consultant and set on concrete slabs cast in place.
 1. 1200 mm diameter manhole as per OPSD 701.010.
2. Precast catch basins: to ASTM C478M.
 1. Catch basins as per OPSD 705.010
3. Joints: to be made watertight using rubber rings or cement mortar.
4. Mortar:
 1. Aggregate: to CSA A82.56.

2. Cement: to CAN/CSA-A8.
5. Ladder rungs: to CAN/CSA-G30.18, No. 25M billet steel deformed bars, hot dipped galvanized to CAN/CSA G164 Rungs to be safety pattern (drop step type).
6. Adjusting rings: to ASTM C478M.
7. Concrete Brick: to CAN3-A165 Series.
8. Frames, gratings, covers to dimensions as indicated and following requirements:
 1. Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
 2. Gray iron castings: to ASTM A48, strength class 30B.
 3. Castings: coated with two applications of asphalt varnish.
 4. Storm manhole frames and covers: heavy duty municipal type for road service. Cover cast without perforations and complete with two 25 mm square lifting holes, as per OPSD 400.010, unless otherwise specified.
 5. Catchbasin frame and cover: as per OPSD 400.010.
 6. Manhole frame and cover as per OPSD 401.010.
9. Granular bedding and backfill: Granular B Type I: to OPSD 1010 and Section 02701 – Aggregates: General and to Section 02315 – Excavating, Trenching and Backfilling.
10. Unshrinkable fill: to Section 02315 – Excavating, Trenching and Backfilling.

3. **EXECUTION**

3.1. **Excavation and Backfill**

1. Excavate and backfill in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Obtain approval of Consultant before installing manholes or catch basins.

3.2. **Installation**

1. Construct units in accordance with details indicated, plumb and true to alignment and grade.
2. Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
3. Dewater excavation free of standing water or as directed by Consultant and remove soft and foreign material before placing concrete base.
4. Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% Corrected Maximum Dry Density.
5. Precast units.
 1. Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with rubber ring gaskets, cement mortar, or combination thereof.
 2. Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
 3. Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
6. For sewers:

1. Place stub outlets and bulkheads at elevations and in positions indicated.
2. Bench to provide a smooth U-shaped channel in manholes.
7. Compact granular backfill to 98% Corrected Maximum Dry Density.
8. Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
9. Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

3.3. **Leakage Test**

1. Visual inspection of leakage will be carried out. If any leakage is observed, correct leakage as directed by Consultant at no additional cost.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Description**

1. The work included in this Section includes for all labour, equipment and materials required for the watermain construction within the site, and watermain construction within the municipal right of way connecting to existing municipal servicing.
2. Included in the work is coordination and cooperation with Municipal forces as required to complete the work including providing temporary blow offs, isolation valves, pressure testing and chlorination as required by Municipal forces.

1.3. **Related Work**

1. Excavating, Trenching and Backfilling Section 31 23 10

1.4. **References**

1. The Municipality Standards and Specifications for watermain construction.

1.5. **Scheduling Of Work**

1. Schedule work to minimize interruptions to existing services.

2. **PRODUCTS**

1. All products utilized within the water system to comply with the Municipality Standards and Specifications.

3. **EXECUTION**

3.1. **Preparation**

1. Clean pipes, fittings, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects to approval of Consultant. Remove defective materials from site as directed by Consultant.

3.2. **Trenching**

1. Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Trench depth to provide cover over pipe of not less than 2.0 metres from finished grade or as indicated.
3. Trench alignment and depth require Consultants' approval prior to placing bedding material and pipe.

3.3. **Granular Bedding**

1. Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 300 mm below bottom of pipe or to depth as indicated.
2. Do not place material in frozen condition.
3. Shape bed true to grade to provide continuous uniform bearing surface for pipe.
4. Shape transverse depressions in bedding as required to suit joints.
5. Compact each layer full width of bed to at least 95% of corrected maximum dry density.
6. Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling with compacted bedding material.

3.4. **Pipe Installation**

1. Lay pipes to ANSI/AWWA C600 Manual of Practice and manufacturer's standard instructions and specifications. Do not use blocks except as permitted in 3.3.2.
2. Join pipes in accordance with ANSI/AWWA C600, ANSI/AWWA C206, AWWA Manual of Practice and manufacturer's recommendations.
3. Bevel or taper ends of PVC pipe to match fittings.
4. Handle pipe by methods approved by Engineer recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
5. Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
6. Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends upgrade.
7. Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
8. Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
9. Position and join pipes with equipment and methods approved by Consultant.
10. Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
11. Align pipes carefully before jointing.
12. Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
13. Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.
14. Complete each joint before laying next length of pipe.
15. Minimize deflection after joint has been made.
16. Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
17. Ensure completed joints are restrained by compacting bedding material alongside and over

installed pipes or as otherwise approved by the Consultant.

18. Provide necessary fittings and adaptors as required between existing watermain pipe materials and proposed watermain pipe materials.
19. When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
20. Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
21. Do not lay pipe on frozen bedding.
22. Contractor responsible for satisfactory completion of hydrostatic and leakage testing to Consultant's approval. Contractor also responsible for degree of backfilling complete prior to hydrostatic and leakage testing as well as isolation and correction of any leaks resulting in failed tests.
23. Backfill remainder of trench.

3.5. **Cathodic Protection And Tracer Wire**

1. ALL mechanical restraint systems shall be installed with cathodic protection complete with 12-gauge tracer wire along the top of Polyvinyl Chloride (PVC) and concrete Pressure Pipe (CPP).

3.6. **Hydrostatic And Leakage**

1. Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described as required by the Municipality standards.
2. Notify Consultant at least 24 h in advance of all proposed tests. Perform tests in presence of Consultant.
3. Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
4. Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Consultant.
5. Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by Consultant.
6. Leave hydrants, valves, backflow preventer, water meter, joints and fittings exposed.
7. When testing is done during freezing weather, protect hydrants, valves, backflow preventer, water meter, joints and fittings from freezing.
8. Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
9. Open valves.
10. Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.
11. Thoroughly examine exposed parts and correct for leakage as necessary.
12. Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
13. Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
14. Repeat hydrostatic test until all defects have been corrected.
15. Apply a leakage test pressure of equal to design pressure after complete backfilling of

trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 h.

16. Define leakage as amount of water supplied from water meter in order to maintain test pressure for 2 h.
17. Do not exceed allowable leakage of 0.03 L/mm diameter per 300 m of pipe, including lateral connections, per hour.
18. Locate and repair defects if leakage is greater than amount specified.
19. Repeat test until leakage is within specified allowance for full length of water main.

Pipe Surround

20. Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes as indicated.
21. Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 5 m of pipe.
22. Place layers uniformly and simultaneously on each side of pipe.
23. Do not place material in frozen condition.
24. Compact each layer from pipe invert to mid height of pipe to at least 95% of SPMDD to ASTM D698.
25. Compact each layer from (mid height) of pipe to underside of backfill to at least 95% of SPMDD and in accordance with Geotechnical Report for site.

3.7. Backfill

1. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
2. Do not place backfill in frozen condition.
3. Compact native backfill to at least 95% of SPMDD.

3.8. Flushing And Disinfecting

1. The Municipality shall perform all chlorination works.
2. Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min., or until foreign materials have been removed and flushed water is clear.
3. Flushing flows shall be as follows:

<u>Pipe Size NPS</u>	<u>Flow (L/s) Minimum</u>
6 and below	38
8	75

4. Provide connections and pumps for flushing as required.
5. Open and close valves, hydrants and service connections to ensure thorough flushing.
6. Complete flushing to satisfaction of Consultant and The Municipal forces.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda for all work, including work outside the property line including work within Regional and Municipal right of way unless otherwise noted.

1.2. **Related Work**

- | | |
|--|------------------|
| 1. Site Grading | Section 31 23 13 |
| 2. Excavating, Trenching and Backfilling | Section 31 23 10 |
| 3. Manholes and Catchbasins | Section 33 05 14 |
| 4. Aggregates: General | Section 31 05 17 |

1.3. **References**

1. ASTM D3034, Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and fittings.
2. CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type),
3. CAN/CSA-B182.11, Recommended Practice for the Installation of Plastic Crain and Sewer Pipe and Pipe Fittings.
4. Ontario Provincial Standard Specification MUNI 410.

1.4. **Material Certification**

1. Submit manufacturer's test data and certification at least 2 weeks prior to commencing work.
2. Certification to be marked on pipe.

1.5. **Scheduling of Work**

1. Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

2. **PRODUCTS**

2.1. **PVC Pipe**

Poly Vinyl Chloride pipe as specified in the Contract Drawings shall be in accordance with OPSS 410, Pipe Sewer Installation in Open Cut.

2.2. **Pipe Bedding, Surround and Cover Materials**

1. Granular embedment materials to Section 31 05 17 – Aggregates.

2.3. **Backfill Material**

1. Backfill to Section 31 23 10 – Excavation, Trenching and Backfilling
2. Backfill within the public right of way to be un-shrinkable fill.

2.4. **Joint Mortar**

1. Portland cement: to CAN/CSA-A5, normal type 10.

2. Mortar: one part Portland cement to two parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additive..

3. **EXECUTION**

3.1. **Preparation**

1. Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.2. **Trenching**

1. Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Do not allow contents of any sewer or sewer connection to flow into trench.
3. Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3. **Granular Bedding**

1. Place granular bedding material to details indicated in bedding detail OPSD 802.010 to OPSD 802.054, depending on type of soil and pipe. Use Class B bedding and place bedding in unfrozen condition. Type of soil to be defined in the field as Type 1, 2, 3, or 4 as per Health and Safety Act and Regulations for Construction Projects.
2. Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
3. Compact each layer full width of bed to at least 95% corrected maximum dry density.
4. Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
5. Shape transverse depressions as required to suit joints.
6. Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted common backfill.

3.4. **Installation of Sanitary Sewer Pipes**

1. Lay and join pipe in accordance with manufacturer's recommendations and to approval of Consultant.
2. Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
3. Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
4. Do not exceed maximum joint deflection recommended by pipe manufacturer.
5. Do not allow water to flow through pipes during construction except as may be permitted by Consultant.
6. Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
7. PVC Pipe as specified in the Contract Drawings shall be installed in accordance with OPSS MUNI 410, Pipe Sewer Installation in Open Cut.
8. When any stoppage of work occurs, restrain pipes as directed by Consultant, to prevent "creep" during down time.
9. Cut pipes as required for special inserts, fittings or closure pieces, as recommended by

pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

10. Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available. Support connections as per OPSD 708.020.
11. Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.
12. Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5. **Pipe Surround**

1. Place surround material in unfrozen condition.
2. Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated.
3. Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Pipe surround material to extend 300 mm above crown of pipe.
4. Place layers uniformly and simultaneously on each side of pipe.
5. Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

3.6. **Backfill**

1. Place backfill material in unfrozen condition.
2. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

3.7. **Field Testing**

1. Repair or replace pipe, pipe joint or bedding found defective.
2. When directed by Consultant, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
3. Remove foreign material from sewers and related appurtenances by flushing with water.

END OF SECTION

1. **GENERAL**

1.1. **General Requirements**

1. Read and be governed by the conditions of the *Contract Documents*, including sections of the Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2. **Related Work**

- | | | |
|----|---------------------------------------|------------------|
| 1. | Excavating, Trenching and Backfilling | Section 31 23 10 |
| 2. | Manholes and Catchbasins | Section 33 05 14 |
| 3. | Aggregates: General | Section 31 05 17 |

1.3. **References**

1. ASTM C14, Specification for Concrete Sewer, Storm Drain and Culvert Pipe.
2. ASTM C76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
3. ASTM C443M-85a (1990), Specification for Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.
4. CSA A3000, Portland Cement.
5. CAN/CSA-A257, Series M92, Standards for Concrete Pipe.
6. CAN3-G401-M81, Corrugated Steel Pipe products.
7. Ontario Provincial Standard Specification MUNI 410.

1.4. **Material Certification**

1. Certification to be marked on pipe.

1.5. **Scheduling of Work**

1. Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

2. **PRODUCTS**

2.1. **Concrete Pipe**

1. Non-reinforced circular concrete pipe and fittings: to CAN/CSA-A-257-2, ASTM C14M, Class 3 designed for flexible rubber gasket joints to ASTM C443 M and CAN/CSA A257.
2. Reinforced circular concrete pipe and fittings: to CAN/CSA-A257, ASTM C76M, strength classification as indicated in the Contract Drawings, designed for flexible rubber gasket joints to ASTM C443M and CAN/CSA A257.
3. Manufactured tees for pipe-to-pipe connections.
4. Lifting holes:
 1. Pipe 900 mm and less diameter: no lift holes.

2. Pipe greater than 900 mm diameter: lift holes not to exceed two in piece of pipe.
3. Provide pre-fabricated plugs to effectively seal lift holes after installation of pipe.

2.2. PVC Pipe

Poly Vinyl Chloride pipe as specified in the Contract Drawings shall be in accordance with OPSS MUNI 410, Pipe Sewer Installation in Open Cut.

2.3. Trench drains

Trench drains as specified in the Contract Drawings shall be in accordance with manufacturers requirements.

2.4. Pipe Embedment, Surround and Cover Materials

1. Granular material to Section 31 05 17 – Aggregates.
2. Granular A to Section 31 23 13 – Site Grading
3. Pipe embedment shall be in accordance with OPSD 802.010

2.5. Backfill Material

1. Backfill shall be granular material as specified in Section 31 23 10 – Excavation, Trenching and Backfilling.

2.6. Joint Mortar

1. Portland cement: to CAN/CSA-A5, normal type 10.
2. Mortar: one part Portland cement to two parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.

3. EXECUTION

3.1. Preparation

1. Clean pipes and fittings of debris and water before installation and remove defective materials from site.

3.2. Trenching

1. Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Do not allow contents of any sewer or sewer connection to flow into trench.
3. Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3. Granular Bedding

1. Place granular bedding material to details indicated in bedding detail OPSD 802.010 to OPSD 802.054, depending on type of soil and pipe. Use Class B bedding and place bedding in unfrozen condition.

Type of soil to be defined in the field as Type 1, 2, 3, or 4 as per Health and Safety Act and Regulations for Construction Projects.

2. Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
3. Compact each layer full width of bed to at least 95% corrected maximum dry density.
4. Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
5. Shape transverse depressions as required to suit joints.
6. Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted granular backfill.

3.4. Installation of Storm Drainage Pipes

1. Lay and join pipe in accordance with manufacturer's recommendations and to approval of Consultant.
2. Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
3. Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
4. Do not exceed maximum joint deflection recommended by pipe manufacturer.
5. Do not allow water to flow through pipes during construction except as may be permitted by Consultant.
6. Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
7. Joints

1. Poly Vinyl Chloride Pipe

PVC Pipe as specified in the Contract Drawings shall be installed in accordance with OPSS MUNI 410, Pipe Sewer Installation in Open Cut.

8. When any stoppage of work occurs, restrain pipes as directed by Consultant, to prevent "creep" during down time.
9. Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
10. Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available. Support connections as per OPSD 708.020.

11. Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.
12. Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5. Pipe Surround

1. Place surround material in unfrozen condition.
2. Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated.
3. Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Pipe surround material to extend 300 mm above crown of pipe.
4. Place layers uniformly and simultaneously on each side of pipe.
5. Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

3.6. Backfill

1. Place backfill material in unfrozen condition.
2. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
3. Trench backfill shall be imported granular material consisting of Granular B Type I, or reclaimed granulars free of organics.
4. Trench backfill within the public right of way is to be unshrinkable fill.

3.7. Field Testing

1. Repair or replace pipe, pipe joint or bedding found defective.
2. When directed by Consultant, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
3. Remove foreign material from sewers and related appurtenances by flushing with water.

END OF SECTION

1. GENERAL

1.1. General Requirements

1. Read and be governed by the conditions of the *Contract Documents*, including sections of the Division 01.
2. Conform to the requirements stated in the General Conditions, Supplementary General Conditions of this Specification and all addenda.

1.2. Related Work

1. Excavating, Trenching and Backfilling Section 31 23 10
2. Aggregates: General Section 31 05 17

1.3. References

1. OPSS 1801 – Corrugated Steel Pipe Products
2. OPSS 1840 – Polyethylene Pipe Products
3. OPSS 1860 – Geotextiles
4. CSA G164-M1981 – Hot Dip Galvanizing of Irregularly Shaped Articles.
5. CGSB 41-GP-29Ma-1983 - Tubing, Plastic, Corrugated, Drainage

1.4. Material Certification

1. Certification to be marked on pipe.

1.5. Scheduling of Work

1. Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

2. PRODUCTS.

2.1. PVC Pipe

Poly Vinyl Chloride pipe as specified in the Contract Drawings shall be in accordance with OPSS 410, Pipe Sewer Installation in Open Cut.

2.2. Pipe Embedment, Surround and Cover Materials

1. Granular material to Section 31 05 17 – Aggregates.
2. Pipe embedment shall be in accordance with OPSD 802.010

2.3. Backfill Material

1. Backfill shall be granular material as specified in Section 31 23 10 – Excavation, Trenching and Backfilling.

3. EXECUTION

3.1. Preparation

1. Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.2. Trenching

1. Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
2. Do not allow contents of any sewer or sewer connection to flow into trench.
3. Trench alignment and depth to approval of Consultant prior to placing bedding material and pipe.

3.3. Granular Pipe Surround

1. Granular materials surrounding the pipe shall be in accordance with OPSS MUNI 1010.

3.4. Installation of Subdrains

1. Installation of subdrains is to be in accordance with OPSS MUNI 405.

3.5. Pipe Surround

1. Place surround material in unfrozen condition.
2. Pipe surround material shall be HL-8 Coarse Bedding Stone

3.6. Backfill

1. Place backfill material in unfrozen condition.
2. Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
3. Trench backfill shall be imported granular material consisting of Granular B Type I, or reclaimed granulars free of organics.
4. Trench backfill within the public right of way is to be unshrinkable fill.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Submittals
- .5 1.5 Closeout Submittals
- .6 1.6 Quality Assurance
- .7 1.7 Extended Warranty
- .8 2.1 Materials
- .9 3.1 Examination
- .10 3.2 Installation
- .11 3.3 Cleaning
- .12 3.4 Protection

1.3 SUMMARY

- .1 Section includes:
 - .1 *Supply* and installation of precast trench drain systems in the vehicle bays where indicated in the *Contract Documents*.
 - .2 Coordination with Divisions 21, 22 and 23 and the mechanical *Drawings* to ensure the proper connections are made to the sanitary drain system.

1.4 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this Section.
- .3 *Shop Drawings*:
 - .1 Submit *Shop Drawings* showing layout, profiles, product components, base material, surface finish (inside and out), hardware, and attachment and anchorage devices.
 - .2 *Shop Drawings* shall indicate field measurements taken at the *Place of the Work* prior to fabrication.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.

.2 Operation and maintenance data:

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

.3 Maintenance materials:

- .1 Submit special tools required for accessing, assembly/disassembly, maintenance or removal of precast trench drain systems.

1.6 QUALITY ASSURANCE

.1 Qualifications:

- .1 Installers / applicators / erectors: The *Contractor* shall *Provide* work of this Section, executed by competent installers with a minimum of five years' experience in application of *Products*, systems and assemblies specified, and with approval and training of *Product* manufacturers.

1.7 EXTENDED WARRANTY

- .1 The *Contractor* shall warrant work of this Section in accordance with Section 01 78 36 -Warranties for a period of two years and as specified in Article A-15 – Warranty Period of the Agreement Between *Owner* and *Contractor*.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Trench drains to be Northstar Industries 'MEADRAIN Supreme - System EN 2000', tel: 1-800-871-4547, or *Equivalent*, and to the following specifications:
- .1 Channel body polymer concrete in 1000 (39 3/8") lengths, with built-in cast iron black coated steel rail. Stepped system with Profix boltless stainless steel locking system or *Equivalent*. Ductile iron grates to be hot dip galvanized.
- .2 Catch Basin: FTC-223 with hot dip galvanized grate or *Equivalent*.
- .3 End caps to be polymer concrete with coated black steel rail.
- .4 Sealant and installation devices to be used.

PART 3- EXECUTION

3.1 EXAMINATION

- .1 Verify actual measurements/openings by field measurements before fabrication.
- .2 Show recorded measurements on *Shop Drawings*.

3.2 INSTALLATION

- .1 Installation shall be in accordance with the manufacturer's instructions.

3.3 CLEANING

- .1 Upon completion of the work of this Section, thoroughly clean all trench drain systems in accordance with the manufacturer's recommendations.
- .2 Remove all rubbish and debris caused by the work of this Section.

- .3 Any cutting or damage done to the work of other Sections by the work of this Section, shall be made good to the satisfaction of the affected section and will not be considered or approved as a change in the *Work*.

3.4 PROTECTION

- .1 Protect the installed trench drain system and finish surfaces from damage during subsequent construction activities.

END OF SECTION