DURHAM CATHOLIC DISTRICT SCHOOL BOARD

EIGHT CLASSROOM ADDITION

ST. LUKE THE EVANGELIST

CATHOLIC SCHOOL

55 TWIN STREAMS ROAD, WHITBY ON, L1P1N9

Request for Tender

T27-01

Project 25062

Date: November 4, 2026

BARRY BRYAN ASSOCIATES
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250 Water Street, Suite 201
Whitby, ON L1N 0G5

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A102	Enlarged Demolition Site Plan	5	-	Nov. 3, 2026
A103	Part Detail Site Plan	2	-	Nov. 3, 2026
A104	Site Details	5	-	Nov. 3, 2026
A201	Overall Key Plans & Life Safety Plans	6	-	Nov. 3, 2026
A202	Part Demolition Plans	5	-	Nov. 3, 2026
A203	Part First Floor Plan	6	-	Nov. 3, 2026
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A205	Part Roof Plan	6	-	Nov. 3, 2026
A206	Part First Floor Plan & Reflected Ceiling Plan - Change Room	4	-	Nov. 3, 2026
A207	Part First Floor Reflected Ceiling Plan	4	-	Nov. 3, 2026
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A209	Part First Floor Finishes Plan	3	-	Nov. 3, 2026
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A211	Miscellaneous Floor Plans	2	-	Nov. 3, 2026
A301	Part Elevations	5	-	Nov. 3, 2026
A401	Building Sections	4	-	Nov. 3, 2026
A405	Wall Sections	4	-	Nov. 3, 2026
A406	Wall Sections	4	-	Nov. 3, 2026
A501	Stair Plans, Sections & Details	3	-	Nov. 3, 2026
A502	Stair Sections & Details	2	-	Nov. 3, 2026
A601	Plan Details	3	-	Nov. 3, 2026
A602	Plan Details	2	-	Nov. 3, 2026
A603	Roof Details	2	-	Nov. 3, 2026
A605	Section Details	3	-	Nov. 3, 2026

Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
A606	Section Details	3	-	Nov. 3, 2026
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A801	Millwork Plans & Elevations	3	-	Nov. 3, 2026
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A901	Schedules	3	-	Nov. 3, 2026
CIVIL				
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C002	Grading and Erosion Control Plan	2	-	Oct. 19, 2026
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S102	General Notes, Schedules & Typical Details	3	-	Nov. 3, 2026
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S201	Part Foundation Plans	3	-	Nov. 3, 2026
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S203	Foundation Plan	3	-	Nov. 3, 2026
S204	Second Floor Framing Plan	3	-	Nov. 3, 2026
S205	Roof Framing Plan & Wind Uplift Diagram	3	-	Nov. 3, 2026
S206	Roof Screen Framing Plan	3	-	Nov. 3, 2026
S501	Sections & Details	3	-	Nov. 3, 2026
S502	Sections & Details	3	-	Nov. 3, 2026
S503	Sections & Details	3	-	Nov. 3, 2026
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M203	Roof Plan – Plumbing	4	-	Nov. 3, 2026
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Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
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M301	First Floor Plan – HVAC	4	-	Nov. 3, 2026
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M304	Existing Mechanical Room Plans – HVAC	4	-	Nov. 3, 2026
M310	Second Floor Boiler Room Plan - HVAC Piping Demo.	4	-	Nov. 3, 2026
M311	First Floor Plan - HVAC Piping	4	-	Nov. 3, 2026
M312	Second Floor Plan - HVAC Piping	4	-	Nov. 3, 2026
M313	Second Floor Boiler Room Plan - HVAC Piping New	4	-	Nov. 3, 2026
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M315	Existing Roof Plan - HVAC Piping	4	-	Nov. 3, 2026
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M402	Change Room Renovation – New	4	-	Nov. 3, 2026
M410	Existing Gym Modifications	4	-	Nov. 3, 2026
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M600	Mechanical - Typical Details #1	4	-	Nov. 3, 2026
M601	Mechanical - Typical Details #2	4	-	Nov. 3, 2026
M602	Mechanical - Typical Details #3	4	-	Nov. 3, 2026
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M610	Mechanical Equipment Details	4	-	Nov. 3, 2026
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M700	Mechanical Schedules #1	4	-	Nov. 3, 2026
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E002	Electrical Riser Diagram	4	-	Nov. 3, 2026
E003	Panel Schedule	4	-	Nov. 3, 2026
E004	Fire Alarm Schedule	4	-	Nov. 3, 2026
E005	Fire Alarm Active Graph	4	-	Nov. 3, 2026

Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
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E202	Electrical Demolition Plan (2)	4	-	Nov. 3, 2026
E301	Electrical Lighting Additional Plan - First Floor	4	-	Nov. 3, 2026
E302	Electrical Lighting Additional Plan - Second Floor	4	-	Nov. 3, 2026
E401	Electrical Power and F.A. Additional Plan - First Floor	4	-	Nov. 3, 2026
E402	Electrical Power and F.A. Additional Plan - Second Floor	4	-	Nov. 3, 2026
E403	Electrical Power Additional Plan - Roof Floor	4	-	Nov. 3, 2026
E404	Electrical Modification Plan – First Floor Washroom	4	-	Nov. 3, 2026
E405	Electrical Modification Plan – Second Floor	4	-	Nov. 3, 2026
E406	Electrical Modification Plan – Gym Area	4	-	Nov. 3, 2026
E407	Electrical Modification Plan – Second Floor	4	-	Nov. 3, 2026
E408	Electrical Modification Plan – Second Floor	4	-	Nov. 3, 2026
E501	Electrical Detail (1)	4	-	Nov. 3, 2026
E601	Electrical Room Controller Detail (1)	4	-	Nov. 3, 2026
E602	Electrical Room Controller Detail (2)	4	-	Nov. 3, 2026

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Work covered by Contract Documents

.2 Owner

.3 Place of the Work

.4 Approved Vendors

.5 Site access

.6 Work sequence

.7 Contractor use of premises

.8 Engineer design

.9 Designated substances: ACM and others

.10 Building smoking environment

.11 Special conditions

.12 Site security

.13 Security clearance

.14 “By Others”

.15 Protection of Drawings

1.2 Work Covered by Contract Documents

.1 Work of this Contract comprises the construction of the Eight Classroom Addition St. Luke The Evangelist Catholic School Request for Tender T27-01 as indicated on the Contract Drawings and Specifications.

1.3 Owner

.1 Durham Catholic District School Board, 650 Rossland Road West Oshawa, ON L1J 7C4

1.4 Place of the Work

.1 The Work of this Contract is located at 55 Twin Streams Road, Whitby On, L1P1N9

1.5 Approved Vendors

.1 Refer to the Durham Catholic District School Board, List of approved vendors.

1.6 Metric Project

.1 This project is to be based on The International System of Units (SI). Measurements are expressed in metric (SI) units.

.2 All dimensions are to be shown in meters and millimeters.

1.7 Site Access

.1 Access to the site to be arranged by the Owner.

.2 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work

.3 Provide secure construction fencing as specified and where indicated.

1.8 Work Sequence

.1 Construct Work continuously during working hours permitted by the Owner.

1.9 Contractors Use of Premises

.1 Contractor has restricted use of site and existing building until Substantial Performance.

1.10 Engineer Design

.1 Where specifications require work to be designed by an engineer, engage an engineer licensed in the Province of Ontario to design such work. Refer to Section 01 78 00.

1.11 Designated Substances: ACM and Others

.1 The Owner shall provide any prospective constructor or contractor a copy of building ACM surveys and information on designated substances that are known or suspected of being present within the area or scope of work.

.2 The General Contractor shall ensure that a copy of the ACM survey is provided to each contractor and subcontractor who will be working on the Project.

.3 Any findings of undeclared ACM, or damaged ACM that could pose a risk to workers is to be brought to the attention of the Owner immediately, and work is to be stopped.

.4 All project design and construction activities must be carried out in compliance with the Regulations.

.5 No asbestos-containing materials, as defined by O. Reg. 278/05, may be specified or used in any project.

1.12 Verification

.1 All dimensions shall be verified on site, and all necessary modifications and adjustments shall be made as necessary to suit.

1.13 Building Smoking Environment

.1 Smoking and vaping are prohibited in all work places within the Owner's buildings and on the Owner's property.

1.14 Special Conditions

.1 The following general and special conditions apply:

.1 All existing surfaces and finishes are to be repaired wherever damaged during the course of the Work.

.2 Wherever existing floor and wall finishes are to be removed, include full removal down to the existing substrate of all tile, base, mortars, grouts, waterproofing membranes and adhesives in accordance with TTMAC recommended procedures. Patch and repair existing substrate to the quality required by the new finish material manufacturer for the installation of their products.

.3 All openings in existing fire rated assemblies or fire separations which are created by the removal of existing services, plumbing, conduit, ductwork, fittings fixtures or accessories are to be firestopped to maintain the integrity of the existing construction.

.4 All exposed interior surfaces except prefinished surfaces shall be painted whether referred to in the specifications and drawings or not.

1.15 Site Security

.1 Daily Inspection: Provide inspection of the work areas daily while the work is in progress and take whatever measures are necessary to secure the construction zones from theft, vandalism and unauthorized entry.

1.16 Security Clearance

.1 Personnel employed on this project will be subject to security check in accordance with DCDSB Policy PO314 Criminal Background Checks and Offence Declarations.

.2 The Durham Catholic District School Board has the responsibility under the law to provide a safe and secure working and learning environment for students and employees. To ensure the safety of all staff and students, and in accordance with Ontario Regulation 521/01- Collection of Personal Information, the Board will collect criminal background checks for all service providers who have direct and regular contact with students.

1.17 "By Others"

.1 The term "by others" where it is used in the contract documents means that work shown or described in the contract documents and labeled with this designation is not included in the specific sub-trade's scope of work but will be required to be done within the General Contractor's contract.

1.18 Use of Drawings

.1 Drawings are not to be scaled.

.2 Copies of architectural and structural "issued for construction" drawings in digital format will be made available for the contractors use under the following conditions.

.1 Copyright remains with BBA.

.2 The drawings will only be used for shop drawings for this project and not be put to any other use.

.3 BBA assumes no liability for errors or omissions in the drawings. The Contractor assumes all risk and expenses associated with the use of drawings in the production of his work.

.4 References to BBA and other Consultants must be deleted from the title block.

.5 The Contractor signs a release available from BBA that addresses the above items in more detail.

.3 Arrangements for use of Sub-Consultant drawings must be made with the Appropriate Sub-Consultant.

1.19 Protection of Drawings

.1 Copyright of electronic document belongs to the Consultant. Electronic documents may not be forwarded to others, transmitted, downloaded or reproduced in any format, whether print or electronic, without the express, written permission of the copyright owner.

.2 Drawings, specifications and other contract related documents which are posted on Contractor controlled websites for access by sub-trades and suppliers, shall be posted only on password protected platforms with access only to those parties with an expressed interest in the Project.

.3 Provide Consultant and Owner with access to such websites as noted above.

PART 2 PRODUCTS

3.1 Not Used

.1 Not used

PART 3 EXECUTION

3.2 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Consultants

.1 ARCHITECT:

Barry Bryan Associates

201 - 250 Water Street

Whitby, Ontario L1N 0G5

Tel: (905) 666-5252

Attention: Ms. Rhonda Sukumaran OAA, B.Arch.

.2 STRUCTURAL ENGINEER:

Barry Bryan Associates

201 - 250 Water Street

Whitby, Ontario L1N 0G5

Tel: (905) 666-5252

.3 MECHANICAL ENGINEER:

RDZ Engineering

17A-30 Pennsylvania Avenue,

Vaughan, ON L4K 4A5

.4 ELECTRICAL ENGINEER:

RDZ Engineering

17A-30 Pennsylvania Avenue,

Vaughan, Ontario L4K 4A5

.5 CIVIL ENGINEER:

Monument

335 Hwy 49,

Deseronto, Ontario K0K 1X0

Tel: (613) 800-1579

info@monumentge.com

PART 2 PRODUCTS

3.1 Not Used

.1 Not used

PART 3 EXECUTION

3.2 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Cash Allowances

1.2 References

.1 Canadian Construction Documents Committee CCDC2-2020 Stipulated Price Contract including the Supplementary Conditions.

1.3 Cash Allowances

.1 Refer to General Conditions, GC4.1.

.2 Unless otherwise specified, Cash Allowances shall cover the cost of the materials and equipment delivered F.O.B. job site, and all applicable taxes, except Harmonized Sales Tax. The Contractor's handling costs on the site, labour, installation costs, overhead and profit and other expenses shall be included separately in the Stipulated Price and not in the Cash Allowance.

.3 Where it is specified that a Cash Allowances is to include both supply and installation costs, such allowances shall cover the cost of the materials and equipment delivered and unloaded at the site, all applicable taxes and the contractor’s handling costs on the site, labour and installation costs and other expenses, except overhead and profit which shall be included separately in the Stipulated Price.

.4 If the cost of the Work covered by Cash Allowances, when determined, is more or less than the allowance, the Contract Sum shall be adjusted accordingly.

.5 In the event that the cost of the work covered by Cash Allowances should exceed the cash allowance, while the Contract Sum will be adjusted in conformity therewith, there shall be no adjustment to the Contractor's fee or other expenses such as overhead or profit, it being understood and agreed that the contract sum includes the Contractor's expenses and profit for all Cash Allowances whether or not they are exceeded.

.6 Progress payments on accounts of work authorized under Cash Allowances shall be included in monthly certificate for payment.

.7 Expenditures from Cash Allowances shall be authorized by Site Instruction, Change Directive or Change Order.

.8 Cash Allowance for independent inspection and testing shall cover the cost of such services as provided by independent testing agency only. The Contractor's cost for labour, overhead and other expenses related to independent inspection and testing shall be included separately in the Stipulated Price and not in the Cash Allowance.

.9 Cause the work covered by Cash Allowances to be performed for such amounts and by such persons as the Consultant may select and direct or as required by the project drawings and specifications.

.10 Amount of each allowance, for Work specified in respective specification Sections is as follows:

.1 Independent Inspection and Testing: $50,000.00

.2 Interior & Exterior Building Signage: $8,000.00

.3 Supply only of Finishing Hardware: $44,000.00

.4 Security Vendor: $22,000.00

.5 Abatement of Designated Substances: $20,000

.6 Contingency Allowance: $200,000.00

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Requests for Substitution (RFS) prior to execution of Contract.

.2 Requests for Substitution (RFS) after execution of Contract.

1.2 Definitions

.1 Products Not Available: When all listed manufacturer's products in the specification Section are no longer manufactured.

.2 Proprietary Specification: A specification which includes one or more proprietary names of products or manufacturers, or both, and may also include descriptive, reference standard, or performance requirements, or any combination thereof.

.3 Non-proprietary Specification: A specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does not include proprietary names of products or manufacturers.

.4 Substitution: A product or manufacturer not specified by proprietary name, which may be acceptable in place of a product or manufacturer which, is specified by proprietary name.

1.3 Procedures

.1 Product Options:

.1 For products specified by non-proprietary specification:

.1 Select any product by any manufacturer, which meets requirements of Contract Documents.

.2 For products specified by proprietary specification:

.1 Select any product or manufacturer named, or

.2 Substitute an unnamed product or manufacturer in accordance with Substitutions – Manufacturers article of this Section.

.3 For products specified by proprietary specification and accompanied by words indicating that substitutions will not be accepted:

.1 Select any product or manufacturer named; substitutions are not permitted.

.2 Substitution Requests Prior to Execution of Contract: Submit substitutions requests to Consultant no later than the time stated in the Instructions to Bidders.

1.4 Substitutions – Products

.1 Substitute Products: Where substitute products are permitted, unnamed products may be accepted by the Consultant, subject to the following:

.1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the specified products.

.2 Substitutions for Cause: Changes proposed by Subcontractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

.3 Substitutions for Convenience: Changes proposed by Subcontractor or Contractor that are not required in order to meet other Project requirements but may offer advantage to Contractor or Subcontractor.

1.5 Substitutions – Manufacturers

.1 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers may be accepted by the Consultant, subject to the following:

.1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturers.

.2 In making a substitution Contractor and the Subcontractor represents that they have:

.1 Investigated substitute product or manufacturer, or both, and determined it meets or exceeds the criteria of the specified product, and;

.2 Will provide the same warranty for the Substitution as for the specified product.

.3 Will make any changes to the Work necessitated by substitution as required for Work to be complete in all respects, and;

.4 Waives claims for additional costs and time caused by substitution which may subsequently become apparent.

.5 Will reimburse Consultant’s services for review or redesign, additional studies, investigations, review of submittals, and associated contract administration.

.6 Received necessary approvals of authorities having jurisdiction.

.7 Investigated the proposed substitute to determine if license fees and royalties are pending.

.8 If accepted, the substitution will not adversely affect the Construction Schedule.

.3 Do not install requested Substitutions without Consultant’s acceptance.

.4 If, in the Consultant’s opinion, a substitution does not meet requirements of Contract

Documents, Contractor shall, at no extra cost to Owner, provide a product which, in the Consultant's opinion, does meet requirements of Contract Documents.

1.6 Proprietary Specifications

.1 Notwithstanding specified proprietary names of either or both products or manufacturers, products provided shall meet other applicable requirements of Contract Documents. Modify products if necessary, to ensure compliance with all requirements of Contract Documents.

1.7 Changes to Accepted Products and Manufacturers

.1 Products and manufacturers accepted by the Consultant for use in performance of Work of Contract shall not be changed without Consultant's written consent. .

.2 Submit requests to change accepted products and manufacturers to Consultant in writing, including product data indicated in Product Data article.

1.8 Product Data

.1 When requested by the Consultant, submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:

.1 Product identification, including manufacturer's name and address.

.2 Manufacturer's literature providing product descriptions, applicable reference standards, performance and test data, in form consistent with the Contract Documents and readily comparable with product being substituted and can provide the specified and indicated requirements.

.3 Samples, as applicable.

.4 Name and address of projects on which product has been used and date of each installation.

.5 Itemized comparison of substitution with named product(s). List significant variations.

.6 Designation of availability of maintenance services and sources of replacement materials

.7 Completed Substitutions Request Form. Incomplete forms will be rejected.

1.9 Consultant Procedure

.1 In reviewing the supporting data submitted for substitutions, Consultant will use, for purposes of comparison, all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Specifications.

.2 Consultant will review supporting data and will determine that the substitution in the Consultant's opinion is or is not able to meet or exceed the standards of quality, appearance and performance to the material specified.

.3 Consultant will sign, date and issue the RFS indicating acceptance or refusal, with applicable pre-contract or contract documentation, to affected participants.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Requests for Information

1.2 Request for Information (RFI)

.1 A request for information (RFI) is a formal process used during the Work to obtain an interpretation of the Contract Documents or to obtain additional information.

.2 An RFI shall not constitute notice of claim for a delay.

1.3 Submittal Procedures

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Number RFI's consecutively in one sequence in order submitted, in numbering system as established by the Contractor.

.3 Submit one distinct subject per RFI form. Do not combine unrelated items on one form.

.4 RFI Form:

.1 Submit a draft "Request for Information" form to be approved by the Owner and Consultant.

.2 Submit RFI's to the Consultant on approved "Request for Information" form. The Consultant shall not respond to an RFI except as submitted on this form.

.3 Where RFI form does not have sufficient space to provide complete information thereon, attach additional sheets as required.

.4 Submit with RFI form all necessary supporting documentation.

.5 RFI Log:

.1 Maintain log of RFI's sent to and responses received from the Consultant, complete with corresponding dates.

.2 Submit updated log of RFI's at each construction meeting.

.6 Submit RFI's 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 so will not be paid by the Owner.

.7 Only the Contractor shall submit RFI's to the Consultant.

.8 RFI's submitted by Subcontractors or Suppliers directly to the Consultant will not be accepted.

1.4 Screening of RFI's

.1 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. 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.

1.5 Response to RFI's

.1 Consultant shall review RFI's from the Contractor submitted in accordance with this section with the following understandings:

.1 Consultant's response shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Price or Contract Time or changes in the Work.

.2 Only the Consultant shall respond to RFI's. Responses to RFI's received from entities other than the Consultant shall not be considered.

1.6 Response Timing

.1 Allow 5 Working Days for review of each RFI by the Consultant.

.2 Consultant's review of RFI commences on date of receipt of RFI submission by the Consultant from Contractor and extends to date RFI returned by Consultant.

.3 When the RFI submission is received by Consultant before noon, review period commences that day. When RFI submittal is received by Consultant after noon, review period begins on the next Working Day.

.4 If, at any time, the Contractor submits a large enough number of RFI's or the Consultant considers the RFI to be of such complexity that the Consultant cannot process these RFI's within 5 Working Days, the Consultant will confer with the Contractor within 3 Working Days of receipt of such RFI's, 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 among the RFI's submitted. The Contractor shall accommodate such necessary time at no increase in the Contract Time and at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Preconstruction Conference

.2 Project Meetings

.3 On Site Documents

.4 Cost Breakdown

1.2 Preconstruction Conference

.1 The Consultant will call for and administer a Preconstruction Conference at time and place to be announced.

.2 Contractor, all major Subcontractors, and major suppliers shall attend the Preconstruction Conference.

.3 Agenda will include, but not be limited to, the following items.

.1 Permits

.2 Lines of communication and contact information

.3 Submittal and RFI procedures

.4 Schedules

.5 Personnel and vehicle permit procedures

.6 Use of premises

.7 Location of any Contractor on-site facilities

.8 Security

.9 Housekeeping

.10 Inspection and testing procedures, on-Site and off-Site

.11 Control and reference point survey procedures

.12 Health and safety

.13 Contractor’s Schedule of Values

.14 Contractor’s Schedule of Submittals

.4 The Consultant will distribute copies of minutes to attendees. Attendees shall have seven days to submit comments or additions to minutes. Minutes will constitute final documentation of results of Preconstruction Conference.

1.3 Project Meetings

.1 The Consultant will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

.2 Meetings will be held minimum bi-weekly.

1.4 On-Site Documents

.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings, product data, and samples.

.5 Requests for Information (RFI's)

.6 Change Orders and other modifications to Contract.

.7 Field test reports.

.8 Inspection certificates.

.9 Manufacturer's certificates.

.10 Geotechnical reports

.11 DSS reports

.12 Approved Work schedule.

.13 Manufacturers' installation and application instructions.

.14 Safety Data Sheets (SDS).

.15 Health and Safety Plan and other safety related documents.

.16 Other documents as specified.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Consultant.

1.5 Cost Breakdown

.1 Submit a detailed cost breakdown to Consultant at least ten working days prior to the submission of the first progress claim. After approval by Consultant the cost breakdown will be used as basis for progress payment.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Submittals.

.2 Schedules.

.3 Format.

.4 Submission.

.5 Critical Path Scheduling.

.6 Submittals Schedule.

1.2 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.3 Schedules Required

.1 Submit schedules as follows:

.1 Construction Progress Schedule.

.2 Submittal Schedule for Shop Drawings and Product Data.

.3 Submittal Schedule for Samples.

.4 Product Delivery Schedule.

.5 Cash Allowance Schedule for purchasing Products or Services.

.6 Shutdown or Closure Activity.

1.4 Format

.1 Prepare schedule in form of a horizontal bar chart using Microsoft Project 2016 or later.

.2 Provide a separate bar for each major item of work, trade or operation.

.3 Split horizontally for projected and actual performance.

.4 Provide horizontal time scale identifying first work day of each week.

.5 Format for listings: chronological order of start of each item of work.

.6 Identification of listings: By Systems description.

1.5 Submission

.1 Submit initial format of schedules within 10 working days after award of Contract.

.2 Submit schedules in electronic format, by email as PDF files.

.3 Consultant will review schedule and return reviewed copy within 10 days after receipt.

.4 Resubmit finalized schedule within 7 days after return of reviewed copy.

.5 During progress of Work revise and resubmit schedule as directed by Consultant.

.6 Submit revised progress schedule with each application for payment.

.7 Distribute copies of revised schedule to:

.1 Job site office.

.2 Subcontractors.

.3 Other concerned parties.

.4 Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.

.8 Table current and up to date schedule at each regular site meeting.

1.6 Critical Path Scheduling

.1 Include complete sequence of construction activities.

.2 Schedules shall represent a practical plan to complete the work within the Contract period, and shall convey the plan to execute the work. Schedules as developed shall show the sequence and interdependencies of activities required for complete performance of the work.

.3 The submittal of schedules shall be understood to be the Contractor's representation that the schedule meets the requirements of the Contract Documents and that the work will be executed in the sequence and duration indicated in the schedule.

.4 Failure to include any element of work required for performance of the Contract or failure to properly sequence the work shall not excuse the Contractor from completing all work within the Contract Time.

.5 All schedules shall be developed utilizing industry standard 'best practices' including, but not limited to:

.1 No open-ended activities.

.2 No use of constraints other than those defined in the Contract Documents without the prior approval of the Consultant.

.3 No negative leads or lags.

.4 No excessive leads or lags without prior justification and approval from the Consultant.

.5 For individual schedule construction activities, do not exceed 14 days in duration without prior approval of the Consultant. Subdivide activities exceeding 14 days in duration to an appropriate level.

.6 Sufficiently describe schedule activities to include what is to be accomplished in each work area. Express activity durations in whole days. Clearly define work that is to be performed by subcontract.

.7 Create the schedule in conformance with the work-hours and constraints set forth in these Contract Documents.

.6 Include dates for commencement and completion of each major element of construction.

.7 Show projected percentage of completion of each item as of first day of month.

.8 Indicate progress of each activity to date of submission schedule.

.9 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.10 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

1.7 Submittals Schedule

.1 Include schedule for submitting shop drawings, product data, and samples. Indicate manufacture and delivery lead times into the shop drawing submittal schedule.

.2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Administrative

.2 Requests for Information

.3 Shop Drawings and Product Data

.4 Interference Drawings

.5 Samples

.6 Mock-Ups

.7 Certificates and Transcripts

.8 Progress Photographs

1.2 Administrative

.1 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in metric units.

.4 Where items or information is not produced in metric units converted values are acceptable.

.5 Verify field measurements and affected adjacent work are coordinated.

.6 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review.

.7 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant’s review.

.8 Keep one reviewed copy of each submission on site.

1.3 Requests for Information (RFI’s)

.1 Refer to Section 01 26 15 – Requests for Information

1.4 Shop Drawings and Product Data

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, product data and other data which the Contractor provides to illustrate details of a portion of Work.

.2 Coordinate each submission with requirements of Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

.3 Submit shop drawings bearing stamp and signature of qualified professional Engineer registered or licensed in the Province of Ontario where required by the individual specification sections. Each submittal and each resubmittal must bear the stamp of the Engineer

.4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.5 Prior to submission to Consultant, review all submitted drawings. By this review, Contractor represents to have determined and verified field measurements, site conditions, materials, catalogue number and similar data and to have checked and coordinated each drawing with the requirements of Work and of Contract Documents. Contractor's review of each drawing shall be indicated by stamp, date and signature of a responsible person.

.6 At time of submission, notify Consultant in writing of any deviations in drawings from the requirements of the Contract Documents.

.7 Allow ten days for Consultant's review of each submission.

.8 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.9 Make any changes in submitted drawings which Consultant may require, consistent with Contract Documents and resubmit unless otherwise directed by Consultant. When resubmitting, notify Consultant in writing of any revisions other than those requested by Consultant.

.10 Accompany submissions with transmittal letter containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.11 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

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

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.12 After Consultant's review, distribute copies.

.13 Submit one electronic copy in PDF format of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.14 Submit electronic copy in PDF format of product data sheets or brochures for requirements requested in Specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.15 Delete information not applicable to project.

.16 Supplement standard information to provide details applicable to project.

.17 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.18 The review of shop drawings by the Consultant is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.5 Interference Drawings

.1 Prepare interference drawings to coordinate the installation of the work of all sections, within available space. Conflicts between trades which could be determined beforehand, by the careful coordination and preparation of interference drawings, shall be corrected at no expense to the Owner.

.2 Prepare interference drawings of all buried services as necessary to avoid conflicts with new or existing structures, foundations or services.

.3 Submit interference and equipment placing drawings as specified in Section 01 71 00, when requested by the Consultant.

Mock-Ups

.4 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.6 Samples

.1 Submit for review samples as requested in respective specification Sections. Label samples with origin, manufacturer, product information, applicable specification section,

and intended use.

.2 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.3 Where colour, pattern or texture is criterion, submit full range of manufacturer's samples.

.4 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.5 Make changes in samples which Consultant may require, consistent with Contract Documents.

.6 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.7 Progress Photographs

.1 Progress photograph to be electronically formatted and labelled as to location and view.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Contractor Use of Premises

.2 Owner's use of Existing Building

.3 Dust Control

.4 Protection

.5 Emergency and Fire Protection

.6 Temporary Exhaust

.7 Hoisting of Materials and Equipment

1.2 Contractor Use of Premises

.1 Limit access of construction personnel to existing building only at locations approved by the Owner, and only when necessary to perform work within the existing building. Any other access by contractors is strictly prohibited.

.2 Ensure that construction personnel perform work in existing building only as required under the Contract; and that they do not use it as access to work areas, except for work in existing building, or for other purposes.

.3 Use of washroom and services in existing building by construction personnel is strictly prohibited.

.4 Construction personnel shall use areas of the existing building for their purposes only as designated by the Owner and only while Work is in progress. Prohibit lounging. Keep assigned areas clean and return them to an "as was" condition at completion of construction.

.5 Do not take meal and coffee breaks in the existing building. Provide space in site trailer for workers' breaks.

.6 Smoking is strictly prohibited on the Owner's property.

.7 Keep traffic through existing occupied areas to an absolute minimum in executing the Work.

.8 Minimize noise, dust, and odours to ensure staff in areas adjacent to the construction area are disturbed as little as possible. Implement immediate corrective action to cease or limit disagreeable annoyances to staff and public upon notification by Owner.

.9 Make good damage to building, fixtures, and fittings caused during use by construction personnel by replacement with new work. Include cost of installation and making good of other work thereby affected in replacement.

.10 Assume total responsibility for security of construction areas within the existing building upon commencement of Work, particularly where construction areas are exposed to the exterior. Secure construction areas by methods compatible with the total security established for building.

.11 Construction personnel shall use areas of the existing buildings only in a manner as determined by the Work.

.12 Arrange with the Owner for appropriate times for doing cutting and coring operations.

1.3 Owner's Use of Existing Building

.1 The existing building will remain in use throughout the duration of construction of the new building.

.2 The Owner will maintain control over operation of building systems during construction.

.3 Maintain fire department access to existing building.

.4 Maintain existing exits and always provide proper and safe means of egress from all parts of the existing building to open spaces to the approval of jurisdictional authorities. Identify, provide exit lights, and illuminate temporary means of egress.

.5 Execute work in existing building at times approved by Owner, so not to inconvenience their occupation or in any manner hinder their use of building.

.6 Give Owner minimum 14 working days of notice of intention to commence work in a room or area of existing building.

.7 Execute work as quietly as possible in and around existing building while Owner is occupying it. Schedule noisy operations with Owner to achieve least disturbance to ongoing activities and programming.

1.4 Dust Control

.1 Obtain and refer to the Designated Substances Report provided by the Owner. Take all precautions necessary to comply with legislated requirements for the control and spread of dust to occupied areas of the building. Controls shall include but not be limited to the use of HEPA filters on grinding equipment and saws, the installation of temporary filters or screens on air intake systems and the installation of dust tight screens and covers over all openings including doors, archways, windows and louvres.

.2 Prior to any work being done or removal of ceiling tiles or opening of ceiling access hatches, erect a floor to ceiling dust tight partition which completely encloses the area of work;

.1 Maintain barriers throughout the work and repair or replace as required or instructed.

.2 Completely remove barrier when work is finished and remove any marks left by tape or studs.

.3 Provide dust tight partitions to prevent dust and dirt migrating from the work area. Remove when no longer required.

.4 Post "Construction Zone" signage outside barrier and entrance to all work areas.

.5 Take precautions when working on existing ceilings, ducts and piping systems.

.6 Protect workers with the following minimum requirements:

.1 Carefully remove acoustical ceiling panels keeping horizontal if possible, and vacuum and clean the panels immediately upon removal.

.2 Clean air ducts, conduits and space above the ceiling with a HEPA filter equipped vacuum cleaner prior to start of any work.

.7 Throughout the work period, ensure that:

.1 Plastic barrier flaps or doors to construction area remain closed.

.2 Place adhesive floor strips or walk-off mats outside the door to the construction area.

.3 Clean and vacuum construction and surrounding areas frequently with vacuum cleaners Equipped with HEPA filters.

.4 Vacuum carpeted areas daily or more often if necessary

.5 Shampoo carpets when the construction work is complete.

.6 Remove dust from body and clothing when traversing Owner occupied areas.

.7 Carts, tools and equipment entering the construction area should remain there until the work is complete. Clean thoroughly prior to removal from the construction area.

1.5 Protection

.1 Protect staff and visitors from any danger arising from work. Supply, erect, maintain and remove signs, barricades, barriers, etc. as required. Sharp tools and dangerous objects must not be left unattended.

.2 The job site shall always remain clean and tidy. Only those materials required each day are to be brought to the job site.

.3 Remove all garbage and scrap from work site daily, or more often if required. Owners recycle containers and garbage bins shall not be used.

.4 Fire routes or personnel thoroughfares must not be obstructed. Fire doors must not be wedged open or latches disengaged.

.5 Safety clearances are required before any cutting, welding, core drilling, open flame work or dust work is done. A request in writing to the Owner must be made and approved a minimum of 72 hours before this work is anticipated.

1.6 Emergency and Fire Protection

.1 Provide and maintain ready access to firefighting equipment.

.2 While work is proceeding in existing building, existing fire hoses and fire extinguishers shall be used as required. Recharge fire extinguishers if used and re-rack hoses.

.3 Provide temporary portable fire extinguishers throughout the work and at every work area.

.4 Prior to execution of any work which may possibly start a fire, provide proper and suitable precautions and fire extinguishers. Provide fire-watch during and for minimum 6 hours after all welding operations.

1.7 Temporary Exhaust

.1 Maintain areas of construction and demolition under negative pressure during the work. Employ minimum 400 L/s temporary exhaust system to provide directional airflow from occupied space through dust screens.

.2 Provide and maintain during the work, temporary exhaust system discharging to the building exterior, consisting of discharge ducts, exhaust fan, atmospheric draft damper, temporary duct with taped joints from exhaust fan through new opening in the building envelope and extract points within each contained construction area. Make good roof opening upon removal.

1.8 Hoisting of Materials and Equipment

.1 Movement of materials and equipment that requires hoisting above, or movement through, occupied grounds beyond hoarding lines shall not be performed without prior knowledge and approval from the Owner. Schedule such activity to coincide with Owner's scheduling so as not to be performed when staff are on parking lots and areas of site within close proximity to areas of work.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Administrative

.2 Fires

.3 Disposal of Wastes

.4 Drainage

.5 Site Clearing and Plant Protection

.6 Pollution Control

.7 Unanticipated Soil Contamination

1.2 References

.1 Statutes of Canada 1999 Chapter 33.

.1 Canadian Environmental Protection Act 1999.

.2 SOR/2003-289. Federal Halocarbon Regulations, 2003.

.3 Transportation of Dangerous Goods Act, 1992 (1992, c. 34)

.2 OPSS 805 Construction Specification for Temporary Erosion and Sediment Control Measures

.3 Province of Ontario Environmental Protection Act, R.S.O. 1990, c. E.19

.4 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management

1.3 Administrative

.1 Comply with all federal, provincial, and municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, including those referenced above.

.2 Failure to comply with environmental requirements may result in a stop work order or assessment of damages commensurate with repair of damage.

.3 It is the Contractor's responsibility to be aware of environmental requirements and the best management practices and pollution control measures necessary to meet them.

.4 It is the Contractor's responsibility to obtain and abide by permits, licenses and compliance certificates at appropriate times and frequencies as required by the authorities

having jurisdiction.

.5 All hazardous materials are to be stored with secondary containment

1.4 Fires

.1 Fires and burning of rubbish on site not permitted.

1.5 Disposal of Wastes

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.6 Drainage

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing deleterious substances into waterways, sewer or drainage systems.

.3 Protect storm drains against entry by sediment, debris, oil, or chemicals.

.4 Control disposal or runoff of water containing deleterious substances or other harmful substances in accordance with local authority requirements.

1.7 Site Clearing and Plant Protection

.1 Protect trees and plants on site and adjacent properties.

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.4 Restrict tree removal to areas indicated.

.5 Prevent unnecessary disturbance of topsoil and underlying soil from vehicles and heavy equipment.

.6 Minimize stripping of topsoil and vegetation.

.7 Comply with the requirements of Ontario Regulation O. REG 406/19, “On-Site and Excess Soil Management”, for the importation of new soils and fill materials and the exportation, removal and disposal off-site, of excavated materials. Complete testing of imported and exported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

1.8 Pollution Control

.1 Maintain, inspect, and repair temporary erosion and pollution control features installed under this contract on a weekly basis. Submit inspection logs to the Owner when requested.

.2 Control emissions from equipment and plant to conform to federal, provincial, and municipal requirements.

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

.4 Take all measures necessary to prevent material and mud tracking on adjacent roads and streets.

.5 Use mechanical sweepers as often as necessary to keep adjacent roads and streets clean of material and mud that is deposited from this project.

.6 On site disposal or clean out of concrete trucks is not permitted. Any spillage of concrete onto asphalt or other surfaces must be cleaned up before spillage sets.

1.9 Unanticipated Soil Contamination

.1 Should unanticipated soil contamination be discovered:

.1 Stop work and assess the situation for safety.

.2 If situation does not appear to be safe, evacuate workers from area.

.3 If safe to do so, take immediate steps to control any spread of contamination, in accordance with Contractor’s spill prevention and response plan.

.4 Immediately contact the Consultant.

.2 Removal and disposal off site of contaminated materials shall comply with the requirements of Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 References

.2 Owner's Regulations

.3 Standards and Definitions

.4 Designated Substances

.5 Hazardous Materials

.6 Spills Reporting

.7 Protection of Water Quality

.8 Potable Water Systems

.9 Soils Management

.10 Access for Inspection and Testing

.11 Other Regulatory Requirements

1.2 References

.1 Perform Work in accordance with Ontario Building Code (OBC), National Fire Code of Canada (NFC), the Canadian Electrical Code CSA C22.1:21, including all Supplements and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Where a material is designated in the Contract Documents for a certain application, unless otherwise specified, that material shall conform to standards designated in the Code. Similarly, unless otherwise specified, installation methods and standards of workmanship shall also conform to standards invoked by the aforementioned Code.

.3 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

.3 Manufacturer's instructions.

.4 Where requirements of Contract Documents exceed Code requirements provide such additional requirements.

.5 Where the Contract Documents or the Building Code do not provide all information necessary for complete installation of an item, then the manufacturer's instructions for first quality workmanship shall be strictly complied with.

1.3 Owner's Regulations

.1 Conform to requirements, regulations and procedures of the Owner.

1.4 Standards and Definitions

.1 Where a reference is made to specification standards produced by various organizations and agencies, conform to latest edition of standards, as amended and revised to date of Contract.

.2 Have a copy of each specified standard which relates to the work available on the site to be produced immediately on Consultant's request.

1.5 Designated Substances

.1 Known designated substances are identified in the Designated Substance Report provided by the Owner.

.2 Stop work immediately when material resembling asbestos, mould or any other designated substance which is not identified in the Designated Substance Report is encountered during the course of the work. Notify Owner and Consultant immediately.

.3 The Owner will arrange for independent testing of suspected designated substances and removal of such substances encountered on the site during the course of the work which are not identified in the Designated Substance Report.

1.6 Hazardous Materials

.1 Definition: "Hazardous Material" is material, in any form, which by its nature, may be flammable, explosive, irritating, corrosive, poisonous, or may react violently with other materials, if used, handled or stored improperly. Included are substances prohibited, restricted, designated or otherwise controlled by law.

.2 Provide SDS for all materials brought to the Place of Work.

.3 Hazardous Materials will not be introduced for experimental or any other use prior to being evaluated for hazards.

.4 Make known to the Consultant those hazardous materials or designated substances intended to be used in the workplace and receive permission to use before introducing to the Owner's property.

.5 Many common construction materials such as asbestos pipe and various insulations are designated substances and shall not be used under any circumstances.

1.7 Spills Reporting

.1 Spills or discharges of pollutants or contaminants under the control of the Contractor, and spills or discharges of pollutants or contaminants that are a result of the Contractor's operations that cause or are likely to cause adverse effects shall forthwith be reported to the Consultant. Such spills or discharges and their adverse effects shall be as defined in the Environmental Protection Act R.S.O. 1999.

.2 All spills or discharges of liquid, other than accumulated rain water, from luminaries, internally illuminated signs, lamps, and liquid type transformers under the control of the Contractor, and all spills or discharges from this equipment that are a result of the Contractor's operations shall, unless otherwise indicated in the Contract, be assumed to contain PCB's and shall forthwith be reported to the Consultant.

.3 This reporting will not relieve the Contractor of his legislated responsibilities regarding such spills or discharges.

1.8 Protection of Water Quality

.1 No waste or surplus organic material including topsoil is to be stored or disposed of within 30 metres of any watercourses. Run-off from excavation piles will not be permitted to drain directly into watercourses. Where this measure is not sufficient or feasible to control sediment entering the watercourses, sedimentation traps or geo-textile coverage will be required.

.2 If de-watering is required, the water shall be pumped into a sedimentation pond or diffused onto vegetated areas a minimum of 30 metres from any watercourses and not pumped directly into the watercourses.

.3 Provide all de-watering and sedimentation control required to properly complete the work of this contract.

.4 Supply, install and maintain silt/sediment control fencing along the edge of the site or where indicated to intercept construction runoff silt, to the satisfaction of the Owner.

1.9 Potable Water Systems

.1 Potable water systems in completed buildings must meet criteria and guidelines established by Provincial and Municipal authorities, prior to occupancy by the Owner.

.2 Upon completion, submit testing certificates verifying water quality and water systems meets all applicable Provincial and Legislated Standards

1.10 Soils Management

.1 Comply with the requirements of Ontario Regulation O. REG 406/19, “On-Site and Excess Soil Management”, for the importation of new soils and fill materials and the exportation, removal and disposal off-site, of excavated materials. Complete testing of imported and exported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

1.11 Access for Inspection and Testing

.1 Cooperate fully with and provide assistance to, all outside authorities including Building Inspectors, utilities, testing agencies and consultants, with the inspection of the Work.

1.12 Other Regulatory Requirements

.1 Conform to the requirements of the Ontario Ministry of Transportation, Regional and Local authorities regarding transportation of materials.

.2 Obtain required road occupancy permits.

.3 Pay any required roadway damage deposits required by the local municipality.

.4 Conform to the requirements of the Ontario Ministry of the Environment.

.5 Conform to the requirements of the Ontario Ministry of Labour.

.6 Conform to the requirements of the local Conservation Authority.

.7 Conform to all applicable local by-laws, regulations and ordinances.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Inspection

.2 Independent Inspection Agencies.

.3 Access to Work

.4 Procedures

.5 Rejected Work

.6 Reports

.7 Contractors Responsibilities

.8 Tests and Mix Designs

.9 Mock-Ups

.10 Equipment and Systems.

1.2 Inspection

.1 Contractor is responsible for Quality Control (QC).

.2 Allow Owner and Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or law of Place of Work.

.4 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.5 Consultant will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Owner shall pay cost of examination and replacement.

1.3 Independent Inspection Agencies

.1 Independent Inspection and Testing Agencies will be engaged by Contractor for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Contractor and paid from the cash allowances specified in Section 01 21 13.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and re-inspection.

1.4 Access to Work

.1 Allow inspection and testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.5 Procedures

.1 Notify Owner and Consultant 48 hours in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples

1.6 Rejected Work

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other work damaged by such removals or replacements promptly.

.3 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Consultant will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.7 Reports

.1 Submit electronic .pdf format inspection and test reports to Consultant.

.2 Provide copies to Subcontractor of work being inspected or tested or manufacturer or fabricator of material being inspected or tested.

1.8 Contractors Responsibilities

.1 Be responsible for the execution of the Construction Quality Plan and is to pay all costs for the execution of the Construction Quality Plan. Designate an experienced site representative for carrying out the Construction Quality Plan.

.2 Provide the Owner with a completed quality product for the Work. Contractor shall be responsible for any costs associated with re-testing and reperforming the Work as a result of the Contractor's poor performance or workmanship or other failure to comply with the Contract Documents.

.3 All Work shall be done by persons qualified in their respective trades, and the workmanship shall be first-class in every respect. Contractor is responsible for ensuring employees are appropriately trained. All materials and equipment furnished shall be the best of their respective kinds for the intended use and unless otherwise specified, same shall be new and of the latest design.

.4 The Consultant will have the authority to reject Work that does not conform to the Contract Documents or may require special inspection or testing, whether or not such Work is to be then fabricated, installed or completed.

.5 Failure by a Contractor to conduct its operations, means and methods and coordinate proper sequencing of the Work may cause the Owner to withhold payment or any other means deemed necessary to correct non-conforming Work.

.6 The Owner shall engage a testing firm to perform such engineering laboratory services and on-site inspection as deemed necessary by the Owner. The testing firm will determine compliance with the requirements of the Contract Documents. This Work will not be a service to the Contractors for the performing of tests and checking of materials required of the Contractors.

.7 Copies of test and inspection reports will be furnished to the Contractor. The laboratory and its representatives will be instructed to promptly call to the attention of the Contractor, any instance of non-compliance with the requirements of the Contract Documents. Failure to so notify the Contractor shall not relieve the Contractor of any of its responsibilities for compliance or making good workmanship or materials which are not in compliance with the requirements of the Contract Documents. The agency shall notify the Consultant and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services

.8 Contractor's construction materials, procedures and work shall be subject to specified testing procedures and shall be in conformance with the Contract Documents as verified by Testing Agency.

.9 Cooperate with the testing firm and provide labor to assist with sample preparations where applicable.

.10 Except where specifically indicated to be provided by another entity as identified, inspections, tests, and similar quality control services including those specified to be

performed by independent agency are the Contractor's responsibility, and costs thereof are not to be included in contract sum.

.11 Cooperate with independent agencies performing required inspections, tests, and similar services. Provide auxiliary services as reasonably requested, including access to Work, the taking of samples or assistance with the taking of samples, delivery of samples to test laboratories, and security and protection for samples and test equipment at Project site.

.12 Coordination: Contractor and each engaged independent agency performing inspections, tests, and similar services for project are required to coordinate and sequence activities so as to accommodate required services with minimum delay of Work and without the need of removal/replacement of work to accommodate inspections and tests. Scheduling of times for inspections, tests, taking of samples, and similar activities is Contractor's responsibility.

.13 Where sampling and testing is required for Sections of Work listed in the Contract Documents, the tests shall be performed by an independent testing lab and paid for by the Contractor.

.14 Test procedures to be used shall be submitted for approval of the Consultant where other than those specified are recommended by the testing agency.

.15 Testing Agency Duties: The independent Testing Agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Owner, the Consultant and Contractors in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

.16 Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.9 Tests and Mix Designs

.1 Furnish test results and mix designs as requested.

1.10 Mockups

.1 Prepare mockups for Work specifically requested in specifications.

.2 Construct in locations acceptable to Consultant.

.3 Prepare mockups for Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mockups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Mock-ups may remain as part of Work unless indicated otherwise.

1.11 Equipment and Systems

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Temporary utilities

1.2 Installation and Removal

.1 Provide temporary utilities and controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 Dewatering

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.4 Water Supply

.1 Existing sources of water can be made available to the Contractor at no charge, subject to operational requirements. Arrange for connection and pay all costs for installation, maintenance and removal. Conversions or alterations to existing sources of water to meet construction requirements are the responsibility of the Contractor.

.2 The points of delivery and limits on amount available will be determined on site by the Owner whose written permission must be obtained before any connection is made.

.3 Conveniently locate water supply for use by all Sections of the Work. Protect water lines from freezing.

.4 Water shall be potable and shall meet the requirements of the technical sections of the specifications.

1.5 Temporary Heating and Ventilation

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted, unless prior approval is given by the Consultant.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10° C in areas where construction is in progress.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building may not be used when available, unless there are savings to the Contract Price and Consultant's written permission is obtained stating conditions of use, provisions relating to guarantees on equipment and operation and maintenance of system. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters.

.8 Ensure Date of Substantial Performance and warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.

.9 Pay costs for maintaining temporary heat, when using permanent heating system. Owner will pay utility charges when temporary heat source is existing building equipment.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform to applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct fired combustion units to outside.

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6 Temporary Power and Light

.1 Existing sources of electric power can be made available to the Contractor. Conversions or alterations to existing sources of electric power to meet construction requirements are the responsibility of the Contractor.

.2 The points of delivery and limits on amount available will be determined on site by the Owner whose written permission must be obtained before any connection is made.

.3 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected.

.4 Provide and maintain temporary lighting throughout project. Lighting levels shall be sufficient to complete work including inspections. Provide minimum lighting levels of 400 lux at work areas. Lighting levels at floors and stairs not within work areas shall be not less than 160 lux at all times during construction activity.

.5 All equipment used shall be CSA approved.

.6 Wiring and method of installation shall conform to local power requirements and shall be reviewed by a licensed inspector prior to use.

1.7 Temporary Communication Facilities

.1 Provide and pay for temporary telephone, fax, cellular data, lines and all equipment necessary for Contractor's own use.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Construction aids

.2 Site storage

.3 Construction parking

.4 Offices

.5 Equipment, tool and material storage

.6 Sanitary facilities

.7 Signage

.8 Shoring

1.2 References

.1 CSA Group (CSA)

.1 CAN/CSA Z321-96 (R2006) Signs and Symbols for the Workplace

.2 CSA Z797:18 (R2023) Code of Practice for Access Scaffold

1.3 Installation and Removal

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 Scaffolding

.1 Scaffolding in accordance with CSA Z797.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.

.3 Enclose and heat scaffolding during cold weather.

1.5 Hoisting

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment.

.2 Hoists and cranes shall be operated by qualified operator.

1.6 Site Storage/Loading

.1 Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.7 Construction Parking

.1 Parking will be permitted on site at areas designated by the Owner provided it does not disrupt performance of Work or ongoing Owners operations.

.2 Provide and maintain adequate access to project site.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.8 Offices

.1 General Contractor and Subcontractors may provide their own offices as necessary and subject to site constraints. Direct location of these offices.

1.9 Equipment, Tool and Material Storage

.1 Provide and maintain, in a 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 on site in a manner to cause least interference with work activities.

1.10 Sanitary Facilities

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 Use of Owner’s washroom facilities is prohibited.

1.11 Construction Signage

.1 Direct requests for approval to erect a Contractor signboard to Consultant.

.2 Signs and notices for safety and instruction shall be in English. Graphic symbols shall conform to CAN/CSA Z321.

.3 Post "Construction Zone" signage outside barrier and entrance to all work areas.

.4 Maintain approved signs and notices in good condition for duration of project and dispose

of off-site on completion of project.

.5 Install signage to direct site traffic and deliveries to the Construction work areas.

1.12 Shoring

.1 Examine the site to determine the conditions under which work will be performed.

.2 Contractor shall formulate his own conclusions as to the extent of the existing conditions and shoring required.

.3 The method of shoring shall be according to the Contractor's and his Engineer's directions.

.4 All existing loads must be shored prior to commencement of demolition and removal of load bearing elements.

.5 All shoring and frame braces must be supplied with a safe load rating which must not be exceeded. Install in accordance with manufacturer's recommended procedures and safety guidelines. Ensure that the safe load conditions of the shoring are not exceeded by dead, live or construction loads.

.6 All shoring shall be subject to the Consultant's review and approval prior to commencing demolition work.

.7 Completely remove all shoring after new structure is installed and all concrete is set.

.8 Submit shoring drawings and a proposed installation procedure stamped by a professional engineer registered in the Province of Ontario. Procedures shall follow the information provided on these drawings. The shoring design engineer shall be retained and paid for by the Contractor. The shoring engineer shall review all existing conditions on site prior to completing shoring design.

.9 Removal of existing materials without proper engineered shoring is a safety hazard and will not be permitted.

.10 Make good all damage to the existing structure and adjoining structures and bear full responsibility for failure to provide adequate shoring.

.11 The failure or refusal of the Consultant to suggest the use of shoring, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of the work or of any of their obligations under the Contract, nor impose any liability on the Owner or their agents; nor shall any delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Owner, or their agents, or employees, relieve the Contractor from necessity of properly and adequately protecting the existing structure from collapse or damage, nor from and of his obligations under the Contract relating to injury to persons or property, nor entitle him to any claims for extra compensation or an extension in schedule.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 Installation and Removal

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 Site Fencing

.1 Contractor's lay-down area designated by the Owner must be secure and there must be no access by unauthorized persons. Provide temporary fencing around whole work site. Use modular free-standing fencing: galvanized, minimum 1.8m high, chain link or welded steel mesh, pipe rail. Provide one lockable truck entrance gate and at least one pedestrian door as directed. Equip all gates with locks and keys. Maintain fence in good repair.

1.4 Dust Control and Protection of Kindergarten Playground

.1 The Contractor is strictly responsible for keeping the exterior kindergarten playground completely free from construction dust, debris, and contaminants at all times.

.2 Because this area is actively used by young children, dust mitigation is a critical safety and environmental requirement. The Contractor must implement the following measures immediately and maintain them throughout the duration of the project:

.1 Required Dust Mitigation Measures

.1 Physical Barriers: Erect high-density dust screens/partitions between the construction zone and the playground.

.2 Wetting and Suppression: Utilize continuous water misting or dampening methods on dry materials, cutting zones, and excavation areas to prevent airborne particles.

.3 Point-of-Origin Capture: Use tool-mounted vacuum shrouds and HEPA-filtered extraction systems on all dust-producing equipment.

.4 Scheduled Cleanup: Clean and sweep the perimeter of the construction zone daily using wet mopping or HEPA vacuums. Do not use dry brooms or leaf blowers near the playground.

.5 Work Scheduling: Coordinate high-dust activities outside of school hours or during times when the playground is guaranteed to be unoccupied.

.2 Monitoring and Compliance

.1 The playground will be inspected daily. Failure to control construction dust effectively will result in an immediate stop-work order for the dust-producing activity at the Contractor's expense until remediation steps are taken.

1.5 Guard Rails and Barricades

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs and wherever else necessary to prevent accidental falls.

.2 Provide as required by governing authorities.

1.6 Weather Enclosures

.1 Provide weather tight 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; enclose building interior work for temporary heat.

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

1.7 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 public.

.2 Maintain and relocate protection until such work is complete.

1.8 Hoarding

.1 Where part of a building continues to be occupied, the occupied part shall be separated from the part being demolished by a fire separation having a fire-resistance rating of not less than 1 hour. Refer to O. Reg. 213/07 Div. B Art. 8.1.2.15.

1.9 Protection for Off Site and Public Property

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 Protection of Building Finishes

.1 Provide protection for finished and partially finished building finishes and equipment

during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Consultant locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

1.11 Protection of Surrounding Work

.1 Provide protection for finished and partially finished Work from damage.

.2 Provide necessary cover and protection.

.3 Be responsible for damage incurred due to lack of or improper or inappropriate protection.

1.12 Public Traffic Flow

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.13 Fire Routes

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Tolerances for Execution of Work.

.5 Protection of Work in progress.

.6 Existing Utilities

1.2 Definition – Basis of Design

.1 Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

.1 Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

.2 Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

.1 Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.

.3 Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 -Submittal Procedures.

1.3 Quality

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.4 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 Storage, Handling and Protection

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 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.

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

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Consultant.

.9 Touch up damaged factory finished surfaces to Consultant's satisfaction. Use touch up materials to match original. Do not paint over name plates.

1.5 Transportation

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Owner will be paid for by Owner. Contractor shall be responsible for the unloading, handling and storage of such products.

1.6 Manufacturer's Instructions

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re installation at no increase in Contract Price or Contract Time.

1.7 Quality of Work

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed.

.2 Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.3 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.

.4 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.8 Coordination

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 Concealment

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Consultant if there is interference. Install as directed by Consultant.

1.10 Remedial Work

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 Location of Fixtures

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.12 Fastenings

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

.4 Space anchors within individual load limit or shear capacity and ensure 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.

1.13 Fastenings – Equipment

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

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 Dielectric Separation

.1 Ensure that a dielectric separator is provided in a permanent manner over entire contact surfaces to prevent electrolytic action (galvanic corrosion) between dissimilar materials. Similarly, prevent corrosion to aluminum in contact with alkaline materials such as contained in cementitious materials.

1.15 Tolerances for Execution of Work

.1 Unless specifically indicated otherwise, Work shall be installed plumb, level, square and straight.

.2 Unless acceptable tolerances are otherwise specified in specification sections, or are otherwise required for proper functioning of equipment, site services and mechanical and electrical systems:

.1 "Plumb and level" shall mean plumb or level within 1 mm in 1m.

.2 "Square" shall mean not in excess of 10 seconds lesser or greater than 90 degrees.

.3 "Straight" shall mean within 1 mm under a 1 m long straight edge.

.4 "Flush" shall mean within:

.1 6 mm for exterior concrete, masonry and paving materials.

.2 1 mm for interior concrete, masonry, tile and similar surfaces.

.3 0.5 mm for other interior surfaces.

.3 Allowable tolerances shall not be cumulative

1.16 Protection of Work in Progress

.1 Adequately protect 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 Consultant, at no increase in Contract Price or Contract Time.

.2 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of the Consultant.

1.17 Existing Utilities

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.18 Hazardous Materials

.1 Report any found or suspected hazardous materials to the Owner.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Safety Requirements

.2 Fire Protection

.3 Accident Reporting

.4 Records on Site

1.2 References

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Fire Commissioners of Canada, FC 301, Standard for Construction Operations

.3 National Fire Protection Agency (NFPA)

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

.4 Occupational Health and Safety Act

.1 R.R.O. 1990, Reg. 860: Workplace Hazardous Materials Information System (WHMIS)

.2 O. Reg. 632/05: Confined Spaces

.5 Ontario Building Code

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit to Owner and Consultant copies of the following documents, including updates issued:

.1 Notice of Project filed with Ontario Ministry of Labour, Immigration, Training and Skills Development.

.2 Site-specific Health and Safety Plan prior to commencement of work on the work site. Plan shall include but not be limited to the following:

.1 Name and contact info of Contractor's Health and Safety Representative for Work Site; including twenty-four (24) hour emergency contact phone numbers.

.2 Phone numbers of local fire, police, and ambulance outside of 911 services.

.3 Location of nearest medical facility and level of injury that each can service.

.3 Submit to the Owner, Consultant and Municipal Fire Department, for review, a “Fire Safety Plan” conforming to Section 2.14 of the National Fire Code of Canada. Maintain a copy of the “Fire Safety Plan” on site.

.4 Copies of certification for all employees on site of applicable safety training including, but not limited to:

.1 WHMIS.

.2 Fall arrest and protection.

.3 Suspended Access Equipment.

.4 Erection of Scaffolding.

.5 License for powder actuated devices.

.5 On-site Contingency and Emergency Response Plan addressing:

.1 Standard procedures to be implemented during emergency situations.

.2 Preventative planning and protocols to address possible emergency situations.

.3 Guidelines for handling, storing, and disposing of hazardous materials that maybe encountered on site, including measures to prevent damage or injury in case of an accidental spill.

.4 Incident and accident reports, promptly if and upon occurrence

.1 Reports or directions issued by authorities having jurisdiction, immediately upon issuance from that authority.

.2 Accident or Incident Reports, within 24 hours of occurrence.

.5 Submit other data, information and documentation upon request by the Consultant as stipulated elsewhere in this section.

1.4 Compliance Requirements

.1 Comply with the latest edition of the Ontario Occupational Health and Safety Act, and the Regulations made pursuant to the Act.

1.5 Constructor

.1 Notify all regulatory bodies required for construction activities, (i.e., Notice of Project, employer notification, etc.). Notifications shall include, but not be limited to, the notification requirements laid out in OHSA Sec 51-53 and the requirements of Ontario Regulation

213/91 for Construction Projects, Sections 5, 6 and 7. For the purpose of this contract the Contractor shall be the "Constructor".

.2 The “Constructor” will be solely responsible for the safety of all persons on the Site.

1.6 Safety Requirements

.1 Observe and enforce all construction safety measures and comply with the latest edition and amending regulations of the following documents and in the event of any differences among those provisions, the most stringent shall apply:

.1 Occupational Health and Safety Act (OHSA) and Regulation for Construction Projects, R213/91; April 2025

.2 Hazardous Products Act (HPA) and the Canada Labour Code (CLC) Part II

.3 The Workplace Safety and Insurance Act

.4 Ontario Building Code Act, Ontario Regulation 73/24 including amendments.

.5 National Building Code of Canada, Part 8: Safety Measures on Construction and Demolition Sites.

.6 National Fire Code of Canada.

.7 NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations, 2027 Edition.

.8 Environmental Protection Act.

.9 The Power Commission Act.

.10 The Boiler and Pressure Vessels Act.

.11 The Elevators and Lifts Act.

.12 The Operating Engineer's Act.

.13 Municipal statutes.

.2 Obey all Federal, Provincial and Municipal Laws, Acts, Statutes, Regulations, Ordinances and By-laws which could in any way, pertain to the work outlined in the Contract, or to any employees of the Contractor. Satisfy all statutory requirements imposed by the Occupational Health and Safety Act and Regulations made thereunder, on a Contractor, and Constructor and/or Employer with respect to or arising out of the performance of the Contractors obligations under this Contract.

.3 Working at Heights: The supervisor of the project, will be responsible to ensure that his employees and subcontractors/suppliers have current Working at Heights and Fall Protection certification.

.4 The supervisor of the project will be responsible for his employees and subcontractors/suppliers maintaining standard safety practices, as well as the specific safety rules listed below, while working on the Owner's property.

.5 The Owner reserves the right to order individuals to leave the site if the individual is in violation of any safety requirement or any Act. Any expense incurred will be the responsibility of the Contractor.

.6 Notify the Owner should any hazardous condition become apparent.

.7 Enforce the use of CSA approved hard hats, reflective vests and safety boots for all persons entering or working at the construction site. Refuse admission to those refusing to conform to this requirement.

.8 Provide safeguard and protection against accident, injury or damage to any person on the site, adjacent work areas and adjacent property.

1.7 Safety Meetings

.1 Site toolbox safety meetings will be held weekly for all Contractor employees and all sub trade contractors.

.2 Where a Joint Health and Safety Committee is required on a project, workers and supervisors, selected, as members of the committee must attend.

1.8 Workplace Hazardous Materials Information System (WHMIS)

.1 Be familiar with WHIMIS regulations and be responsible for compliance.

.2 Provide to the Consultant a list of Designated Substances that will be brought to the site prior to commencing work. Safety Data Sheets (SDS) and the hazardous material inventory for each substance listed must be kept on the Project.

.3 Be responsible for all other requirements of regulations as applicable to Employers.

.4 All controlled products to be properly labelled and stored.

.5 Immediately inform Owner and Consultant if any unforeseen or peculiar safety-related factor, hazard, or condition becomes evident during performance of Work.

1.9 Fire Protection

.1 Provide and maintain safeguard and protection against fire in accordance with current fire codes and regulations.

.2 Provide temporary fire protection throughout the course of construction. Particular attention shall be paid to the elimination of fire hazards.

.3 Comply with the requirements of FCC No. 301 Standards for Construction Operations issued by the Fire Commissioner of Canada and the National Building Code.

.4 Provide and maintain portable fire extinguishers during construction, in accordance with Part 6 of the National Fire Code of Canada 2015 and NFPA 241.

.5 Maintain unobstructed access for firefighting at all areas in accordance with the National Building Code of Canada.

1.10 First Aid

.1 Provide such equipment and medical facility as required by WSI Act to supply first aid services to anyone who may be injured at the place of Work. Report all accidents or injuries to the proper authorities and to the Owner and Consultant.

1.11 Accident Reporting

.1 Investigate and report incidents and accidents as required by Occupational Safety and Health Act, and the Regulations made pursuant to the Act.

1.12 Records on Site

.1 Maintain on site a copy of the safety documentation as specified in this Section and any other safety related reports and documents issued to or received from the authorities having jurisdiction.

.2 Upon request, make copies available to the Consultant.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Field Engineering survey services.

.2 Survey services to establish and confirm inverts for Work.

.3 Recording of subsurface conditions found.

1.2 References

.1 Owner's identification of existing survey control points and property limits.

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit name and address of Surveyor to Consultant.

.3 On request of Consultant, submit documentation to verify accuracy of field engineering work.

.4 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

1.4 Examination of Work and Site

.1 Examine the site and existing building to be fully informed of their particulars as related to the Work.

.2 Verify dimensions of completed Work in place before fabrication of Work to be incorporated with it. Ensure that all necessary job dimensions are taken for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions.

.3 No claims for extra payment will be paid for extra work made necessary or for difficulties encountered due to conditions of the site which were visible or reasonably inferable from an examination of the site at the time prior to tender closing date and furthermore, failure of the Contractor to visit and examine the site shall be deemed a waiver of all claims for extra payment due to any condition of the site existing prior to tender closing date.

.4 As-found damage: Record by photography and submit evidence to Consultant before commencing work, any found damaged surfaces or materials adjacent to new work, and not included under scope of this new work. Remedial work to any damage, not so recorded, shall be the responsibility of the Contractor.

1.5 Qualifications of Surveyor

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Consultant.

1.6 Survey Reference Points

.1 Existing control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Consultant.

.4 Report to Consultant when reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.7 Survey Requirements

.1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

1.8 Existing Services

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings. The Contractor is responsible for coordination of all utility locates.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut off points as directed by Consultant.

.3 Where Work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to building

occupants, pedestrian and vehicular traffic.

.4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.5 Install temporary drain plugs to prevent construction debris from blocking pipes downstream of the work.

.6 All existing concrete floor slabs shall be scanned prior to any cutting or breaking of concrete. Employ a qualified concrete scanning company or inspection and testing agency to scan and map floor slabs for reinforcing, plastic and metal conduit, piping, grounding cables, embedment and the like. Map all slabs and provide copies to the Owner and Consultant.

1.9 Location of Services, Equipment and Fixtures

.1 Location of services, equipment, fixtures and outlets indicated on drawings or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance. Include existing equipment which affects or will be affected by the work.

.3 Inform Consultant of impending installation and obtain approval for actual location.

.4 Location of site services where required, is approximate and is based on information provided by the Owner. Undertake all locates to determine exact locations of existing services and lay out new services to avoid any conflicts with new building elements, including site improvements, building foundations and other new or existing services.

.5 Submit field drawings and interference drawings to indicate relative position of various services and equipment. Refer to requirements for interference drawings specified elsewhere.

.6 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided.

.7 Prepare drawings to indicate coordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus and connections are coordinated.

.8 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance and access are indicated and maintained.

.9 Submit interference drawings to Owner and Consultant in accordance with Section 01 33 00.

.10 Unless specifically indicated by the Consultant, interference drawings will be received for

information only and will not be reviewed.

1.10 Records

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 Record locations of maintained, re-routed and abandoned service lines.

1.11 Subsurface Conditions

.1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Requirements and limitations for cutting and patching the Work.

1.2 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit written request and obtain Consultant's approval in advance of cutting or alteration which affects:

.1 Structural integrity of any element of Project.

.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

.3 Include in 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 Work of Owner or separate contractor.

.7 Date and time work will be executed.

1.3 Materials

.1 As specified and required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 25 00 - Substitution Procedures.

.3 Requests for change in materials shall include documentation indicating conformance to project requirements and intent.

1.4 Definitions

.1 Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

.2 Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

PART 2 PRODUCTS

2.1 Materials

.1 General: Comply with requirements specified in other Sections.

.2 In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

.3 If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Consultant for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 Preparation

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

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

3.2 General

.1 Carry out all cutting, fitting and patching required for the work of the Contract.

.2 Repair all wall and floor surfaces where items have been removed.

.3 Make good all finishes as required.

.4 Repaint damaged wall surfaces.

.5 Fit several parts together, to integrate with other Work.

.6 Uncover Work to install ill-timed Work.

.7 Remove and replace defective and non-conforming Work.

.8 Provide cutting and patching of all openings in non-structural elements of Work as necessary to complete installation of mechanical and electrical Work. Include complete removal and replacement of such elements as necessary to provide construction access.

.9 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.10 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.11 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools are not allowed on masonry work without prior approval.

.12 Restore work with new products in accordance with requirements of Contract Documents.

.13 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.14 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with "ULC approved firestopping material, full thickness of the construction element. Include any openings in existing building elements created by removal of existing services or equipment.

.15 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

3.3 Cutting and Patching

.1 General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

.2 Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

.3 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

.4 Temporary Support: Provide temporary support of work to be cut.

.5 Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

.6 Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 - Summary of Work.

.7 Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

.8 Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

.1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

.2 Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

.3 Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

.4 Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

.5 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

.6 Proceed with patching after construction operations requiring cutting are complete.

.9 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

.1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

.2 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

.1 Clean piping, conduit, and similar features before applying paint or other finishing materials.

.2 Restore damaged pipe covering to its original condition.

.3 Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, colour, texture, and appearance. Remove in-place floor

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

.1 Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

.4 Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

.5 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

.10 Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.4 Subfloor Levelling

.1 Where existing flooring is to be removed from floor slabs to remain, including ceramic tile flooring, carefully remove all flooring, grout, adhesives, waterproofing membranes and the like down to the base slab. Clean, patch and repair slab where damaged with concrete or acceptable leveling compound in accordance with new flooring manufacturer's instructions and ASTM F710. Refer to original building drawings and remove and replace existing concrete floor toppings as necessary and where required.

.2 Where new flooring is to be installed on new concrete slab or on framed floors, subfloor shall be levelled in accordance with flooring manufacturer's specifications and tolerances and with ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

3.5 Fire Barrier Seals

.1 Ensure fire separations are maintained as indicated on the drawings. Patch and firestop all penetrations accordingly.

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Progressive Cleaning

.2 Final Cleaning

1.2 References

.1 National Fire Protection Association (NFPA)

.1 NFPA 241-27 Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.3 Project Cleanliness

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Owner. Do not burn waste materials on site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use clearly marked separate bins for recycling.

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

.8 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

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

PART 2 PRODUCTS

2.1 Products

.1 All cleaning materials and products shall be low VOC type. Submit list of cleaning products including SDS for approval prior to commencement of cleaning operations.

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

PART 3 EXECUTION

3.1 Final Cleaning

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.5 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.

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

.7 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.

.8 Thoroughly vacuum clean interior of electrical equipment.

.9 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.10 Clean and seal concrete floor surfaces with non-skid matte sealer.

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

.12 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.13 Broom clean and wash exterior paved areas, walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs. Clear all drains, scuppers, gutters and downspouts.

.16 Remove debris and surplus materials from crawl spaces and other accessible concealed spaces.

.17 Remove snow and ice from access to building.

.18 Under direction of Consultant, aim adjustable luminaires.

3.2 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

End of Section

PART 1 GENERAL

1.1 Section Includes

.1 Definitions

.2 Waste Management Goals for the Project

.3 Documents

.4 Waste Management Plan

.5 Materials Source Separation Program

.6 Disposal of Wastes

.7 Scheduling

.8 Storage, Handling and Protection

.9 Application

.10 Diversion of Materials

1.2 References

.1 O. Reg. 102/94 Waste Audits and Waste Reduction Work Plans.

.2 O. Reg. 278/05 Occupational Health and Safety Act

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit a completed Waste Management Plan (WMP) prior to project start-up.

1.4 Definitions

.1 Waste Management Plan (WMP): Contractor's approved overall strategy for waste management including waste reduction workplan and materials source separation program.

.2 Materials Source Separation Program (MSSP): Consists of a series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.3 Separate Condition: Refers to waste sorted into individual types.

1.5 Waste Management Goals for the Project

.1 The Owner has established that this Project shall generate the least amount of waste possible and that processes shall be employed that ensure the generation of as little waste as possible including prevention of damage due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing over packaging and poor quantity estimating.

.2 Of the waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling. Waste disposal in landfills or incinerators shall be minimized.

1.6 Waste Management Plan

.1 Waste Management Plan: Submit a Waste Management Plan within 10 calendar days after receipt of Notice of Award of Contract, or prior to any waste removal, whichever occurs sooner. The Plan shall contain the following:

.1 Analysis of the proposed job site waste to be generated, including the types of recyclable and waste materials generated (by volume or weight). In the case of demolition, a list of each item proposed to be salvaged during the course of the project should also be prepared

.2 Alternatives to Land Filling: Contractor shall designate responsibility for preparing a list of each material proposed to be salvaged, reused, or recycled during the course of the Project.

.2 Post WMP or summary where workers at site are able to review its content.

1.7 Materials Source Separation Program

.1 The Waste Management Plan shall include a Source Separation Program for recyclable waste and shall be in accordance with the established policies currently in place at the local Municipality, and the requirements of O. Reg. 102/94.

.2 Prepare MSSP and have ready for use prior to project start-up.

.3 Implement MSSP for waste generated on project in compliance with approved methods and as approved by Consultant.

.4 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.

.5 Provide containers to deposit reusable and/or recyclable materials.

.6 Locate containers to facilitate deposit of materials without hindering daily operations.

.7 Locate separated materials in areas which minimize material damage.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

1.8 Disposal of Wastes

.1 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.2 Provide appropriate on-site containers for collection of waste materials and debris. Containers for volatile wastes shall be closed containers and shall be removed from site daily.

.3 Provide and use clearly marked separate bins for recycling.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.

.5 Remove waste material and debris from site and deposit in waste container at end of each working day.

.6 Do not permit waste to accumulate onsite.

.7 Burying of rubbish and waste materials is prohibited.

.8 Disposal of waste into waterways, storm or sanitary sewers is prohibited.

1.9 Scheduling

.1 Coordinate work with other activities at site to ensure timely and orderly progress of the Work.

1.10 Storage, Handling and Protection

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Owner.

.2 Materials from building demolition to be salvaged or re-used are to be removed and salvaged.

.3 Unless specified otherwise, materials for removal become Contractor's property.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Application

.1 Do work in compliance with Waste Management Plan.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.2 Diversion of Materials

.1 Separate materials from general waste stream and stockpile in separate piles or containers, to approval of Owner, and consistent with applicable fire regulations. Mark containers or stockpile areas.

.2 On-site sale of materials is not permitted.

End of Section

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PART 1 GENERAL

1.1 Section Includes

.1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 References

.1 Canadian Construction Documents Committee

.1 CCDC 2-2020 Stipulated Price Contract including Supplementary Conditions.

.2 OAA/OGCA Document 100 - Recommended Procedures Regarding Substantial Performance of Construction Contracts and Completion Takeover of Projects.

.3 The Construction Act.

1.3 Review and Takeover Procedures

.1 In accordance with OAA/OGCA Document 100, latest edition, except where specified otherwise.

.2 In OAA/OGCA Document 100, where the term "Architect" is used, substitute the term "Consultant", and where the term "inspection" is used in relation to the Consultant's assessment of the Work, substitute the term "review".

.3 Arrange and pay for review by local authorities to obtain permission to occupy/occupancy permit (where applicable) prior to applying for Ready-for-Takeover.

1.4 Inspection and Declaration

.1 Contractor's Inspection: The Contractor shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents. Submit duplicate copies of the deficiency list to the Owner and Consultant.

.1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Consultant's review.

.2 Consultant's Review: Consultant and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies, TSSA, ESA and other regulatory agencies have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Work is complete and ready for Final Review by the Consultant.

.4 Final Inspection: when items noted above are completed, request final review of Work by Consultant, and Contractor. If Work is deemed incomplete by the Consultant, complete outstanding items and request re-review.

.5 Declaration of Substantial Performance: when Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance. Refer to CCDC 2, General Conditions Article GC 5.4 - Substantial Performance of Work and Payment of Holdback for specifics to application.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment: When Consultant considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to CCDC 2, General Conditions Article GC 5.5 – Final Payment for specifics to application.

.8 Payment of Holdback: After issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with CCDC 2, General Conditions Article 5.4 - Substantial Performance of Work and Payment of Holdback.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.2 Operating and Maintenance Manuals

.1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers including red-lined as-builts.

.2 Minimum two weeks prior to commencement of scheduled commissioning activities, submit 2 copies of the draft Operating and Maintenance Manuals, for Consultants review and use during the commissioning activities. After the completion of the commissioning activities, the Consultant will return to the Contractor 1 draft copy, with review comments, for revision. Submit 1 copy of the revised Operating and Maintenance for approval prior to the production of final copies. Prior to the Issuance of the Final Certificate of Completion, and within 10 working days after Substantial Performance, submit 2 copies of the final Operating and Maintenance Manuals.

.3 Bind contents in a three ring, hard covered, black plastic jacketed binder, with labelling pocket on spine and with 'D' type rings. Size for 8-1/2" x 11" size paper, enclose title sheet labelled "Operating and Maintenance Data Manual", project name, date and list of contents. Organize contents into applicable sections of work to parallel project specification breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.4 Include following information as applicable, plus data specified elsewhere:

.1 operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information; copy of building permit.

.2 copy of final inspection certificate by Electrical Safety Authority.

.3 Copy of fire alarm verification certificate.

.4 Copy of sprinkler test verification certificate.

.5 Copy of certificates issued by other utilities.

.6 Copies of field tests.

.7 Copies of all inspection and testing reports.

.8 Maintenance instructions for finished surface and materials.

.9 Copy of hardware and paint schedules.

.10 Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list.

.11 Indicate nameplate information such as make, size, capacity, serial number.

.12 Names, addresses and phone numbers of Contractor, Subcontractors and Suppliers, including local source of supplies and replacement parts.

.13 Manufacturer's product guarantees and warranties, executed in the name of the Owner, showing name and address of project and guaranty/warranty commencement date and duration of guaranty/warranty, and clear indication of what is being guaranteed and what remedial action will be taken under guaranty/warranty.

.1 Separate each warranty or guarantee with index keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer with name, address, and telephone number of responsible principal.

.3 Co-execute submittals when required.

.14 Additional material used in project listed under various sections showing name of manufacturer and source of supply.

.15 A letter on company letterhead clearly stating and verifying that no materials or products containing more than 0.1 per cent asbestos by dry weight has been applied or installed on the project.

.5 For Mechanical and Electrical include:

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with Engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer. Include maintenance and testing schedule.

.11 Provide Contractor’s co-ordination drawings, with installed colour coded piping diagrams.

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

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

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.

.15 Additional requirements: as specified in individual specification Sections.

.6 Neatly type lists and notes. Use clear drawings, diagrams or manufacturers' literature.

.7 Manuals shall include complete set of reviewed shop drawings and product data sheets, indicating corrections and changes made during fabrication and installation.

.8 Create electronic copies of manuals, in their entirety in a searchable PDF file format saved to USB flash-drive.

.9 Building will not be deemed ready for use unless the draft copies of the Operating and Maintenance Manuals and the "As-built" Record Documents have been submitted and reviewed by the Consultant.

.10 Building will not be deemed ready for use unless the completed and submitted Operating and Maintenance Manuals and "As-built" Record Documents have been accepted by the Consultant.

1.3 Project Record Documents

.1 After award of Contract, the Contractor will be provided with electronic copies of the Contract Documents. Contractor will use these to maintain current as-built drawings and specifications by recording deviations caused by site conditions and changes ordered by the Consultant and/or the Owner.

.2 Record locations of:

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

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

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features or structure.

.4 Concealed components of mechanical and electrical services;

.5 Field changes of dimension and detail.

.6 Changes made by Change Order, Change Directive or Site Instruction.

.7 Details not on original Contract Drawings.

.8 References to related shop drawings and modifications.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Record information on set of drawings, provided by Consultant. Record changes using a different colour of felt tip pen markers for each major system.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda, Change Order, Change Directive or Site Instruction.

.6 Photos of concealed components must be taken and tagged to their locations labelled on the record drawings. Save photos to a USB flash-drive and submit with Contract close-out package.

.7 Identify all copies of the drawings and specifications as "Project As-built Copy". Maintain in new condition and make available for review on site by Consultant/Owner. At construction completion, neatly and accurately transfer notations to a second set of hard-copy drawings and specifications. Once completed, create electronic copies of both. As-built drawings to be generated in AutoCAD and PDF file formats. As-built specifications to be generated in PDF file format.

.8 Submit following drawings:

.1 Record changes in red. Mark on one set of prints and at completion of project prior to final inspection, produce electronic “as-built” records on disk using latest version of AutoCad. Annotate “AS-BUILT RECORD” in each drawing title block.

.2 All changes shall be shown on a separate drawing layer named "as-built".

.3 Minimum two weeks prior to commencement of scheduled commissioning activities, submit 2 copies of the draft Operating and Maintenance Manuals, for Consultants review and use during the commissioning activities. After the completion of the commissioning activities, the Consultant will return to the Contractor 1 draft copy, with review comments, for revision. Submit 1 copy of the revised Operating and Maintenance for approval prior to the production of final copies. Prior to the Issuance of the Final Certificate of Completion, and within 10 working days after Substantial Performance, submit 2 copies of the final Operating and Maintenance Manuals.

.9 Minimum 2 weeks prior to application for final payment, submit one (1) electronic copy of the Project Record Documents to Owner via the Consultant.

1.4 Materials and Finishes

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

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

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications Sections.

1.5 Maintenance Materials and Spare Parts

.1 Where supply of maintenance materials and spare parts are specified, deliver to Owner as follows:

.1 Use unbroken cartons, or if not supplied in cartons, they shall be strongly packaged. Supply maintenance materials and spare parts in quantities specified in individual specification sections.

.2 Provide only new materials as maintenance materials and spare parts, of the same manufacture, type and quality as incorporated into the Work.

.3 If applicable, give colour, room number, or area where material used.

.4 Ensure maintenance materials and spare parts provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work

1.6 Special Tools

.1 Where supply of special tools is specified, deliver to Owner in quantities specified as follows:

.1 Provide items with tags identifying their associated function and equipment.

.2 Special tools are to be delivered to the Owner prior to the application for Substantial Performance.

.3 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.4 Ensure spare parts provided are new, undamaged or defective, and of same quality and

manufacture as products provided in Work.

1.7 Storage, Handling and Protection

.1 Store spare parts, maintenance materials and special tools in manner to prevent damage or deterioration and as follows:.

.1 Store in original and undamaged condition with manufacturer's seal and labels intact.

.2 Store components subject to damage from weather in weatherproof enclosures.

.3 Store paints and freezable materials in a heated and ventilated room.

.4 Remove and replace damaged products at own expense and to satisfaction of Consultant.

.5 Clearly mark containers as to content.

.6 Obtain receipt from Owner upon delivery of materials.

1.8 Final Site Survey Certificate

.1 Provide final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 Independent Specialty Engineers Sign-Off

.1 Provide paper and electronic copies of signed and stamped engineers review and sign-off letters stating that the work has been built in accordance with their drawings and designs. Conditional or vague letters of sign-off will not be accepted. All specialty design engineers for all sub-contractors and suppliers will be required to review the work in progress at appropriate intervals to ensure compliance with their designs and drawings and shall provide final sign-off letters. Provide copies of all field reports issued by specialty engineers.

1.10 Electronic Documents

.1 Any electronic documentation submitted must be in the formats described above.

.2 Any electronic documentation submitted must be compatible with Consultant's computers or the documentation will be returned for re-submission.

.3 To ensure that the documents are able to be read on a computer different than the Contractor's, enable the "close the disc upon completion" option in the disc authorizing application.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 02 41 19.13 Selective Building Demolition

.2 Section 31 23 10 Excavating, Trenching and Backfilling

1.3 References

.1 The National Building Code of Canada 2025, Part 8, Safety Measures on Construction and Demolition Sites.

.2 Ontario Provincial Regulations

.1 Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans

.2 Ontario Regulation 103/94 Environmental Protection Act

.3 Ontario Regulation 213/07 The Fire Code

.4 Ontario Regulation 232/98 Landfilling Sites

.5 Ontario Regulation 347 Environmental Protection Act, General - Waste Management

.3 The Workplace Health and Safety Act, and Regulations for Construction Projects

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37

.2 Canadian Environmental Protection Act 1999 (CEPA), c. 33

.5 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005 Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit plan indicating: Descriptions of and anticipated quantities of materials to be salvaged, reused, recycled and landfilled.

.3 Submit copies of certified weigh bills, bills of lading or receipts from authorized disposal sites and reuse and recycling facilities for material removed from upon request from Consultant.

1.5 Quality Assurance

.1 Examine existing site conditions adjacent to demolition work prior to start of Work.

.2 Coordination: Coordinate requirements for Waste Management and Disposal for materials being re used or recycled in accordance with Section 01 74 19.

.1 Divert excess materials from landfill

.2 Separate materials identified for recycling place in identified areas in accordance with Waste Management Plan

.3 Label location of salvaged material's storage areas and provide barriers and security devices

.4 Remove materials that cannot be salvaged for re use or recycling and dispose of in accordance with applicable codes at licensed facilities

.3 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA and applicable Provincial regulations.

.4 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Consultant and at no cost to Owner.

.3 Remove and store materials to be salvaged, in manner to prevent damage.

1.7 Project Conditions

.1 Protect existing site features to remain or identified for salvage or re use; make repairs and restore to a similar condition to existing where damage to these items occurs as directed by the Consultant and at no cost to Owner:

.1 Remove and store salvaged materials to prevent contamination.

.2 Store and protect salvaged materials as required for maximum preservation of material.

.3 Handle salvaged materials the same as new materials.

.2 Protect existing site features and structures, trees, plants and foliage on site and adjacent properties.

.3 Provide erosion and sedimentation control as specified in Section 31 23 10.

.4 Ensure that demolition work does not adversely affect adjacent water courses, groundwater and wildlife, or contribute to excess air and noise pollution.

.5 Do not dispose, of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

.6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Preparation

.1 Inspect site and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities, preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Separate work areas from areas occupied by the Owner and the public, as specified in Section 01 56 00.

3.2 Removal of Hazardous Wastes

.1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.3 Removal Operations

.1 Remove items as indicated.

.2 Do not disturb items designated to remain in place.

.3 Remove existing basketball pole and backboard where indicated and salvage for reuse. Existing concrete bases shall be removed entirely. Reinstall at end of construction in location determined by Owner.

.4 Remove sections of chain link fence where indicated on drawings and salvage for reuse. Existing concrete bases shall be removed entirely. Reinstall at end of construction.

.5 Backfill: Refer to Section 31 23 10.

3.4 Restoration

.1 Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.

.2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

.3 Restore areas within public roadways and road allowances in accordance with municipal standards.

3.5 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion of work, remove debris, trim surfaces and leave work site clean.

.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 02 41 13 Selective Site Demolition

.2 Section 31 23 10 Excavating, Trenching and Backfilling

1.3 References

.1 The National Building Code of Canada 2025, Part 8-Safety Measures on Construction and Demolition Sites.

.2 CSA Group (CSA)

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

.3 ASTM International (ASTM)

.1 ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

.4 Ontario Provincial Regulations

.1 Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans.

.2 Ontario Regulation 103/94 Environmental Protection Act.

.3 Ontario Regulation 213/07 The Fire Code.

.4 Ontario Regulation 232/98 Landfilling Sites.

.5 Ontario Regulation 278/05 Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.

.6 Ontario Regulation 347 Environmental Protection Act, General — Waste Management.

.7 Ontario Regulation 332/12 The Building Code.

.5 The Workplace Health and Safety Act, and Regulations for Construction Projects.

.6 The Contractors Health and Safety Policy.

.7 Laws, rules and regulations of other authorities having jurisdiction.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit detailed written schedule, methodology and proposed procedures for demolition, including a Safe Work Plan for review prior to commencement of demolition.

.3 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details clearly showing sequence of disassembly work or supporting structures and underpinning.

.4 Drawings for structural elements of the demolition process including shoring, underpinning and installation of new lintels or beams in existing load bearing walls, shall bear signature and stamp of qualified professional engineer registered in the Province of Ontario.

.5 Submit proposed dust-control measures.

.6 Submit proposed noise-control measures.

.7 Submit schedule of demolition activities indicating the following:

.1 Detailed sequence of demolition and removal work, including start and end dates for each activity.

.2 Dates for shutoff, capping, and continuation of utility services.

.8 If hazardous materials are encountered and disposed of, landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

.9 At Project Closeout: Submit record drawings in accordance with Section 01 78 00. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions

1.5 Permits

.1 Obtain and pay for all permits and comply with all laws, rules, ordinances, and regulations relating to Demolition of Building and preservation of Public Health and Safety.

.2 The Consultant will complete General Review during demolition in accordance with the Ontario Building Code. All other engineering required for shoring design and for other structural elements of the demolition work will be completed by the Contractor’s own engineer and paid for by the Contractor.

1.6 Waste Management Plan

.1 All work of this Section shall be completed in accordance with the Contractors approved

Waste Management Plan specified in Section 01 74 19.

1.7 Definitions

.1 Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.

.2 Demolition Waste: Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel. The materials may include rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.

.3 Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human or animal life; affect other species of importance to humanity; or degrade the utility of the environment for aesthetic, cultural or historical purposes.

.4 Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively for the purpose of disposal.

.5 Inert Solids/Inert Waste: Non-liquid solid waste including, but not limited to, soil and concrete that does not contain hazardous substances or soluble pollutants at concentrations in excess of water-quality standards established by a regional water board and does not contain significant quantities of decomposable solid waste.

.6 Landfill: A landfill that accepts non-hazardous materials such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A landfill must have a solid waste facilities permit from the Ministry of the Environment and be in conformance to O. Reg 232/98.

.7 Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

.8 Remove: Remove and legally dispose of items, except those identified for use in recycling, re-use, and salvage programs.

.9 Reuse: The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.

.10 Solid Waste: All putrescible and non-putrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure,

vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by law.

1.8 Quality Assurance

.1 Demolition Firm Qualifications: Demolition contractor shall be an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.

.2 Regulatory Requirements: Comply with governing regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Obtain and pay for all permits required.

.3 Pre-demolition Conference: Conduct a conference at Project site.

.1 Review the environmental goals of this Project and make a proactive effort to increase awareness of these goals among all labor forces on site.

.2 Review schedule and scheduling procedures.

.3 Review health and safety procedures.

.4 Review of Project conditions including review of record photographs.

1.9 Project Conditions

.1 Construct safety barriers, barricades, fencing and hoarding to separate public from work areas as described in Section 01 56 00.

.2 The Owner assumes no responsibility for the actual condition of the structures to be demolished.

.3 Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. Variations within the structures may occur by the Owner's salvage operations prior to start of demolition.

1.10 Designated Substances

.1 Should any material resembling asbestos or other hazardous substances be encountered in course of demolition work, immediately stop work and notify the Owner’s Representative.

PART 2 PRODUCTS

2.1 Materials

.1 Provide all materials necessary for temporary shoring. On completion, remove temporary materials from site.

.2 All building materials removed from the building shall become the property of the Contractor unless specified otherwise and shall be reused in new construction or removed from the Site.

.3 All concrete, masonry, asphalt and similar materials shall be crushed prior to disposal.

2.2 Salvage

.1 All items of salvageable value must be salvaged.

.2 Provide a schedule of items to be salvaged and clearly indicate which items are to be retained by Owner. Clearly identify and tag each salvageable item.

.3 Transport salvaged items from the site as they are removed.

.4 Items of salvageable value to the Contractor may be removed from the structure as the work progresses, if such items are not claimed by the Owner.

2.3 Reuse

.1 Salvage and reuse materials as indicated on the drawings.

2.4 Recycle

.1 All materials from demolition and land clearing which can be recycled through local municipal programs and which is not scheduled for salvage shall be sorted and separated in accordance with Regional, Provincial and Municipal standards and regulations.

.2 Provide recycling receptacles for the duration of construction activities at the building site.

PART 3 EXECUTION

3.1 Examination

.1 Survey existing conditions and correlate with requirements indicated to determine extent of demolition, salvage and recycling required.

.2 Verify that utilities have been disconnected and capped.

.3 Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.

.4 Retain a licensed and qualified civil or structural engineer to provide analysis, including calculations, necessary to ensure the safe execution of the demolition work.

.5 Perform surveys and tests as the Work progresses to detect hazards resulting from demolition activities.

.6 Preliminary Survey:

.1 The Demolition Plans indicate the general extent of existing conditions based upon drawings provided by the Owner and existing site conditions. Review all areas of work to determine full extent of areas to be demolished, altered or renovated and become familiar with actual conditions and extent of work required.

.2 Before commencing demolition operations, examine Site and provide engineering survey to determine type of construction, condition of structure, and Site conditions. Assess strength and stability of damaged or deteriorated structures.

.3 Assess potential effect of removal of any part or parts on the remainder of structure before such part(s) are removed.

.4 Assess effects of demolition at adjacent structures and consider need for underpinning, shoring and/or bracing.

.5 Investigate for following conditions:

.1 load bearing walls and floors

.2 structure suspended from another

.3 effects of soils, water, lateral pressures on retaining or foundations walls

.4 presence of tanks and other piping systems

.5 presence of designated substances and hazardous materials.

.7 After determining demolition methods, determine area of possible vibration. Carefully inspect beyond those adjacent areas. List potential damage areas and photograph each for record purposes before starting work.

3.2 Preparation

.1 Erect and maintain dustproof and weatherproof partitions as required to prevent spread of dust, fumes and smoke to other parts of building. Maintain fire exits. On completion, remove partitions and make good surfaces to match adjacent surfaces of building.

.2 Provide all shoring and bracing required for the execution of the work.

.3 Ensure all sedimentation controls as required are in place prior to commencement of demolition activities.

.4 Before commencing demolition, verify that existing water, gas, electrical and other services in areas being demolished are cut off, capped diverted or removed as required.

Post warning signs on electrical lines and equipment which must remain energized to serve adjacent areas during period of demolition.

.5 Conduct demolition operations and remove materials from demolition to ensure minimum interference with roads, streets, walks, and other adjacent occupied and utilized facilities.

.6 Do not close or obstruct streets, walks, or other adjacent occupied or utilized facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

3.3 Utilities

.1 Contact authorities or utility companies for assistance in locating and marking services passing under, through, overhead or adjacent to structure to be demolished. Such services include:

.1 Electrical power lines

.2 Gas mains

.3 Communication cables

.4 Fibre optic cables

.5 Water lines.

.6 Drainage piping (storm and sanitary).

.2 Before disconnecting, removing, plugging or abandoning any existing utilities serving the building:

.1 Notify the Owner, applicable utility companies, and local authorities having jurisdiction.

.2 Cut off and cap utilities at the mains on the property or in the street as required by the Owner and responsible utility company. Maintain fire protection to the existing buildings at all times.

.3 Remove, cut off and plug, or cap all utilities within the existing building areas to be demolished, except those designated to remain

3.4 Protection

.1 Erect and maintain temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Maintain such areas free of snow, ice, water and debris. Lighting levels shall be equal to that prior to erection.

.2 Provide safe access and egress from working areas using entrances, hallways, stairways or ladder runs, protected to safeguard personnel using them from falling debris.

.3 Do not interfere with use and activities of adjacent buildings and site. Maintain free and safe passage to and from buildings.

.4 Where demolition operations prevent normal access to adjacent properties, provide and maintain suitable alternative access.

.5 Provide flagmen where necessary or appropriate, to provide effective and safe access to site to vehicular traffic and protection to Owner's personnel. Refer to Division 1 for safety requirements.

.6 Protect existing site improvements and appurtenances that are designated to remain in place.

.7 Ensure that all necessary controls are in place at the beginning of each work period which will prevent the spread of contaminated material beyond the work area limits. Stop work immediately if there exists any possibility of the spread of contaminated materials.

.8 Keep dust from entering existing facilities and areas of building not affected by the Work. Comply with Ministry of Health requirements regarding debris control.

.9 Ensure scaffolds, ladders, equipment and other such equipment are not accessible to public. Protect with adequate fencing or remove and dismantle at end of each day or when no longer required.

.10 Take precautions to guard against movement, settlement or collapse of adjacent structures, services or driveways. Be liable for such movement, settlement or collapse caused by failure to take necessary precautions. Repair promptly such damage when ordered.

.11 If Owner considers additional bracing and shoring necessary to safeguard and prevent such movement or settlement, install bracing or shoring upon Owner's orders.

.12 Particular attention shall be paid to prevention of fire and elimination of fire hazards which would endanger new work or existing premises.

.13 Protect existing adjacent work against damages which might occur from falling debris or other causes due to work of this Section.

.14 At all times protect the structure from overloading.

.15 Provide protection around floor and/or roof openings.

.16 Protect from weather, parts of adjoining structures not previously exposed.

.17 Protect interiors of building parts not to be demolished from exterior elements at all times.

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

3.5 Temporary Ventilation

.1 Provide all required temporary ventilation for demolition work.

3.6 Environmental Controls

.1 Comply with provincial and municipal regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment and noise pollution.

.2 Protection of Natural Resources:

.1 Preserve the natural resources.

.2 Confine demolition activities to areas defined by public roads, easements, and work area limits indicated on the drawings.

.3 Water Resources: Comply with applicable regulations concerning the direct or indirect discharge of pollutants to underground and natural surface waters. Provide sedimentation control where necessary.

.4 Store and service construction equipment at areas designated for collection of oil wastes.

.5 Oily Substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water in such quantities as to affect normal use, aesthetics, or produce a measurable ecological impact on the area.

.3 Dust Control, Air Pollution, and Odour Control: Prevent creation of dust, air pollution and odors.

.1 Use temporary enclosures and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.

.2 Store volatile liquids, including fuels and solvents, in closed containers.

.3 Properly maintain equipment to reduce gaseous pollutant emissions.

.4 Noise Control: Perform demolition operations to minimize noise.

.1 Provide equipment, sound deadening devices, and take noise abatement measures that are necessary to comply with municipal regulations.

.5 Salvage, Re-Use, and Recycling Procedures:

.1 Identify re-use, salvage, and recycling facilities.

.2 Develop and implement procedures to re-use, salvage, and recycle demolition materials.

.3 Identify materials that are feasible for salvage, determine requirements for site storage, and transportation of materials to a salvage facility.

.4 Source-separate clean and uncontaminated demolition materials including, but not limited to the following types:

.1 Concrete, Concrete Block, Concrete Masonry Units (CMU), Brick.

.2 Metal (ferrous and non-ferrous).

.3 Wood.

.4 Glass.

.5 Plastics and Insulation.

.6 Gypsum Board.

.7 Porcelain Plumbing Fixtures.

.8 Fluorescent Light Tubes.

.9 Paper: Bond, Newsprint, Cardboard, Paper, Packaging Materials.

.10 Other materials as appropriate.

3.7 Performance

.1 Ensure demolition work is supervised by competent foreman at all times.

.2 Demolition shall proceed safely in systematic manner. Work on each floor level shall be complete before commencing work on supporting structure and safety of its supports are impaired. Parts of building which would otherwise collapse prematurely shall be securely shored. Walls and piers shall not be undermined.

.3 Until acceptance, maintain and preserve active utilities traversing premises.

.4 Provide enclosed chutes for disposal of debris from heights more than 1 storey in accordance with CSA S350.

.5 Maintain safety of site by shoring below-grade-structures and excavations resulting from demolition against collapse.

3.8 Demolition

.1 Review demolition procedures to ensure no personnel or equipment are located or working without additional safe working platforms or working surface adequate to support the operations.

.2 Any damage caused to the adjacent buildings or properties by the neglect of the Contractor or any of his forces shall be made good at the expense of the Contractor including all costs and charges which may be claimed by the Owner for damages suffered.

.3 Demolish in a manner to minimize dusting. Keep dusty materials wetted at all times.

.4 Demolition: Use methods required to complete Work within limitations of governing regulations and as follows:

.1 Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

.2 Demolish concrete and masonry in sizes that will be suitable for acceptance at recycling or disposal facilities.

.3 Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

.4 Break up and remove concrete slabs on grade in small sizes, suitable for acceptance at recycling or disposal facilities, unless otherwise shown to remain.

.5 Remove all disconnected, abandoned utilities.

.6 Remove all finishes, fixtures, fitments and services as indicated

.7 Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

.8 Prevent access to excavations by means of fences or hoardings.

3.9 Selective Demolition

.1 Carefully dismantle and remove all items in as shown and as necessary to complete the work.

.2 Salvage items scheduled for reuse or to be handed over to the Owner.

.3 Particular attention shall be paid to prevention of fire and elimination of fire hazards which would endanger the existing buildings.

.4 Where existing flooring is to be removed from floor slabs to remain, including ceramic tile flooring, carefully remove flooring, grout, adhesives, waterproofing membranes and the

like down to the base slab. Patch and repair slab where damaged with concrete or acceptable leveling compound in accordance with new flooring manufacturer's instructions and ASTM F710. Refer to original building drawings and remove and replace existing concrete floor toppings as necessary and where required.

.5 Return areas to condition existing prior to the start of the work unless indicated otherwise.

.6 At exterior and interior bearing walls to be removed, include breaking out and removal of existing concrete foundations to a minimum of 200 mm below new finished floor level.

3.10 Handling of Demolished Materials

.1 Conform to the approved Waste Management Plan.

.2 Do not allow demolished materials to accumulate or be stored on-site for more than 5 days.

.3 Do not burn, bury or otherwise dispose of rubbish and waste materials on project site.

.4 Pallet and shrink-wrap materials scheduled for re-use and stockpile where directed on site.

.5 Disposal: Transport demolished materials off Owner's property and legally reuse, salvage, recycle, or dispose of materials. Legally transport and dispose of materials that cannot be delivered to a source separated or mixed recycling facility to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.

.6 Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.

3.11 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Clean adjacent streets and driveways of dust, dirt and materials caused by demolition operations.

.3 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

.4 Upon completion of demolition work, remove debris, trim surfaces and leave work site clean.

.5 Video storm and sanitary sewers and jet clean where debris may have accumulated

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 20 00 Concrete Reinforcing

.2 Section 03 30 00 Cast-in-Place Concrete

.3 Section 05 50 00 Metal Fabrications

.4 Section 31 23 10 Excavating, Trenching and Backfilling

1.3 References

.1 American Concrete Institute (ACI)

.1 ACI 117-10 Specifications for Tolerances for Concrete Construction and Materials.

.2 ACI 347R-14 Guide to Formwork for Concrete

.3 ACI SP-4-14 Formwork for Concrete

.2 CSA Group (CSA)

.1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete

.2 CSA B111-1974 (R2003) Wire Nails, Spikes and Staples

.3 CSA O86:19 Engineering Design in Wood

.4 CSA O121-2017 (R2022) Douglas Fir Plywood

.5 CSA O141:23 Canadian Standard Lumber

.6 CSA S269.1-16 (R2021) Falsework and Formwork

.3 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 1204 Material Specification for Polyvinyl Chloride Waterstops

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings showing type, extent and locations of items to be built into concrete.

.2 Sleeving Drawings: Submit drawings showing sleeves required through floors, roof and other structural members.

.3 Submit drawings showing size and spacing of conduits and piping.

.4 Coordinate with other Divisions prior to submittal.

.5 Do not commence placing sleeves, conduits, or piping before drawings have been reviewed and Consultant's comments incorporated on drawings issued to site.

.6 Assume responsibility for accuracy of Work. Review of submitted shop drawings does not relieve Contractor from compliance with requirements of Contract Documents.

.3 Required by Regulatory Agencies: Submit shop drawings bearing signature and seal of Professional Engineer responsible for formwork design, as may be required by regulatory Agencies. Proceed with construction of formwork only with their approval.

1.5 Quality Assurance

.1 Obtain a copy of CSA A23.1/A23.2 and maintain on site

.2 Design of Formwork: Assume full responsibility for complete structural design and construction of formwork in accordance with CSA S269.1 and CSA O86, as applicable.

.1 The design and engineering of the formwork, as well as its' construction, shall be the responsibility of the Contractor.

.3 Formwork shall be designed for the loads and lateral pressures outlined in the ACI publication "SP-4 Formwork for Concrete" and wind pressures and allowable stresses as set down in the National Building Code and in accordance with CSA A23.1 and A23.2. Formwork shall be of sufficient strength and rigidity to support all concrete and construction loads, taking into account proposed rate and method of pouring concrete so that the resultant finished concrete shall conform to the shapes, lines and dimensions of the members shown on the drawings.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Protect formwork to prevent functional damage and damage to faces affecting appearance of concrete surfaces exposed to view.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 All materials shall be new, in accordance with referenced standards.

.2 Plywood: Douglas Fir, conforming to CSA O121. Sound undamaged sheets finished one side, fabricated especially for use as concrete form panels, with sealed edges. Minimum 17mm thickness.

.3 Lumber: Conforming to CSA O141, with grade stamp clearly visible.

.4 Chamfers: Cut from 19mm x 19mm wood, smooth with no open defects.

.5 Form Ties: snap ties, with spreader washer and 25mm break back.

.6 Void Form: Honeycomb cellular core structure manufactured from kraft fibre. Top and sides protected with wax coated corrugated board, and bottom unprotected.

.7 Round Column Fibre Forms: Sonotube “W” Coated, by Sonoco Limited.

.8 Joint Tape: non-staining, water impermeable, self-release.

.9 Nails, Spikes and Staples: Galvanized, conforming to CSA B111.

.10 Form Release Agent: Colourless mineral oil which will not stain concrete.

.11 For concrete surfaces exposed to view, provide panels smooth and free of defects which would be reproduced as concrete blemishes.

PART 3 EXECUTION

3.1 Examination

.1 Before starting this work, examine work done by others which affects this work.

.2 Notify the Consultant of any conditions which would prevent proper completion of this work.

.3 Commencement of work implies acceptance of existing conditions.

3.2 Erection

.1 Verify lines, levels and centres before proceeding with formwork. Ensure dimensions

agree with drawings.

.2 Align joints and make watertight, to prevent leakage of cement paste and disfiguration of concrete.

.3 Construct formwork to produce concrete with dimensions, lines and levels within tolerances specified in ACI 347R-14.

.4 Provide formed openings where required for pipes, conduits, sleeves and other work to be embedded in and passing through concrete members.

.5 Install chamfers at all external corners exposed to view.

.6 Voidform: Install voidform and place 7.5 mm thick plywood over voidform, to provide firm surface for supporting reinforcement.

.7 Round Fibre Forms:

.1 At concealed locations, provide uncoated fibre form.

.2 Provide round fibre form where indicated for piers, equipment bases, light pole bases, fence foundation and wherever indicated or required.

.8 Adequately brace and shore formwork to sustain loads (both concrete and working loads) applied during construction.

.9 Be responsible for safety of the structure both before and after the removal of forms, until the concrete has reached its specified 28 day strength.

3.3 Built-In Work

.1 Form openings and build in anchors, inserts, sub-frames, key-ways, sleeves, miscellaneous metal items, reglets and similar items furnished under Work of other Sections, which are indicated on Drawings and on shop drawings of other trades, and as required for proper completion of Work.

.2 Do not embed wood in concrete.

.3 Anchor Bolts: Tie anchor bolts securely in position to prevent movement during concrete placing. Use template to locate bolts. Verify that bolts have specified projection above concrete.

.4 Openings or Sleeves Not Shown on Structural Drawings:

.1 Obtain Consultant's written approval before forming openings of sleeves through columns and beams, or through slabs within 1800 mm of their supports.

.2 Obtain Consultant's written approval before forming openings or sleeves larger than 200 mm square in any location.

.5 Embedded Pipe or Conduit Not Shown or Detailed on Structural Drawings:

.1 Obtain Consultant's written approval before placing conduit or pipe which would be embedded in finished structure.

.6 Confirm that built-in items that penetrate surface waterproofing are installed to meet requirements of waterproofing trade.

3.4 Construction Joints

.1 Form construction and expansion joints with bulkheads to ensure straight lines. Immediately before subsequent pour at construction joint, remove bulkhead and tighten forms so that concrete surfaces will be on same plane with no overlapping of concrete.

.2 Review with Consultant proposed location and details of construction joints in walls, columns, beams and slabs.

.1 Construction joints shall present appearance of normal form panel joint.

.2 Install continuous shear key in construction joints in walls and framed floors which are 152mm or more thick.

.3 Provide vertical construction joints in walls at not more than 20 metres centre to centre.

.4 Provide waterstops in accordance with manufacturer’s instructions at construction joints in walls which retain earth. Waterstops shall be continuous.

3.5 Treatment of Formwork Surfaces

.1 Form Release Agent:

.1 Coat formwork with form release agent before reinforcement, anchors, accessories, and other built in items are installed.

.2 Do not coat plywood forms pre-treated with release agent.

.3 On surfaces to receive finish materials, adhesives, sealers, paint or other coatings or materials, use a compatible release agent.

3.6 Stripping of Formwork

.1 Strip formwork on vertical surfaces when concrete has hardened sufficiently that no damage will result from stripping operations.

.2 Do not remove plywood formwork by jerking loose or by metal pinch bars. Use wood wedges and gradually force panels loose. Leave plywood forms in place as long as possible to permit maximum shrinkage away from concrete.

.3 Take particular care not to damage external corners when stripping formwork.

.4 When forms are stripped during curing period, cure and protect exposed concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.

3.7 Defective Work

.1 Movement and displacement of formwork during construction, variations in excess of specified tolerances, marked and disfigured surfaces, and failure of materials or workmanship to meet requirements of this specification, and which cannot be repaired by approved methods, will be considered defective work.

.2 Replace defective work, as directed by Consultant.

.3 Pay for additional inspection and testing, redesign, corrective measures, and related expenses, if work has proven to be deficient.

.4 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 10 00 Concrete Forming and Accessories

.2 Section 03 30 00 Cast-in-Place Concrete

.3 Section 04 05 19 Masonry Anchorage and Reinforcing

.4 Section 04 22 00 Concrete Unit Masonry

.5 Section 04 27 00 Multiple Wythe Unit Masonry

.6 Section 05 50 00 Metal Fabrications

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A143/A143M-07(2020) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement

.2 ASTM A1064/A1064M-22 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

.2 American Concrete Institute (ACI)

.1 ACI SP-66 (04) ACI Detailing Manual

.3 CSA Group (CSA)

.1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete

.2 CSA A23.3:19 Design of Concrete Structures

.3 CSA G30.18:21 Carbon Steel Bars for Concrete Reinforcement

.4 CSA G40.20-13/G40.21-13 (R2018) General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

.5 CSA W186:21 Welding of Reinforcing Bars in Reinforced Concrete Construction

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC Reinforcing Steel Manual of Standard Practice

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings, including placing drawings and bar lists.

.2 Prepare placing drawings and bar lists in accordance with the American Concrete Institute (ACI) Detailing Manual, and the Reinforcing Steel Institute of Canada (RSIC) Reinforcing Steel Manual of Standard Practice and the typical details included with Contract Documents.

.3 Prepare placing drawings to minimum scale of 1:50.

.4 Submit placing drawings and bar lists sufficiently detailed and dimensioned to permit correct placement of reinforcement and accessories without reference to architectural or structural Drawings.

.5 Show reinforcement, including dowels, in elevation on placing drawings for wall reinforcement.

.6 Show concrete cover to reinforcement.

.7 Show location of construction joints.

.3 Inspection Reports: Inspection and Testing Company shall:

.1 Submit written reports of inspection and tests.

.2 Distribute reports as follows:

.1 Consultant.

.2 Contractor.

.4 Quality Assurance Submittals:

.1 Mill Test Report: provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Submit in writing proposed source of reinforcement material to be supplied.

1.5 Quality Assurance

.1 Obtain a copy of CSA A23.1/A23.2 and maintain on site.

.2 Qualifications: Welding: Undertake welding of reinforcement only by a fabricator or Subcontractor approved by Canadian Welding Bureau to requirements of CSA W186.

.3 Source Quality Control: Source Quality Control may be performed by an Inspection and Testing Company appointed by Consultant.

.4 Review provided by Inspection and Testing Company does not relieve Contractor of his sole responsibility for quality control over Work. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of his responsibilities in complying with the requirements of the Specification.

.5 Identify and correlate reinforcing steel from Canadian mills with test reports for compliance with requirements specified.

.6 Test unidentified reinforcing steel at expense of Contractor. Perform testing for each 1 tonne or part thereof supplied for incorporation in Work.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 In accordance with reference standards.

.2 Substitute different size bars only if permitted in writing by Consultant.

.3 Bar Reinforcing Steel:

.1 Bars which are to be welded by arc-welding process: to CSA G30.18, Grade 400W.

.2 Other bars: to CSA G30.18, Grade 400R.

.4 Plain round bars: to CSA G40.20-04/G40.21.

.5 Welded Wire Fabric: to ASTM A1064/A1064M and in flat sheets, not rolls.

.6 Cold-drawn annealed steel wire ties: to ASTM A497.

.7 Chairs, bolsters, bar supports, spacers: to CSA A23.1.

.8 Mechanical splices: subject to approval of Consultant.

2.2 Fabrication

.1 Fabricate reinforcing steel only in permanent fabricating shop.

.2 Fabricate reinforcing steel in accordance with shop drawings.

.3 Tag reinforcing bars to indicate placement as designated on shop drawings.

.4 Splices:

.1 Provide splices only where specifically indicated on Drawings.

.2 Stagger alternate mechanical splices 750 mm apart.

.3 Stagger alternate end bearing splices 750 mm apart.

.4 Install on threaded splices, plastic internal coupler thread protector and plastic bar end thread protector.

PART 3 EXECUTION

3.1 Examination

.1 Before starting this work, examine work done by others which affects this work.

.2 Examine formwork to verify that it has been completed, and adequately braced in place.

.3 Notify the Consultant of any conditions which would prejudice proper completion of this work.

.4 Commencement of work implies acceptance of existing conditions.

3.2 Installation

.1 Place reinforcing steel in accordance with reviewed placing drawings, typical details, and CSA A23.3.

.2 Adequately support reinforcing and secure against displacement within tolerances permitted.

.3 Place reinforcing steel to provide minimum spacing and proper concrete cover as noted on drawings.

.4 Do not cut reinforcement to incorporate other Work.

.5 Relocate or rebend bars only on written instructions of Consultant.

.6 Tie reinforcement in place. Do not weld.

3.3 Adjusting

.1 Adjust and secure reinforcement in correct position immediately before concrete is placed.

.2 Remove contaminants which lessen bond between concrete and reinforcement.

3.4 Field Quality Control

.1 Provide competent supervisor, with at least three years of experience in reinforcement placement, to direct placement of reinforcement.

.2 Inspect placement of reinforcement for conformance with Drawings and Specifications, before each concrete placement, and correct as necessary.

.3 Consultant's periodic review of selected areas of reinforcement are for verification of conformity to design concept and general arrangement only and shall not relieve Contractor of responsibility for quality control, errors, or omissions, or conformance with requirements of Contract Documents.

3.5 Defective Work

.1 Incorrectly fabricated, misplaced or omitted reinforcement will be considered defective Work.

.2 Replace or adjust defective reinforcement before concrete is placed as directed by Consultant.

.3 Replace or strengthen concrete work which is deficient as a result of incorrectly fabricated, misplaced, or omitted reinforcement, which was not corrected before concrete was placed.

.4 Pay for additional inspection and testing, redesign, corrective measures, and related expenses, if Work has proven to be deficient.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 10 00 Concrete Forming and Accessories

.2 Section 03 20 00 Concrete Reinforcing

.3 Section 04 05 19 Masonry Anchorage and Reinforcing

.4 Section 04 22 00 Concrete Unit Masonry

.5 Section 04 27 00 Multiple Wythe Unit Masonry

.6 Section 05 31 00 Steel Deck

.7 Section 05 50 00 Metal Fabrications

.8 Section 07 92 00 Joint Sealants

.9 Section 31 66 00 Helical Piles

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C260/C260M-24 Standard Specification for Air-Entraining Admixtures for Concrete

.2 ASTM C295/C295M-19 Standard Guide for Petrographic Examination of Aggregates for Concrete

.3 ASTM C309-25 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

.4 ASTM C330/C330M-23 Standard Specification for Lightweight Aggregates for Structural Concrete

.5 ASTM C494/C494M-24 Standard Specification for Chemical Admixtures for Concrete

.6 ASTM C881/C881M-20a Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

.7 ASTM C1017/C1017M-13e1 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.8 ASTM C1107/C1107M-20 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

.9 ASTM D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

.10 ASTM D570-22 Standard Test Method for Water Absorption of Plastics

.11 ASTM D624-00(2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

.12 ASTM D638-22 Standard Test Method for Tensile Properties of Plastics

.13 ASTM D1259-06(2025) Standard Test Methods for Nonvolatile Content of Resin Solutions

.14 ASTM D1751-23 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)

.15 ASTM D2240-15(2021) Standard Test Method for Rubber Property—Durometer Hardness

.16 ASTM D5329-20 Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphalt Pavements and Portland Cement Concrete Pavements

.2 American Concrete Institute (ACI)

.1 ACI 117-10 Specifications for Tolerances for Concrete Construction and Materials.

.2 ACI 232.1R-12 Report on the Use of Raw or Processed Natural Pozzolans in Concrete

.3 CSA Group (CSA)

.1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete.

.2 CSA A283:19 Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-18 Cementitious Materials Compendium

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 1010 Material Specification for Aggregates - Granular A, B, M and Select Subgrade Material.

.2 OPSS 1212 Material Specification for Hot-Poured Rubberized Asphalt Joint Sealing Compound.

.5 Government of Canada Treasury Board Secretariat (TBS)

.1 Standard on Embodied Carbon in Construction

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples: Submit for inspection, material samples of specified mix designs.

.3 Concrete Mix Designs:

.1 Submit concrete mix designs for review. Specify intended use for each mix design.

.2 Review of mix design does not relieve Contractor from responsibility for compliance with Contract Documents.

.3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1. Mix design shall be adjusted to prevent alkali aggregate reactivity problems.

.4 Provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements of CSA A23.1.

.5 Submit written requests for use of admixtures not specified, for site mixing of concrete, and for use of bonding agents.

.6 Submit in writing, proposed method of in-situ strength testing.

.4 Inspection Reports: Inspection and Testing Company shall:

.1 Submit written reports of inspection and tests.

.2 Distribute reports as follows:

.1 Consultant;

.2 Contractor.

.3 On concrete cylinder test reports, include:

.1 Specific location of concrete represented by sample

.2 Design strength.

.3 Unit weight of sample

.4 Class of exposure

.5 Aggregate size and mixtures incorporated

.6 Date, hour and temperature at time sample taken

.7 Percentage air content

.8 Test strength of cylinder

.9 Type of failure if test fails to meet specification.

1.5 Quality Assurance

.1 Obtain a copy of CSA A23.1/A23.2 and maintain on site.

.2 Pre-Construction Conference:

.1 At least 35 days prior to the start of concrete construction schedule, conduct a meeting to review proposed mix designs and to discuss detailed requirements of the proposed concrete operations. Review requirements for submittals, coordination, and availability of materials. Establish work progress and sequencing schedules and procedures for material testing, inspection and certifications.

.3 Source Quality Control:

.1 Both source quality control, and field quality control specified in Article 1.5.4, may be performed by an Inspection and Testing Company appointed by Consultant.

.2 Review provided by Inspection and Testing Company does not relieve the Contractor of his sole responsibility for quality control over Work. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of his responsibilities in complying with the requirements of the Specification.

.3 Inspection and Testing Company shall be certified under CSA A283, Qualification Code for Concrete Testing Laboratories, for Category 1 Certification.

.4 Payment for specified Work performed by Inspection and Testing Company will be made from Cash Allowance.

.5 Payment for additional tests (including testing of structure and its performance and load testing) required by changes of materials or mix design requested by Contractor, and failure of completed Work to meet specified requirements, shall be made at Contractor's expense.

.6 Perform Work of source quality control in accordance with CSA A23.2 and to include:

.1 Verification that ready-mix supplier is qualified to supply concrete in accordance with Specification.

.2 Review of proposed concrete mix designs.

.3 Sampling, inspection, and testing of materials as may be required.

.4 Field Quality Control:

.1 Inspection and Testing Company, when appointed as specified for Source Quality Control, shall perform sampling, inspection and testing of concrete work at site.

.2 Perform sampling, inspection and testing in accordance with CSA A23.2, and to include:

.1 Making of standard slump tests.

.2 Obtaining of three standard specimens for strength tests from each 100 m of concrete, or fraction thereof, of each mix design of concrete placed in any one day. In addition, for slabs-on-grade, obtain beam specimens for determination of modulus of rupture.

.3 Verification that test specimens are stored within an enclosure, maintained at specified temperatures.

.4 Making compression tests of each set of three specimens, one at 7 days and two at 28 days; modulus of rupture tests at 90 days.

.5 Verification of air content of air-entrained concrete.

.1 For Class of exposure F-1, and C-2, test at frequency in accordance with CSA A23.1.

.2 Make first test before placing any concrete.

.3 After stable air content has been established, frequency of tests will be determined by Consultant.

.4 For other Classes of exposure, test at time of obtaining strength test specimens.

.3 Inspection for Tolerances:

.1 Confirm that concrete work meets specified tolerance requirements.

.2 Use the elevation survey records of elevations of finished concrete surfaces specified in Section 03 10 00 and this section as basis for judging compliance.

.3 Use approved aluminum straightedge to judge compliance with specified slab tolerances, except use dipstick equipment where F-number tolerance is specified.

.4 Slabs-on-Grade:

.1 Observe application of curing compound to sample slab, recording rate of application.

.2 Monitor on a random basis acceptable to the Consultant, that slab is being saw cut before slab temperature starts to fall.

.3 Qualifications: Floor finishing shall be undertaken only by contractors with at least 10 years of experience.

.4 Sample of Finish Flooring:

.1 Finish an area of floor slab where directed by Consultant to provide sample of finish for approval.

.2 Protect new sample area until finish is approved.

.3 If liquid membrane curing compound is to be used on Project, determine and apply correct quantity required to meet rate of coverage recommended by manufacturer for measured test area.

.4 Approved sample will provide standard by which subsequent finishing will be judged and will be incorporated into Work.

1.6 Tolerances

.1 In accordance with ACI 117 and CSA A23.1.

.2 Concrete tolerance to CSA A23.1

.1 Thick Finishes:

.1 FF = 20/FL = 18

.2 Thin Finishes:

.1 FF = 25/FL = 18

.3 Floor tolerances must be measured within 72 hours following construction.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

1.8 Job Conditions

.1 Protect floor slabs, and concrete surfaces exposed to view or on which finishes are to be applied, from grease, oil, and other soil which will affect the appearance of the concrete, or impair the bond of finish material.

.2 Environmental Conditions: In addition to Cold Weather and Hot Weather Requirements of CSA A23.1, the following shall apply to Work of this Section:

.1 Provide protection or heat, or both, so that temperature of concrete at surfaces is maintained at not less than 21 ° C for three days after placing, not less than 10 ° C for the next two days and above freezing for the next two days.

.2 Do not permit alternate freezing and thawing for fourteen days after placing.

.3 Vent exhaust gases from combustion type heaters to atmosphere outside protection enclosures.

.4 Provide protection to maintain concrete continuously moist during curing period.

.5 For field cured cylinders representing strength development of in-situ concrete, provide same specified hot and cold weather protection for storage of each concrete compression specimen as for concrete from which it was taken, until it is sent to testing laboratory.

.6 Do not place concrete during rain. Should rain commence during placing, cover freshly placed concrete.

.7 Do not place bonded toppings on rough slabs that are less than 15 °C.

.8 Do not grout at ambient air temperatures or concrete surface temperatures less than 5 ° C, or when temperature is forecast to fall to less than 5 ° C within 24 hours of grouting.

.9 Do not apply sealants at ambient air temperatures or concrete surface temperatures less than 5 ° C.

1.9 Project Records

.1 Maintain record of all concrete pour related to time, date, delivery slip serial number and location of each concrete pour and identify related test cylinders. Keep records on site until project is completed.

.2 Delivery Records: File duplicate copies of concrete delivery slips on which shall be recorded: supplier, serial number of slip, date, truck number, contractor, Project, Class of exposure, cementing materials content, air content, volume in load, and time of first mixing of aggregate, cementing materials and water.

.3 Record Drawings:

.1 Record on a set of Drawings:

.1 founding elevations of all footings

.2 variations of foundation Work from that indicated on Drawings.

.2 Make record drawings available for Consultant's inspection at all times.

1.10 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 To meet specified requirements of referenced Standards.

.2 Cement:

.1 Portland Cement: to CSA A3000.

.2 Cementitious Hydraulic Slag: to ACI 232.1R

.3 Fine Aggregate: For slabs-on-grade, fineness modulus of fine aggregate to be between 2.7 and 3.1.

.4 Coarse Aggregates:

.1 20 mm to 5 mm (No. 4 sieve) except as specified below.

.2 For slabs-on-grade 125 mm and thicker: 40 mm to 5 mm (No. 4 sieve); combine at least two of the single sizes specified in Table 5 Group II of CSA A23.1, one of which is to be 40 mm, to obtain maximum bulk density (unit weight) and optimum grading, in accordance with an approved procedure.

.3 For slabs-on-grade: Abrasion loss not to exceed 35%. Petrographic number of aggregate not to exceed 125 when tested in accordance with ASTM C295.

.4 For toppings 50 mm thick and less and for slabs over open web steel joists: 12 mm to 5 mm (No. 4 sieve).

.5 Curing-Sealing Compound: Membrane curing-sealing compound formulated from chlorinated rubber resins, or acrylic emulsion, solvent free for use in occupied buildings, to ASTM C309, type 1.

.1 Basis-of-Design Product: Euclid Chemical Company; Diamond Clear 350 or a comparable product by one of the following:

.1 BASF Corporation - Construction Systems.

.2 Sika Corporation

.3 W.R. Meadows

.6 Bonding Agent: To ASTM C881, 100% reactive, 2 component, low viscosity, high modulus bonding adhesive.

.7 Saw Cut Filler: Semi-rigid epoxy or polyurea in accordance with ACI 302.1R for joint fillers used in control and construction joints.

.1 Basis of Design Euco 700 or Euco QWIKjoint UVR by Euclid Chemical.

.8 Premoulded Joint Fillers: Bituminous impregnated fiber board: to ASTM D1751.

.9 Sealant: Refer to Section 07 92 00 – Joint Sealants

.10 Mechanical Anchors: 'Kwik' Bolts, 'Cinch' Anchors or Parabolts.

2.2 Concrete Mixes

.1 Ready Mix, with 28 day compressive strength as indicated on Drawings.

.2 Design concrete mix in conformance with CSA A23.1, Tables 1, 2, 5 (Alternative 1) and 17, and as follows. Provide concrete meeting water/cementing materials ratio and air content of Table 14 in accordance with Class of exposure specified in following sub-paragraphs, and minimum strength specified on Drawings. Note that concrete designed in accordance with water/cementing materials ratio of Table 14 may yield strength exceeding minimum strength specified on Drawings.

.1 Class of exposure F-2 with 25 percent Portland cement replaced with cementitious hydraulic slag: for grade beams, and for exposed exterior beams, columns, walls and slabs.

.2 Slabs-on-Grade:

.1 Use type 20 Portland cement, or replace 35 percent Portland cement with cementitious hydraulic slag.

.2 When mean daily temperature exceeds 25 ° C at time of placement, replace 25 percent of type 20 cement, or 50 percent of type 10 cement, with cementitious hydraulic slag.

.3 Use water/cementing materials ratio 0.45 maximum.

.4 Use aggregates specified in paragraphs 2.1.3.

.5 Cementing materials content 325 kg/m.

.6 Modulus of rupture 3.5 MPa average, 3.0 MPa minimum.

.7 Slump at delivery, before addition of superplasticizer, 50 mm; add superplasticizer, not water, to bring slump to level acceptable to floor finisher for placement.

.3 Interior Concrete, other than specified above, and not exposed to freezing and thawing or the application of deicing chemicals: select water/cementing materials ratio and cementing materials content on basis of strength, workability, and finishing requirements.

.3 Submit evidence, and material samples, if requested, acceptable to the Inspection and Testing Company, to verify that the proposed concrete mix design will produce specified quality of concrete.

.4 List all proposed admixtures in mix design submission. Do not change or add admixtures to approved design mixes without Consultants approval.

.5 Concrete Weight: Air dry unit weight: minimum 2,300 kg/m; adjusted proportionally for maximum air content listed in CSA A23.1, Clause 15, Table 10.

.6 Concrete supplier to provide documentation indicating the requirements of TBS Standard on Embodied Carbon in Construction have been met.

2.3 Admixtures

.1 Chemical Admixture: To ASTM C494. Incorporate water-reducing admixture, type WN, in all concrete.

.2 Air Entraining Agent: To ASTM C260. Incorporate air-entraining agent in addition to chemical admixture in concrete of relevant Class of exposure, in accordance with CSA A23.1, Clause 15, Table 10.

.3 Chloride: Do not use calcium chloride or admixtures containing chloride in concrete.

2.4 Concrete Toppings

.1 Provide topping with minimum 28 day compressive strength of 32 MPa.

2.5 Premixed Grout

.1 Non-Shrink Metallic: Non-catalyzed metallic grout to ASTM C1107, Compressive strength at 28 days: 48 MPa.

.2 Non-Shrink, Non Stain, Non-Metallic: to ASTM C1107. Compressive strength at 28 days: 59 MPa.

.3 Flowable Grout: High-tolerance Non-shrink, Non-metallic shrinkage compensating grout to ASTM C1107. Compressive strength at 28 days: 59 MPa.

PART 3 EXECUTION

3.1 Examination

.1 Before starting this work, examine work done by others which effects this work.

.2 Notify Consultant of any condition which would prejudice proper completion of this work.

.3 Confirm that surfaces on which concrete is to be placed are free of frost and water before placing.

.4 Confirm that reinforcement, dowels, control joints, inserts and all other built in work are in place and secured.

.5 Commencement of work implies acceptance of existing conditions.

3.2 Treatment of Formed Surfaces

.1 Conform to the requirements of CSA A23.1, and as additionally specified herein.

.2 Treat concrete surfaces which will be exposed or painted in the completed building to provide a "Smooth Rubbed Finish" in accordance with CSA A23.1, uniform in colour and texture.

.3 Plugs at Recessed Ties:

.1 Clean tie holes to remove all foreign matter.

.2 Coat plugs by dipping in adhesive and insert in hole.

.3 Remove excess adhesive immediately with thinner which will not stain concrete, as recommended by manufacturer.

.4 Obtain Consultant's approval of finished exposed concrete and grind or otherwise correct to the satisfaction of the Consultant.

3.3 Placing Concrete

.1 Place concrete in accordance with requirements CSA A23.1/A23.2.

.2 Notify Consultant and inspection and testing firm at least 24 hours prior to commencement of concrete placing operation and 24 hours before wall forms are closed in.

.3 Obtain Geotechnical Engineer’s confirmation that thickness, elevation and compaction of sub-grade meets specifications before placing concrete.

.4 Do not place concrete in water or open frozen surfaces.

.5 Remove contaminants which lessen concrete bond to reinforcement before concrete is placed.

.6 Maintain accurate records of cast in place concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

.7 Ensure that reinforcement, inserts, embedded items, formed expansion joints and the like, are not disturbed during concrete placement.

.8 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Consultant.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.9 Provide construction joint as indicated on the drawings. Ensure dowels are adequately anchored and placed at right angles to the joint before placing concrete.

.10 Place floor slabs to depth indicated on the drawings with 25 MPa minimum concrete unless otherwise noted on drawings but consistent with minimum cement content specified for exposed floors in this specification.

.11 Sloping Surfaces and Slabs: commence concrete placement at bottom of sloping surfaces.

3.4 Finishing Concrete

.1 Perform finishing operations on plastic concrete surfaces in accordance with CSA A23.1, and as specified herein.

.2 Refer to the drawings for floor finishes and coverings.

.3 Screed the top of rough floor slabs to an even level or sloping surface at the proper elevation to receive the finish or topping specified on the drawings and in finish schedule.

.4 Provide a smooth steel trowel finish on all areas scheduled to receive a covering, or painted finish.

.5 Exposed Floor Surfaces: Provide hard, smooth, dense, steel troweled surface, free from blemishes, and of uniform appearance.

.6 Non-slip Surfaces: Provide swirl trowel or broom finish of texture acceptable to Consultant.

.7 Curb Edging: Finish external corners of curbs rounded and smooth.

.8 Drains:

.1 In areas where floor drains are installed, grade the entire floor surface (or as indicated) toward the drains.

.2 Floors to be level around walls and have a minimum 5mm/m uniform pitch to drains unless indicated otherwise.

.3 The slope shall be such that water on all areas of the floor will drain by gravity without leaving pools or puddles on the floor surface.

3.5 Curing

.1 Cure concrete in accordance with CSA A23.1 and as specified herein.

3.6 Grouting

.1 Mix prepackaged grout with water in accordance with manufacturer's printed instructions.

.2 Dampen concrete surfaces immediately before installing grout.

.3 Use non-shrink and shrinkage-compensating grouts only when grout will be contained against expansion and self-disintegration.

.4 Slope grout beyond edge of plate at 45 degrees.

.5 Provide same environmental protection and curing as specified for concrete.

3.7 Joint Sealant

.1 Apply sealant specified in Section 07 92 00 to thoroughly dry surfaces only, at ambient air temperatures above 5 ° C.

.2 Provide sealant on top of joint filler with a polyethylene bond breaker between joint filler and joint sealant applied in accordance with manufacturer's direction.

.3 Confirm that preformed joint filler and backer rod are compatible with sealant.

.4 Caulk joints in accordance with the following:

.1 Do not commence joint preparation until concrete is at least 28 days old.

.2 Thoroughly clean sides of joints with mason's router, or power saw, equipped with double blade where necessary to suit joint width.

.3 Blow clean with compressed air with oil trap on line, or vacuum clean.

.4 Install backer rod of diameter 25 percent greater than joint width, and type recommended by sealant manufacturer to be compatible with sealant. Locate backer rod to provide for sealant depth of one-half joint width, but not less than 12 mm.

.5 Prime joint if required, as recommended by sealant manufacturer.

3.8 Defective Work

.1 Variations in excess of specified tolerances and marked and disfigured surfaces that cannot be repaired by approved methods will be considered defective work.

.2 Replace or modify concrete that is out of place or does not conform to lines, detail or grade as directed by the Consultant.

.3 Replace or repair defectively placed or finished concrete as directed by the Consultant.

.4 Testing and Replacement of Deficient Concrete in Place:

.1 Pay for additional testing and related expenses if concrete has proven to be deficient.

.2 Replace or strengthen deficient concrete work as directed by the Consultant, and pay for all testing and related expenses for replaced work until approved by the Consultant.

3.9 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Clear away from the building site excess and waste materials and debris resulting from Work of this Section.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 22 00 Concrete Unit Masonry

.2 Section 04 27 00 Multiple Wythe Unit Masonry

.3 Section 05 50 00 Metal Fabrications

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.2 ASTM A951/A951M-26 Standard Specification for Steel Wire for Masonry Joint Reinforcement

.2 CSA Group (CSA)

.1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.

.2 CSA S304-14 (R2019) Design of Masonry Structures.

.3 CAN/CSA A371-14 (R2024) Masonry Construction for Buildings.

.4 CSA G30.3-M1983 (R1998) Cold-Drawn Steel Wire for Concrete Reinforcement.

.5 CSA G30.18-09 (R2014) Carbon Steel Bars for Concrete Reinforcement

.6 CSA W186-M1990 (R2016) Welding of Reinforcing Bars in Reinforced Concrete Construction

.3 American Concrete Institute (ACI)

.1 Detailing Manual

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 Reinforcing Steel Manual of Standard Practice

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit the following samples:

.1 Two of each type of masonry reinforcing specified.

.3 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.

.4 Shop Drawings:

.1 Submit shop drawings for all masonry reinforcing. Include placing drawings, bar lists and details. Indicate clearly reinforcing bar sizes, spacing, bending details, lap details, dowels to adjacent construction location and quantities of reinforcement.

.2 Prepare placing drawings and bar lists in accordance with the American Concrete Institute (ACI) Detailing Manual, and the Reinforcing Steel Institute of Canada (RSIC) Reinforcing Steel Manual of Standard Practice, the typical details included with Contract Documents.

.3 Prepare placing drawings to minimum scale of 1:50.

.4 Submit placing drawings and bar lists sufficiently detailed and dimensioned to permit correct placement of reinforcement and accessories without reference to architectural or structural Drawings.

.5 Show reinforcement, including dowels, in elevation on placing drawings for wall reinforcement.

.6 Show cover to reinforcement

.7 Show location of construction joints.

1.5 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

1.6 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 All metal components: hot dipped zinc galvanized to CSA S304 unless otherwise indicated.

.2 Bar Reinforcement: To CSA A371 and CSA G30.18, grade 400R, deformed billet steel bars.

.3 Column Ties: Fero CAT Tie (Column Adjustable Tie), spot weld to columns at 400 mm c/c.

.4 Wire Reinforcement: To CSA A371 and ASTM A951.

.1 Masonry Veneer Walls: Hot dipped galvanized to ASTM A153, Class B2, 4.76 mm wire diameter, to suit overall wall thickness. BL-42 Ladder Reinforcement and System 2000 Seismic Adjustable Tie by Blok-Lok Ltd.

.2 Interior walls: hot dipped galvanized to CSA S304

.1 4.76 mm wire diameter hot dipped galvanized to CSA S304 for interior bearing walls.

.2 3.66 mm wire diameter bright wire finish, standard duty for interior non-bearing walls and partitions

.3 Truss Type: Blok-Trus BL-30 by Blok-Lok Ltd. for non-vertically reinforced walls

.4 Ladder Type: Blok-Trus BL-10 by Blok-Lok Ltd. for vertically reinforced walls

.5 Equivalent products as manufactured by the following manufacturer’s may be used subject to submission and acceptance by the Consultant of technical data:

.1 Hohmann and Barnard Inc.

.6 Epoxy Adhesive: Hilti HIT-HY 2270 Adhesive anchor.

2.2 Fabrication

.1 Fabricate reinforcing in accordance with CSA A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.

.2 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.

.3 Weld reinforcement in accordance with CSA W186.

.4 Ship reinforcement clearly identified in accordance with drawings.

PART 3 EXECUTION

3.1 Installation

.1 Install masonry reinforcement and anchors in accordance with CSA A371, CSA A23.1 and CSA S304 unless indicated otherwise.

3.2 Reinforcement

.1 Unless otherwise noted, all masonry walls shall be reinforced with joint reinforcement.

.2 Reinforcement shall be installed in the first and second bed joints, 200 mm apart immediately above lintels and below sill at openings, and in bed joints at 400 mm vertical intervals elsewhere. Reinforcement in the second bed joint above or below openings shall extend 600 mm beyond the jambs. All other reinforcement shall be continuous except that it shall not pass through vertical masonry control joints. Side rods shall be lapped at least 150 mm at splices.

.3 Use prefabricated corner and tee sections for continuous reinforcement at corners and intersecting walls.

.4 Vertical reinforcement shall have a minimum clearance of 13 mm from the masonry and not less than one bar diameter between bars.

.5 All block cores containing vertical reinforcing and/or anchor bolts shall be solidly filled with non-shrink grout.

.6 Place reinforcement and ties in grout spaces prior to grouting.

.7 Cleanouts: Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 1.5 m.

.8 Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally a maximum of 800 mm on center.

.9 Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimension shall be 76 mm.

.10 After cleaning, close cleanouts with closures braced to resist grout pressure.

3.3 Bonding and Tying

.1 Bond walls of two or more wythes using ladder type reinforcement in accordance with CSA S304, CSA A371 and as indicated.

.2 Tie masonry veneer to backing in accordance with CSA S304, CSA A371 and as indicated.

.3 Masonry ties shall be installed as per the requirements of CSA A371 with maximum spacing of 400 mm vertically and 400 mm horizontally.

3.4 Reinforced Lintels and Bond Beams

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA S304.

3.5 Metal Anchors

.1 Do metal anchors as indicated.

3.6 Lateral Support and Anchorage

.1 Do lateral support and anchorage in accordance with CSA S304 and as indicated.

.2 Anchor new masonry to existing with steel dowels as indicated. Drill into existing masonry and set reinforcing bars in epoxy adhesive in accordance with manufacturer's instructions.

3.7 Control Joints

.1 Terminate reinforcement 25 mm short of each side of control joints unless otherwise indicated.

.2 Control joints shall be stepped to avoid cutting lintel beams. Under no circumstance shall the control joints be placed to compromise the bearing for the lintel.

3.8 Field Bending

.1 Do not field bend reinforcement except where indicated or authorized by Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.9 Field Touch Up

.1 Touch up damaged and cut ends of galvanized reinforcement steel with compatible finish to provide continuous coating.

3.10 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 10 00 Concrete Forming and Accessories

.2 Section 03 20 00 Concrete Reinforcing

.3 Section 03 30 00 Cast-in-Place Concrete

.4 Section 04 05 19 Masonry Anchorage and Reinforcing

.5 Section 04 27 00 Multiple Wythe Unit Masonry

.6 Section 05 12 23 Structural Steel

.7 Section 05 50 00 Metal Fabrications

.8 Section 06 10 00 Rough Carpentry

.9 Section 07 84 00 Firestopping

.10 Section 07 92 00 Joint Sealants

.11 Section 08 11 00 Metal Doors and Frames

.12 Section 09 21 16 Gypsum Board

.13 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C90-24a Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units

.2 ASTM C129-25 Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units

.3 ASTM C150/C150M-24 Standard Specification for Portland Cement

.4 ASTM C207-24 Standard Specification for Hydrated Lime for Masonry Purposes

.5 ASTM D2240-15(2021) Standard Test Method for Rubber Property-Durometer Hardness.

.6 ASTM D5249-10(2021) Standard Specification for Backer Material for Use with Cold and Hot Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.

.2 CSA Group (CSA)

.1 CSA A23.1-14/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.

.2 CSA A165 Series-14 (R2019) CSA Standards on Concrete Masonry Units.

.3 CSA A179-14 (R2019) Mortar and Grout for Unit Masonry

.4 CSA A370-14 (R2018) Connectors for Masonry.

.5 CSA A371-14 (R2019) Masonry Construction for Buildings.

.6 CSA S304-14 (R2019) Design of Masonry Structures.

.3 Canadian Concrete Masonry Producers Association (CCMPA) Quality Assurance Program.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Data: Submit manufacturer's printed product literature, specifications and data sheets

.3 Submit the following samples:

.1 Two (2) of each type of concrete masonry units specified.

.2 Two (2) of each type of masonry accessory specified.

.4 Submit shop drawings for all masonry reinforcing. Include placing drawings, bar lists and details. Indicate clearly reinforcing bar sizes, spacing, bending details, lap details, dowels to adjacent construction location and quantities of reinforcement and connectors.

.5 Submit engineered temporary bracing design drawings for temporary support of masonry walls. Drawings shall be prepared by, and bear the seal of a Professional Engineer, licensed in the Province of Ontario.

.6 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.7 Inspection Reports: Inspection and Testing Company shall submit reports of inspections

and tests.

.1 Distribute inspection reports as follows:

.1 Consultant.

.2 Structural Engineer

.3 Contractor.

1.5 Quality Assurance

.1 The masonry sub-contractor shall have a minimum of five years of continuous documented Canadian experience in work of the type and quality shown and specified. Proof of experience shall be submitted when requested by the Consultant and shall be subject to the approval of the Consultant.

.2 Pre-installation meeting: conduct pre-installation meeting to verify project requirements manufacturer's instructions and manufacturer's warranty requirements.

.3 Field Quality Control:

.1 Inspection and testing will be carried out by Testing Laboratory designated by Owner.

.2 Payment for specified Work performed by Inspection and Testing Company will be made from Cash Allowance.

.3 Inspection and Testing Company shall perform sampling, inspection and testing of masonry work at site, in accordance with referenced standards, including but not limited to the following:

.1 Masonry Placement Inspection

.2 Reinforcing Steel Placement

.3 Grout and Mortar Testing

.4 CMU Testing

.4 Review provided by Inspection and Testing Company does not relieve Contractor of his sole responsibility for quality control over Work. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of his responsibilities in complying with the requirements of the Specification.

.5 Provide access to Work for inspectors.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Materials shall be kept clean and dry.

.4 Deliver cement, lime and mortar ingredients with manufacturer's seal and labels intact.

.5 Cementitious material and aggregates shall be stored in accordance with the requirements of CSA A23.1.

.6 Exposed units which become stained or chipped, surface marked or scratched, and materials which are affected by inadequate protection shall be replaced, at no additional expense to the Owner.

1.7 Project Conditions

.1 Provide heat enclosures and heat as required.

.2 Work to be undertaken shall be carried out according to CAN3-A371, Clause 5.15.2.

.3 Maintain temperature of mortar between 5 ° C and 50 ° C until batch is used.

.4 Keep masonry dry using secure waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven snow, rain and dirt, until masonry work is completed and protected by flashings or other permanent construction.

.5 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Masonry Units: Concrete Block: Modular, conforming to CCMPA requirements and CSA A165.1.

.1 H/20/A/M concrete masonry units to be used at all load bearing masonry walls.

.2 H/15/A/M concrete, masonry units, at all other locations unless noted otherwise.

.3 Refer to drawings for Fire Resistance Ratings. Type of concrete and block to conform to Table 5.0, Fire Resistance Rating of Concrete Block in Hours, of the Canadian Concrete Masonry Producers Association Handbook.

.4 Special shapes: provide special shapes indicated or required including bullnose and corner blocks, base blocks, fillers, and the like as may be required. Provide purpose made shapes for lintels and bond beams.

.5 Exposed block shall all be made by one manufacturer and shall be uniform in colour, shade and texture.

.2 Bar Reinforcement, wire reinforcement and ties: as specified in Section 04 05 19 - Masonry Anchorage and Reinforcing.

.3 Control Joint Filler: to ASTM D5249-10, Type 1, Round, flexible, continuous-length, nonabsorbent, nongassing, nonstaining, and nonshrinking. Extruded from a cross-linked polyethylene. Flexibile foam, heat-Resistant Backer Rod. 9.5 mm thick by width of wall.

.4 Pre-manufactured Masonry Control Joint: Pre-manufactured polyvinylchloride control joints may be used in lieu of the specified built-up type of joint.

.5 Mortar: Conforming to CSA A179.

.1 Use same brand of material and source of aggregate for entire project.

.2 Aggregate: CSA A179, fine grain aggregates.

.3 Cement: normal Portland to ASTM C150, Type 10.

.4 Water shall be clean, potable and free of deleterious amounts of acid, alkalies, or organic materials.

.5 Hydrated Lime: Type ‘S’ to ASTM C207.

.6 Type 'S' mortar shall be used for all concrete block masonry work.

.7 Proprietary Mortar Mixes: conform to mix requirements specified

.8 Mortar colour for concrete unit masonry work shall be grey.

.9 Admixtures of any kind are not allowed.

.6 Grout: to CSA A179, Table 3: Premixed, non-shrink non-metallic grout.

.7 Other materials not specifically described but required for a complete and proper installation of masonry, shall be as selected by the Contractor subject to approval by the Consultant

2.2 Mixes

.1 Mixing: Prepare and mix mortar materials under strict supervision, and in small batches only for immediate use.

.2 Mix proprietary mortars in strict accordance with manufacturer's instructions to produce the specified mortar types in accordance with CSA A179. Do not use re-tempered mortars.

.3 Take representative samples for testing consistency of strength and colour according to CSA A179.

2.3 Accessories

.1 Mechanical Fasteners: As recommended by manufacturer of material to be fastened, and in accordance with the reference standards, corrosion resistant.

PART 3 EXECUTION

3.1 Examination

.1 Examine work of other trades for defects or discrepancies and report same in writing to Consultant.

.2 Installation of any part of this work shall constitute acceptance of such surfaces as being satisfactory.

3.2 General

.1 Do masonry work in accordance with CSA A371 except where specified otherwise.

.2 A competent masonry foreman shall supervise and direct the work and only skilled masons shall execute the work of this Section.

.3 Coordinate work of this Section with others such as, field welding of anchors to steel work, insulation application, and the like. Prepare all items for built-in as the work proceeds, either supplied and installed by other trades or installed under this Section.

.4 Unless otherwise indicated on the drawings, all interior masonry partitions shall extend from floor level to the underside of floor or roof structures above.

3.3 Installation

.1 Build masonry plumb, level, and true to line, with vertical joints in alignment.

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

.3 Lay block with webs to align plumb over each other with thick ends of webs up. The top course of all partitions which do not pass through a ceiling or up to the underside of a roof deck shall have the open cells filled solid.

.4 Cut exposed block with power driven abrasive cutting disc or diamond cutting wheel for flush mounted electrical outlets, grilles, pipes, conduits, leaving 3 mm maximum clearance.

.5 Fill all vertical and bed joints, including plain end faces, through the entire wall thickness solidly with mortar.

.6 Do not break bond of exposed walls where partitions intersect and if bond would show through on exposed face of walls. Bond these partitions to walls they intersect with prefabricated intersection masonry reinforcement in each course.

.7 Bond intersecting block walls in alternate courses.

.8 Terminate non load bearing walls within 20 mm of structure above unless indicated otherwise.

.9 Where walls are pierced by structural members, ducts, pipes, fill voids with mortar to within 20 mm of such members.

.10 Buttering corners of units, throwing mortar droppings into joints, deep or excessive furrowing of bed joints, is not permitted. Do not shift or tap units after mortar has taken initial set. Where adjustment must be made after mortar has started to set, remove mortar and replace with fresh supply.

.11 Do not wet concrete masonry before or during laying in wall.

.12 Bed and vertical joints shall be evenly and solidly filled with mortar.

.13 Provide reinforced bond beams where indicated on structural drawings.

.14 Provide vertical reinforcement as indicated on structural drawings. Fill all reinforced cores solid with grout as indicated. Provide cleanout port at bottom of each grouted core when required by Consultant.

3.4 Exposed Masonry

.1 Do not use chipped, cracked or stained, and otherwise damaged units or unsatisfactory material in exposed and load bearing masonry walls.

.2 Lay all joints 10 mm thick (uniform). All joints shall be full of mortar except where specifically designated to be left open.

.3 All joints shall be slightly concave. Use sufficient force to press mortar tight against masonry units on both sides of joints. Remove excess material or burrs left after jointing by means of a trowel or rubbing with burlap bag.

.4 Provide bullnose block at all exposed masonry corners.

3.5 Tolerances

.1 Tolerances in notes to Clause 5.3 of CSA A371 apply.

3.6 Reinforcement

.1 Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.7 Concrete Masonry Lintels

.1 Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.

.2 Lintels in non-load-bearing walls shall be constructed with special bond or lintel block units unless shown otherwise on plans. Lintels shall bear 200 mm minimum and bearing shall be isolated with two layers of heavy asphalt coated paper.

.3 Reinforcing steel in lintels shall be 2 x 20 M bars minimum specified under Section 04 05 19 - Masonry Anchorage and Reinforcing, or as noted on drawings.

.4 Concrete fill for lintels shall be 25 MPa or as noted on the drawings. Concrete shall be as specified in Section 03 30 00.

3.8 Loose Steel Lintels

.1 Install loose steel lintels. Centre over opening width.

.2 Lintels supplied under Section 05 50 00 – Metal Fabrications.

3.9 Control Joints

.1 Provide continuous joints as indicted and at spacing not to exceed 6000 mm c/c unless noted otherwise on drawings.

.2 Break vertical mortar bond with extruded neoprene gasket or building paper.

.3 Prime control joint to prevent drying out of caulking material.

3.10 Support of Loads

.1 Use 25 MPa concrete unless specified otherwise on the Drawings, where concrete fill is used in lieu of solid units.

.2 Use grout to CSA A179 where grout is used in lieu of solid units.

.3 Install building paper below voids to be filled with grout. Keep paper 25 mm back from face of units.

3.11 Lateral Support and Anchorage

.1 Do lateral support and anchorage of masonry in accordance with CSA S304.1 and as indicated.

3.12 Grouting

.1 Grout masonry in accordance with CSA S304.1 and as indicated.

3.13 Temporary Wall Bracing

.1 Design and provide all required temporary engineered wall bracing.

.2 Brace masonry walls to resist wind pressure and other lateral loads during construction period.

.3 Provide temporary bracing of masonry work during and after erection until mortar has cured and permanent lateral support is in place

3.14 Built-ins

.1 Build in items required to be built into masonry and provided by other Sections, including bearing plates, door frames, anchor bolts, sleeves and inserts. Build in items to present a neat, rigid, true and plumb installation. Leave wall openings required for ducts, grilles, pipes and other items.

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

.3 Brace door jambs to maintain plumb. Fill voids between masonry and metal frames with masonry mortar or insulation, as indicated on drawings or as required to provide a neat, finished appearance.

.4 Set wall plates on masonry in non-shrink grout in accordance with manufacturer's instructions.

.5 Do all cutting, fitting, drilling, patching and making good for other trades in masonry work.

3.15 Protection

.1 Protect masonry units from damage resulting from subsequent construction operations.

.2 Use protection materials and methods which will not stain or damage masonry units.

.3 Remove protection materials upon Substantial Performance, or when risk of damage is no longer present.

3.16 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Allow mortar droppings on unglazed concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

.3 Remove mortar from concrete floor slabs and leave entire area vacuum clean.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 20 00 Concrete Reinforcing

.2 Section 03 30 00 Cast-in Place Concrete

.3 Section 04 05 19 Masonry Anchorage and Reinforcing

.4 Section 04 22 00 Concrete Unit Masonry

.5 Section 06 10 00 Rough Carpentry

.6 Section 07 21 13 Building Insulation

.7 Section 07 27 13 Modified Bituminous Sheet Air Barriers

.8 Section 07 92 00 Joint Sealants

.9 Section 07 95 13 Expansion Joint Covers

.10 Section 08 11 00 Metal Doors and Frames

.11 Section 08 44 13 Glazed Aluminum Curtain Walls

.12 Section 08 51 13 Aluminum Windows

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C90-22 Standard Specification for Loadbearing Concrete Masonry Units

.2 ASTM C129-22 Standard Specification for Nonloadbearing Concrete Masonry Units

.3 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes

.4 ASTM C1634-25 Standard Specification for Dry-Cast Concrete Facing Brick and Other Concrete Masonry Facing Units

.5 ASTM D2240-15(2021) Standard Test Method for Rubber Property-Durometer Hardness

.6 ASTM D5249-10(2021) Standard Specification for Backer Material for Use with Cold-

and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

.2 American Concrete Institute (ACI)

.1 ACI 530.1-05/ASCE 6-05/TMS 602-05 Specification for Masonry Structures.

.3 CSA Group (CSA)

.1 CSA A165 Series-14 (R2024) Concrete Masonry Units.

.2 CSA A179-14 (R2019) Mortar and Grout for Unit Masonry

.3 CSA A370-14 (R2018) Connectors for Masonry

.4 CSA A3000-18 Cementitious Materials Compendium

.5 CSA A371-14 (R2019) Masonry Construction for Buildings.

.6 CSA S304-14 (R2019) Design of Masonry Structures

.4 Canadian Concrete Masonry Producers Association (CCMPA) Quality Assurance Program.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit full range of manufacturer’s standard colour samples of coloured mortar for selection of colours by the Consultant.

.3 Data: Submit manufacturer's printed product literature, specifications and data sheets.

.4 Submit the following samples:

.1 Two of each type of brick masonry units specified.

.2 Two of each type of masonry accessory specified.

.3 Submit samples of coloured mortar selected by the Consultant.

.5 Submit shop drawings for all masonry reinforcing. Include placing drawings, bar lists and details. Indicate clearly reinforcing bar sizes, spacing, bending details, lap details, dowels to adjacent construction location and quantities of reinforcement and connectors.

.6 Submit engineered temporary bracing design drawings for temporary support of masonry walls. Drawings shall be prepared by, and bear the seal of a Professional Engineer, licensed in the Province of Ontario.

1.5 Quality Assurance

.1 The masonry sub-contractor shall have a minimum of five (5) years of continuous documented Canadian experience in work of the type and quality shown and specified. Proof of experience shall be submitted when requested by the Consultant and shall be subject to the approval of the Consultant.

.2 Mockup

.1 Refer to Section 01 45 00 – Quality Control.

.2 Prior to proceeding with the work of this Section, construct a 1200 mm long x 1000 mm high panel mock-up, to establish for the Consultant's review and acceptance, the general construction and appearance of the installed masonry walls including mortar colours. Mock-up panel shall incorporate each type of masonry unit, use of reinforcement, connectors, through wall flashings, air barriers, weep holes, jointing, coursing, mortar and workmanship.

.3 Allow 24 hours for inspection of mock-up by Consultant before proceeding with the work.

.4 Erect as many panels as are necessary to obtain Consultant's acceptance without additional cost to the Owner. Remove rejected panels from site.

.5 Upon the Consultant's acceptance, complete all masonry work in strict accordance with the standards established in the mock-up.

.6 The accepted mock-up panel shall remain intact until the work of this Section has been accepted by the Consultant and shall serve as the basis of standard for the work.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Materials shall be kept clean and dry.

.3 Deliver cement, lime and mortar ingredients with manufacturer's seal and labels intact.

.4 Cementitious material and aggregates shall be stored in accordance with the requirements of CAN A23.1.

.5 Exposed units which become stained or chipped, surface marked or scratched, and materials which are affected by inadequate protection shall be replaced.

.6 Masonry units shall be delivered to site in protective film and shall be stored without contact with ground or ground water.

1.7 Cold Weather Requirements

.1 Provide heat enclosures and heat as required.

.2 Work to be undertaken shall be carried out according to CAN3-A371, Clause 5.15.2.

.3 Maintain temperature of mortar between 5 °C and 50 °C until batch is used.

1.8 Hot Weather Requirements

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

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Concrete Masonry Units:

.1 Concrete Block: Modular, conforming to CCMPA requirements and CSA A165.

.2 H/20/A/M concrete masonry units to be used at all multiple wythe exterior walls.

.3 Special shapes: provide special shapes indicated or required including bullnose and corner blocks, base blocks, fillers, and the like as may be required. Provide purpose made shapes for lintels and bond beams.

.4 Exposed block shall all be made by one manufacturer and shall be uniform in colour, shade and texture.

.2 Facebrick:

.1 To ASTM C1634 normal weight through-body colour concrete brick

.2 Brampton Brick Finesse Series, smooth finish,.

.3 Premier Plus 90 x 79 x 257mm

.4 RainBloc Integral Water Repellent System

.5 Colours: Two colours will be selected by the Consultant to match existing brick colours and coursing.

.3 Masonry Reinforcement and Connectors: Bar Reinforcement, wire reinforcement, connectors and ties: as specified in Section 04 05 19.

.4 Control Joint Filler: to ASTM D5249, Type 1, Round, flexible, continuous-length, nonabsorbent, non-gassing, non-staining, and non-shrinking. Extruded from a

cross-linked polyethylene. Flexible foam, heat-Resistant Backer Rod. 9.5 mm thick by width of wall: Sealtight Cera-Rod by W. R. Meadows Canada Limited.

.5 Pre-manufactured Masonry Control Joint: Pre-manufactured polyvinyl chloride control joints may be used in lieu of the specified Built-up type of joint. Control joints as manufactured by the following are acceptable:

.1 Wall-Tite by Blok-Lok Limited

.2 Rapid Control Joint- Wide Flange by Dur-O-Wall Limited

.3 Flexible PVC Masonry Control Joint by Greenstreak

.6 Mortar and Grout:

.1 Conforming to CSA A179

.2 Use same brand of material and source of aggregate for entire project.

.3 Aggregate: CSA A179 coarse sharp clean sand, free from salt, alkaline or other organic substances, specifically graded for masonry use.

.4 Cement: To CSA A3000, masonry cement. Type N. Blended mixes of Portland cement to CSA A3000 and double hydrated lime to ASTM C207.

.5 Water shall be clean, potable and free of deleterious amounts of acid, alkalies, or organic materials.

.6 Hydrated Lime: Type ‘N’ to ASTM C207.

.7 Type 'N' mortar shall be used for all masonry work.

.8 Proprietary Mortar Mixes: St. Lawrence Cement Company, Blue Circle Cement, Daubois Inc., Lafarge Canada. Mortar mixes shall conform to mix requirements specified.

.9 Mortar colour for concrete block masonry work shall be grey.

.10 Mortar for facebrick units shall be coloured with ground coloured natural aggregates. Colours will be selected by the Consultant.

.1 Coloured mortar: colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample.

.11 Admixtures of any kind are not allowed except as specified for coloured mortar.

.12 Grout: to CSA A179, Table 3.

.13 Premixed, non-shrink non-metallic grout: Non Shrink Grout by C.P.D., V3 Grout by W.R. Meadows of Canada, NS Grout by Euclid.

.14 Parging Mortar: Type N, to CSA A179.

.7 Other Materials: all other materials not specifically described but required for a complete and proper installation of masonry, shall be as selected by the Contractor subject to approval by the Consultant.

2.2 Mixes

.1 Mixing: Prepare and mix mortar materials under strict supervision, and in small batches only for immediate use. Mix proprietary mortars in strict accordance with manufacturer's instructions to produce the specified mortar types in accordance with CSA A179. Do not use retempered mortars.

.2 Admixtures: in accordance with manufacturer’s printed directions.

.3 Use mortar within 2 hours after mixing at temperatures of 26 °C, or 2-1/2 hours at temperatures under 10 °C.

.4 Take representative samples for testing consistency of strength and colour according to CSA A179.

2.3 Damp Course and Flashings

.1 Fully compatible with air barrier membrane specified in Section 07 27 13. Self-adhesive modified SBS bitumen membrane reinforced with proprietary glass screen, minimum thickness of 1.0 mm:

.1 Vedagard Non-slip by Bakor Inc.

.2 Perm-A-Barrier Wall Flashing by W.R. Grace & Co.

.3 Mel-Dek by W.R. Meadows

.4 Enverge Flashguard by Firestone.

.2 Lap Sealant: recommended by flashing manufacturer.

.3 Surface primers and conditioners as recommended by membrane manufacturer.

2.4 Accessories

.1 Cavity Vents and Weepholes: purpose made PVC vents, with pest resisting design, size to suit masonry units. Cell-Vent with mortar net, or Mor-Control by Dur-O-Wal Inc. Colour to match mortar colour.

.2 Cell vents: polypropylene plastic, honeycomb design.

.1 Size: to suit.

.2 Colour: as selected by Consultant.

.3 Mortar diverters: shaped and sized to suit cavity spaces.

.1 Manufactured from recycled material.

.4 Grout Screens: 6 mm square monofilament screen fabricated from high-strength, non-corrosive polypropylene polymers to isolate flow of grout in designated areas.

.5 Mechanical Fasteners: As recommended by manufacturer of material to be fastened, and in accordance with the reference standards, corrosion resistant.

.6 Packing Insulation: loose glass fibre insulation or mineral wool with minimum density of 17.6 kg/m³.

2.5 Fabrication

.1 Lintels in non-load-bearing walls shall be constructed with special bond or lintel block units unless shown otherwise on plans. Lintels shall bear 150 mm minimum and bearing shall be isolated with two layers of heavy asphalt coated paper.

.2 Reinforcing steel in lintels shall be 2 x 20 M bars or as noted on drawings.

.3 Concrete fill for lintels shall be 20 MPA or as noted on the drawings. Concrete shall be as specified in Section 03 30 00.

PART 3 EXECUTION

3.1 Existing Conditions

.1 Examine work of other trades for defects or discrepancies and report same in writing to Consultant.

.2 Installation of any part of this work shall constitute acceptance of such surfaces as being satisfactory.

3.2 General

.1 Do masonry work in accordance with CSA A371 except where specified otherwise.

.2 Refer to structural drawings for additional requirements for load bearing masonry walls.

.3 Build masonry plumb, level and true to line, with vertical joints in alignment.

.4 Lay out coursing and bond to achieve correct coursing heights and continuity of bond above and below openings, with minimum cutting.

.5 A competent masonry foreman shall supervise and direct the work and only skilled masons shall execute the work of this Section. The workmanship in construction of exposed masonry walls shall be of highest calibre and first class in all respects.

.6 Chipped, cracked or stained, and unsatisfactory material or workmanship of all masonry work shall be replaced with undamaged units.

.7 Co-ordinate work of this Section with others such as, field welding of anchors to steel work, insulation application, installation of conduit and the like. Prepare all items to built-in as the work proceeds, either supplied and installed by other trades or installed under this Section.

.8 Walls shall be constructed as true planes and when tested with a 3 metre straight edge placed anywhere on the wall in any direction shall be true within 3 mm.

.9 Variation in the Sizes of Wall Openings: A 6 mm maximum variation is allowed from the actual designated size of wall openings.

.10 Buttering corners of units, throwing mortar droppings into joints, deep or excessive furrowing of bed joints, will not be permitted. Do not shift or tap units after mortar has taken initial set. Where adjustment must be made after mortar has started to set, remove mortar and replace with fresh supply. Bed and vertical joints shall be evenly and solidly filled with mortar.

.11 All mortar shall be used and placed in final position within 2 hours of mixing. Mortar not used within this time limit shall be discarded.

.12 Lay all joints 10 mm thick (uniform) unless otherwise specified or otherwise indicated on drawings. All joints shall be full of mortar except where specifically designated to be left open.

.13 All joints shall be slightly concave. Use sufficient force to press mortar tight against masonry units on both sides of joints. Remove excess material or burrs left after jointing by means of a trowel or rubbing with burlap bag.

.14 Coordinate with Electrical and Mechanical trades and set smooth faced block at locations of all outlets, boxes, switches, thermostats and other devices.

3.3 Blockwork

.1 Provide special shapes and sizes as required such a halves, jambs, lintels, solids, corners, bullnoses and double bullnoses, semi-solids, ashlar, etc.

.2 Lay block with webs to align plumb over each other with thick ends of webs up.

.3 Cut exposed block with power driven abrasive cutting disc or diamond cutting wheel for flush mounted electrical outlets, grilles, pipes, conduits, leaving 3 mm maximum clearance.

.4 Do not wet concrete masonry before or during laying in wall.

.5 Fill all vertical and bed joints, including plain end faces, through the entire wall thickness solidly with mortar.

.6 Bond intersecting block walls in alternate courses.

.7 Provide bullnose block at all exposed masonry corners.

.8 Provide reinforced bond beams where indicated on structural drawings.

.9 Provide vertical reinforcement as indicated on structural drawings.

.10 Where walls are pierced by structural members, ducts, pipes, fill voids with mortar to within 20 mm of such members.

.11 All exposed interior block corners shall be bullnose.

3.4 Exterior Walls

.1 Exterior wall construction shall be erected as shown on the drawings of exterior concrete brick veneer and concrete block back-up with a nominal 100 mm cavity and 75 mm rigid insulation

.2 Veneer in double wythe masonry wall construction shall be tied to block backup together with adjustable truss type masonry reinforcing as specified in Section 04 05 19.

.3 Bond walls of two or more wythes and tie masonry veneer to backing in accordance with NBC, CSA S304, CSA A371, and as indicated.

.4 Masonry units shall be laid up in running bond unless indicated otherwise.

.5 Place continuous dampcourse and flashing membrane at the bottom of all exterior walls, including at bottom of walls and over all openings. Extend flashing from exterior face of exterior wythe, turned up backing face minimum 150 mm and built into the first horizontal block joint or bonded to sheathing with adhesive, unless otherwise indicated. Lap all joints 150 mm and seal with adhesive.

.6 Jointing: allow joints to dry just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints.

3.5 Air Barriers and Insulation

.1 Apply air barriers and insulation over exterior face of concrete block inner wythe as specified in Section 07 27 13. Do not proceed with veneer application until insulation has been inspected and approved.

3.6 Placement – Veneer Wythe

.1 Use full-size brick units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying. Install cut units with cut surfaces concealed.

.2 Mixing and Blending: mix masonry units within each pallet and with other pallets to ensure uniform blend of colour, size and texture.

.3 Comply with tolerances in ACI 530.1-05/ASCE 6-05/TMS 602-05.

.4 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets.

.5 Avoid using less-than-half-size units, particularly at corners, jambs, and where possible, at other locations.

.6 Bond Pattern: Unless otherwise indicated, lay masonry in running bond, do not use units with less than nominal 100 mm horizontal face dimensions at corners or jambs.

3.7 Moisture Control

.1 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

.2 Mortar diverters: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.

.3 Grout screens: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.

3.8 Reinforcement

.1 Refer to Section 04 05 19 and structural drawings.

3.9 Control Joints

.1 Provide continuous joints as indicated.

.2 Joints shall be full height and thickness of wall and shall be 10 mm wide.

.3 Break vertical mortar bond with extruded neoprene gasket or building paper.

.4 Prime control joint to prevent drying out of caulking material.

3.10 Concrete Masonry Lintels

.1 Install reinforced concrete block lintels over openings in masonry walls where steel or reinforced concrete lintels are not indicated.

.2 End bearing: not less than 200 mm.

.3 Refer to Section 04 05 19 and drawings.

3.11 Loose Steel Lintels

.1 Install loose steel lintels. Centre over opening width. Lintel sizes indicated on structural drawings and supplied under Section 05 50 00.

3.12 Grouting

.1 Grout masonry in accordance with CSA S304 and as indicated.

3.13 Support of Loads

.1 Use 20 MPa concrete unless specified otherwise on the Drawings, where concrete fill is used in lieu of solid units. Refer to structural drawings.

.2 Use grout to CSA A179 where grout is used in lieu of solid units.

.3 Install building paper below voids to be filled with grout. Keep paper 25 mm back from face of units.

3.14 Lateral Support and Anchorage

.1 Refer to Section 04 05 19.

3.15 Temporary Wall Bracing

.1 Design and provide all required temporary engineered wall bracing.

.2 Brace masonry walls to resist wind pressure and other lateral loads during construction. Bracing of all masonry walls during construction and prior to completion of supporting structures is a mandatory requirement.

3.16 Built-Ins

.1 Build in items provided by other Sections, including bearing plates, door frames, anchor bolts, sleeves, inserts and loose steel lintels. Build in items to present a neat, rigid, true and plumb installation. Leave wall openings required for ducts, grilles, pipes and other items.

.2 Fill voids between masonry and metal frames with masonry mortar or insulation, as indicated on drawings or as required to provide a neat finished appearance.

.3 Set wall plates on masonry in non-shrink grout in accordance with manufacturer's instructions.

.4 Do all cutting, fitting, drilling, patching and making good for other trades in masonry work.

.5 Consultant's approval shall be obtained before cutting.

3.17 Protection

.1 Keep masonry dry using secure waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from snow, rain and dirt, until masonry work is completed and protected by flashings or other permanent construction.

.2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

.3 Protect masonry units from damage resulting from subsequent construction operations.

.4 Use protection materials and methods which will not stain or damage masonry units.

.5 Remove protection materials upon Substantial Performance of the Work, or when risk of damage is no longer present.

3.18 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Obtain and follow material manufacturer's written instructions for Cleaning. Test sample area, 3.0 m x 3.0 m, to judge effectiveness of cleaning procedures.

.3 Keep wall clean and free of mortar stains during laying.

.4 Protect windows, trim and metal.

.5 Remove mortar with wood paddles and scrapers before wetting. Saturate masonry with clean water and flush off loose mortar and dirt. Clean masonry work using water, scrubbing brushes and wood paddles only.

.6 Remove mortar from concrete floor slabs and finished surfaces.

.7 Leave entire area vacuum clean.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 04 22 00 Concrete Unit Masonry

.3 Section 04 27 00 Multiple Wythe Unit Masonry

.4 Section 05 21 00 Steel Joists

.5 Section 05 31 00 Steel Deck

.6 Section 05 50 00 Metal Fabrications

.7 Section 07 81 16 Cementitious Fireproofing

.8 Section 08 92 00 Louvred Equipment Enclosures

.9 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International, (ASTM)

.1 ASTM A108-24 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

.2 ASTM A123/A123M-24 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.3 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.4 ASTM A307-21 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

.5 ASTM A653/A653M-25a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.6 ASTM A1011/A1011M-25 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High-Strength

.7 ASTM F3125/F3125M-25a Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

.2 CSA Group (CSA)

.1 CSA G40.20/G40.21-13 (R2018) General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

.2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16:19 Design of Steel Structures.

.4 CSA S136-16 North American Specification for the Design of Cold Formed Steel Structural Members

.5 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel Structures.

.6 CSA-W48.1-M1991 (R1998) Carbon Steel Covered Electrodes for Shielded Metal Arc Welding

.7 CSA-W55.3-08 (R2013) Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.8 CSA W59-18 Welded Steel Construction (Metal Arc Welding).

.9 CSA W178.1-18 Certification of Welding Inspection Organizations.

.10 CSA W178.2-18 Certification of Welding Inspectors.

.3 American Welding Society (AWS)

.1 AWS A2.4:2020 Standard Symbols for Welding, Brazing, and Nondestructive Examination

.4 Structural Steel Painting Council

.1 SSPC-SP 6-91 Commercial Blast Cleaning.

.5 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)

.1 CISC/CPMA 1-73a Quick-Drying, One-Coat Paint for Use on Structural Steel.

.6 American Institute of Steel Construction (AISC)

.1 Code of Standard Practice for Steel Buildings and Bridges, Section 10, Architectural Exposed Structural Steel, latest edition.

.7 The National Building Code of Canada.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop and erection drawings. Submit typical details of connections and any special connections for review before preparation of shop drawings. Assume responsibility for the accuracy of Work. Review of submitted shop drawings is to ensure only that the Contract Documents are being correctly interpreted.

.3 Professional Engineer responsible for connection design shall sign and seal each shop drawing.

.4 Show on shop drawings the size, spacing, and the location of structural steel members; connections; attachments; reinforcing; anchorage and required inserts; and all necessary plans, elevations and details.

.5 Show splice locations and details.

.6 Welded connections shall be designated by welding symbols in compliance with AWS A2.4 and indicate clearly net weld lengths.

.7 Submit design calculations if requested by the Consultant.

.8 Submit diagrams showing methods of erection.

.9 Field Work Drawings shall be submitted as shop drawings.

.10 Notify Consultant in writing of any deviations in shop drawings from the requirements of the Contract Documents.

.11 Submit a schedule of fabrication to the Consultant and the Testing Agency, prior to commencement of fabrication.

1.5 Qualifications

.1 Undertake welding and/or welding inspection by welders fully approved to one or more of the reference codes and standards where applicable.

1.6 Quality Assurance

.1 Connections:

.1 Connections designed by Engineer: Submission of shop drawings for connection which have been detailed on Drawings shall represent acceptance by Contractor that connection can be executed successfully.

.2 Design of other connections which cannot be selected from standard designs tabulated in CISC Handbook of Steel Construction shall be by a Professional Engineer, licensed in the Province of Ontario, experienced in structural steel connection design.

.3 Consultant will review connection arrangement to verify general conformance with overall design concept of structure.

.4 Connection design engineer shall be insured for professional liability in accordance with section 74 subsection (1) of Regulation 941 of the Ontario Professional Engineers Act. The alternative of compliance with subsection (2) is not acceptable.

.5 Provide connections adequate to resist reaction of beam, when beam is loaded to maximum flexural capacity under uniformly distributed load, unless reaction or connection detail is shown on Drawings.

.1 Provide flexible beam connections for unrestrained members in accordance with CSA S16.1, unless shown otherwise on Drawings.

.2 Select connections, wherever possible, from standard designs tabulated in current edition of CISC Handbook of Steel Construction, except that length of beam web angles shall not be less than half the depth of beam, and single angles shall not be used.

.3 Provide direct connections to flanges of spandrel beams (exterior perimeter beams) to restrain twisting.

.2 Design:

.1 Connections:

.1 Provide bolted or welded connections, unless shown otherwise on Drawings.

.2 Use high strength bolts to ASTM F3125 for all connections.

.3 Use slip resistant (friction-type) connections for bolted joints designed to resist reversible forces.

.4 Provide tension adjustment hardware at rod type bracing and at flat bar type bracing.

.5 Do not permit connections to encroach on clearance lines required for installation of Work of other Sections.

.3 Random Splicing: Obtain in writing from Consultant, prior to commencement of shop drawings, special requirements that will be imposed as a necessary condition of acceptance of members with randomly located butt welded splices.

.4 All edge perimeter angles and bent plates installed at roof framing level shall be joined by butt weld splices designed for full tension capacity of members being joined.

1.7 Tolerances

.1 In addition to tolerances specified in CSA S16, erect shelf angles and sash angles attached to steel frame within a tolerance of 3 mm plus or minus, with abutting ends of members at the same level.

1.8 Inspection and Testing

.1 Inspection and testing of materials and shop fabrication of Work of this Section, and field quality control, will be performed by an independent Inspection and Testing Company.

.2 The Inspection and Testing Company shall meet qualification requirements of CSA W178.1 and shall be certified by the Canadian Welding Bureau in Category 1 Buildings.

.3 Welding Inspectors and supervisors shall be certified by Canadian Welding Bureau to CSA W178.2, to minimum level 2 certification.

.4 Provide free access for inspectors to all places work is being performed, whether on site or off.

.5 Mill inspection shall ensure that materials conform to specified requirements. Mill test reports, properly correlated to the materials, will be accepted in lieu of physical tests.

.6 Shop inspection shall ensure that structural steel is fabricated in accordance with the shop drawings, and the specified fabrication and welding procedures.

.7 The cost of inspection and testing of splices introduced by the fabricator and not required on the Contract Documents will be paid by the Contractor.

.8 Inspection and Testing Company when appointed shall carry out shop inspection to verify:

.1 Structural materials and paint conform to Specifications. Mill test reports, properly correlated to the materials, will be accepted in lieu of physical tests of structural materials.

.2 Fabrication and welding conforms to Specifications and dimensioned shop drawings.

.3 Shop cleaning and preparation and prime painting to conform to specified requirements.

.4 Surfaces inaccessible for cleaning and painting after assembly are treated before assembly.

.5 For surfaces painted with zinc rich paint or zinc primer, specified surface preparation is followed and specified paint thickness is applied.

.9 Non-destructive Testing of Welded Connections: Carry out non-destructive testing of welded connections chosen at random as follows:

.1 Check and record steel member sizes for 20% of beams.

.2 Check 5% of all welds by magnetic particle inspection.

.3 Check 25% of moment connections and all connections subject to direct tension involving use of full penetration groove welds by ultrasonic testing.

.4 Check 10% (minimum 2 per connection) in accordance with Section 23 of CSA S16 of pretensioned connections including main building bracing connections.

.10 More frequent testing and inspection shall be completed if random tests described above are not satisfactory. These costs are to be paid by the Contractor.

1.9 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver products that are only supplied under work of this Section to those who are responsible for their installation, to the work site as directed and to meet construction schedule.

.3 Handle and store structural steel in such a manner that no damage, including corrosion, is caused to the stored or erected work, or to other property.

.4 Store structural steel off of ground on timber supports.

1.10 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Rolled shapes, hollow structural sections, plates and rods: new steel, in compliance with CSA and/or ASTM Standards indicated on Structural Drawings.

.2 Welding Electrodes: to meet the requirements set forth in the applicable standard of the CSA W48 Series on welding electrodes. (Any process which produces deposited weld metal meeting the requirements of the applicable W48 Series Standard for any grade of arc welding electrodes shall be accepted as equivalent to the use of such electrodes.)

.3 High Strength Bolts: to meet specified requirements of ASTM F3125

.4 Machine Bolts: to meet specified requirements of ASTM A307.

.5 Anchor Bolts: To CSA-G40.20/G40.21, Grade 300W.

.6 Shop Coat Paint:

.1 Interior structural steel: To meet specified requirements of CISC/CPMA 1-73a and compatible with Master Painters Institute INT 5.1S or 5.1X Institutional low odour/low VOC semi-gloss finish. Colour to be grey.

.7 Galvanizing: hot dipped with zinc coating to CSA G164, ASTM A123 or ASTM A153.

PART 3 EXECUTION

3.1 Fabrication

.1 Fabricate work of this Section in compliance with CSA S16, and as specified following.

.2 Connections:

.1 Make bolted or welded connections.

.2 Use high strength bolts unless otherwise noted on Drawings.

.3 Use friction type high strength bolts for the connections of bracing members (diagonal kickers) resisting the effects of applied lateral loads. Provide tension adjustment at flat bar and rod type lateral bracing.

.4 Do not permit connections to encroach on the clearance lines required for the installation of work of this Section.

.3 Beam Connections:

.1 Provide beam connections adequate to resist the reactions produced by the framing or load conditions.

.2 Provide beam to column connections that apply vertical reaction with negligible eccentricity at the connecting face of the column, such as single or double beam web connections, end plate connections or un-stiffened seats, unless otherwise shown on Drawings. Submit for review, in advance of the preparation of shop drawings, connections which do not meet these requirements.

.3 Provide connections complying with the requirements of the CISC Handbook of Steel Construction, except that the length of beam web angles shall not be less than half the depth of the beam and single angles shall not be used.

.4 Provide direct connections to flanges of spandrel beams to restrain twisting.

.4 Holes in Structural Members:

.1 Punch holes 11 mm to 27 mm in diameter as required for attaching the work of other Sections to structural steel members. Locate holes so that no appreciable reduction of the strength of members is caused.

.2 Provide holes for pipes and ducts, and reinforce openings as indicated on drawings. Cutting of holes in structural members in the field will not be permitted except with written approval of the Consultant.

.3 Provide effective drainage holes to prevent the accumulation of water in tubular members.

.5 Member Separators: Provide separators at approximate spacing of 1200 mm o.c. for double beams and channels as follows:

.1 For beams and channels 225 mm or less in depth: one or two rows of pipe separators.

.2 For beams and channels over 225 mm in depth: channel separators, unless otherwise detailed on Drawings.

.6 Built up Compression Members General Requirements: Comply with the requirements of CSA-S16, for all built up compression members.

.7 Column Bearing Plates: Mill column bearing plates under column bearing unless plate is sufficiently flat to give adequate contact bearing between column and plate.

.8 Structural Steel Painting: All prime painting shall be shop applied and the responsibility of the steel fabricator. Refer to specific priming requirements specified in Section 09 91 23 - Interior Painting.

.1 Paint in accordance with manufacturer’s published directions. Paint steel in the shop under cover. Keep painted members under cover until the paint has dried.

.2 Clean and prepare surfaces, as appropriate for paint specified, in accordance with Commercial Blast Cleaning is only required where zinc rich paint is to be applied. All other steel to be or clean steel in compliance with SSPC SP6 where zinc rich paint is shop applied.

.3 Where paint is applied adjacent to welded joints, remove it to bare metal for a distance of at least 50 mm beyond sides of joints.

.4 Do not paint surfaces and edges to be field welded, contact surfaces of friction type connections assembled by high strength bolts, surfaces encased in or in contact with concrete.

.5 Do not paint surfaces to receive cementitious fireproofing.

.9 Galvanizing: Galvanize members as indicated and in accordance with reference standards, after shop welding is complete.

.1 Steel members, fabrications, and assemblies shall be galvanized after fabrication by the hot dip process in accordance with CSA G164 or ASTM A123.

.2 Bolts, nuts, washers, iron, and steel hardware components shall be galvanized in accordance with CSA G164 or ASTM A153.

.3 Coating Requirements:

.1 Weight: the weight of the galvanized coating shall conform with Table 1 of CSA G164 or paragraph 6.1 of ASTM A123 and Table 1 of ASTM A153 (as appropriate).

.2 Surface Finish: The galvanized coating shall be continuous, adherent, as smooth and evenly distributed as possible and free from any defect that is detrimental to the stated end use of the coated article.

.4 The integrity of the coating shall be determined by visual inspection and coating thickness measurements.

.5 Adhesion: the galvanized coating shall be sufficiently adherent to withstand normal handling.

3.2 Examination

.1 Verify, before delivery of structural steel, that work of other Sections on which work of this Section is dependent is correctly installed and located.

3.3 Preparation

.1 Supply anchor bolts, base and bearing plates and other members to be built in under work of other Sections as the work progresses. Cooperate with installers of this work and provide instructions for setting items to be built in.

3.4 Erection

.1 Comply with CSA S16 and work site safety plans in erection of work of this Section.

.2 Make adequate provision for horizontal and vertical erection loads and for sufficient temporary bracing to keep structural frame plumb and in true alignment until the completion of erection, and the installation of masonry, concrete work, and floor and roof decks which provide the necessary permanent bracing.

.3 Provide temporary steel members as may be required for erection purposes and remove them when no longer required.

.4 Installation of Bearing and Column Base Plates: Install bearing plates and standard wall anchors for beams bearing on masonry or concrete.

.1 Set loose beam bearing plates and column base plates, at proper elevation, true and level, with steel shims, ready for grouting as specified under work of other Sections.

.2 Set loose bearing plates and/or levelling plates to be cast into concrete.

3.5 Coating Touch-Up

.1 Clean welds with wire brushes and wash down with clean water to ensure no residue from electrodes is present.

.2 After erection, give one coat of prime coat or zinc rich paint as applicable and specified for shop coat to field bolts, field connections, burnt areas, and abrasions or damage to shop coats.

.3 Touch up all areas with a specified paint film thickness.

.4 Give areas of bare metal on galvanized members two coats of zinc-rich paint. Repair coating on architecturally exposed galvanized metals in accordance with reference standards and as directed by the Consultant. Replace any materials where damage cannot be repaired to the satisfaction of the Consultant.

3.6 Field Quality Control

.1 Inspection and Testing Company, when appointed as specified in Source Quality Control elsewhere in this Section, shall perform:

.1 Inspection of erection and fit-up, including placing, plumbing, levelling and temporary bracing and conformance with specified tolerances.

.2 Inspection of bolted connections, including verification that ASTM A307, ASTM F3125 snug tight only bolts, and ASTM F3125 pre-tensioned bolts have been installed and used appropriately, and that threads are excluded from shear plane where required.

.3 Inspection of welded joints, including slag removal.

.4 General inspection of field cutting and alterations; report immediately to Consultant, any alterations or cutting not shown on reviewed shop drawings.

.5 General inspection of shop coating touch-up.

.6 Inspection of zinc primer and zinc-rich paint, including surface preparation and coating thickness.

3.7 Defective Work

.1 Variations in excess of specified tolerances, and failure of materials or workmanship to meet requirements of this specification, and which cannot be repaired by approved methods, will be considered defective Work performed by this Section.

.2 Replace defective Work, as directed by Consultant.

.3 Pay for additional inspection and testing, redesign, corrective measures, and related expenses if Work has proven to be deficient.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 20 00 Concrete Reinforcing

.2 Section 03 30 00 Cast-in-Place Concrete

.3 Section 05 12 23 Structural Steel

.4 Section 05 31 00 Steel Deck

.5 Section 07 81 16 Cementitious Fireproofing

1.3 References

.1 ASTM International, (ASTM)

.1 ASTM A108-24 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

.2 ASTM A1011/A1011M-25 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High-Strength

.2 CSA Group (CSA)

.1 CSA S16:19 Design of Steel Structures

.2 CSA S136-16 North American Specification for the Design of Cold Formed Steel Structural Members

.3 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel

.4 CSA-W48.1-M1991 (R1998) Carbon Steel Covered Electrodes for Shielded Metal Arc Welding

.5 CSA W59-18 Welded Steel Construction (Metal Arc Welding)

.6 CSA W55.3-08 (R2018) Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings

.7 CSA W178.1-18 Certification of Welding Inspection Organizations

.8 CSA W178.2-18 Certification of Welding Inspectors

.3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)

.1 CISC/CPMA 2-75 Quick-Drying, Primer for Use on Structural Steel

.2 CISC/CPMA 1-73a Quick-Drying, One-Coat Paint for Use on Structural Steel

.4 The National Building Code of Canada.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Submit steel joist shop drawings as defined in reference standards. Shop drawings shall be stamped by a Professional Engineer registered in the Province of Ontario. Each submission of the shop drawings shall bear the seal of the Engineer.

.2 Indicate, in addition, dimensioned intersections of members, critical bending moments due to eccentricities, joist spacing, framing for openings, and slopes.

.3 Detail welded connections using standard symbols for welding joints as published in the current CISC Handbook of Steel Construction.

.4 Indicate on erection drawings, for each type of joist and bearing condition, the centre of bearing assumed in design and the maximum allowable distance from this point to the intersection of the axes of the chord and the end diagonal.

.5 Review all shop drawings prior to submission. By this review, the Contractor represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue number and similar data or will do so and that he has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.

.6 At time of submission, notify the Consultant in writing of any deviations in the shop drawings from the requirements of the Contract Documents.

.7 The Consultant will review and return shop drawings in accordance with any schedule agreed on, or otherwise with reasonable promptness. The Consultant's review will be for conformity to the design concept and for general arrangement only and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the Contract Documents unless a deviation on the shop drawings has been approved in writing by the Consultant.

.8 Make any changes in shop drawings which the Consultant may require and resubmit unless otherwise directed by Consultant. When resubmitting the Contractor shall notify the Consultant in writing of any revisions other than those requested by the Consultant.

1.5 Quality Assurance

.1 Design Criteria

.1 Design joists to carry loads indicated on structural drawings.

.2 Design joist to ensure that total load deflection does not exceed 1/240 of the span and live load deflection does not exceed 1/360 of the span.

.3 Analyze joists composed wholly or in part of cold formed structural members as rigidly connected linear elastic frame works, including all joint eccentricities. Design cold formed members for combined axial loads and bending moments predicted by analysis. Design hot rolled members for combined axial load and bending moment if eccentricity at one or both ends exceeds limits of reference standards above.

.4 Tie Joists: Where tie joists are used, design tie joist, columns and connections to resist the member forces predicted by a linear elastic analysis.

.5 Design special joist components to allow the passage of mechanical and electrical services through webs of joists, where so indicated on the structural drawings.

.6 Design of joists shall be by a Professional Engineer licensed in the Province of Ontario and experienced in steel joist design.

.7 Design framing members to meet minimum requirements of ULC for listed assemblies

.2 Source Quality Control

.1 Inspection and testing of materials and shop fabrication of work of this Section, and field quality control specified elsewhere in this Section, will be performed by an Inspection and Testing Company appointed by the Consultant.

.2 The Inspection and Testing Company, and welding inspectors and supervisors shall meet qualification requirements of CSA W178, and shall be certified by the Canadian Welding Bureau in Category (1), Buildings.

.3 Provide free access for inspectors to all places work is being performed.

.4 Shop Inspection shall ensure that materials conform to specified requirements. Mill test reports, properly correlated to the materials, will be accepted in lieu of physical tests. Inspection shall ensure that fit up, fabrication, and shop painting conform to specified requirements and dimensioned shop drawings.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver products that are supplied only under work of this Section to those who are responsible for their installation, to the place they direct and to meet construction schedule.

.3 Handle and store joists in such a manner that no damage, including corrosion, is caused to the stored or erected work, or to other property.

.4 Store all steel joists off of the ground on timber supports.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Steel Joists: Formed of hot rolled or cold formed shapes, hollow structural sections, plates and rods: new steel, in compliance with CSA and/or ASTM Standards indicated on Structural Drawings.

.2 Shop Coat Paint: To meet specified requirements of CISC/CPMA Standard 1-73a and compatible with Master Painters Institute INT 5.1S Institutional low odour/low VOC semi-gloss finish. Colour to be grey

2.2 Fabrication

.1 Fabricate joists with their attachments and accessories in accordance with the reference standards.

.2 Provide top chords of sufficient width and material thickness to permit 20 mm diameter arc spot welds of deck to joist to be formed, in accordance with CSA S136.

.3 Prepare joists for attachment of other work as indicated on drawings and required for construction.

.4 Fabricate bridging not less than 3 mm in thickness.

.5 Extend bottom chords of joists where required to support ceiling or walls as shown on drawings.

.6 Fabricate joists and shoes to accommodate roof slopes shown on drawings.

.7 Fabricate web systems to allow clearances for transverse mechanical and electrical services to pass through where so indicated on structural drawings.

.8 Provide shoe depths to suit elevations of bearings in each location.

.9 Fabricate joists of uniform appearance for erection in areas where they are exposed to view.

2.3 Cleaning and Painting

.1 Coordinate with Section 07 81 16, and apply prime paint to steel joists scheduled to be covered with cementitious fireproofing only if such application does not affect or alter the design criteria for fireproof assemblies.

.2 Painting: All prime painting shall be shop applied and the responsibility of the fabricator. Refer to specific priming requirements specified in Section 09 91 23 - Interior Painting.

.1 Paint in accordance with manufacturer's published directions. Paint steel in the shop under cover. Keep painted members under cover until the paint has dried.

.2 Clean and prepare surfaces, as appropriate for paint specified, in accordance with CISC/CPMA 2-75 or clean steel in compliance with SSPC SP6 where zinc rich paint is shop applied.

.3 Where paint is applied adjacent to welded joints, remove it to bare metal for a distance of at least 50 mm beyond sides of joints.

.4 Do not paint surfaces and edges to be field welded, surfaces encased in or in contact with concrete or masonry.

.3 Mark joists to indicate erection orientation when they are fabricated to special design or loading requirements.

.4 Identify each joist with mark corresponding to shop drawing designation.

PART 3 EXECUTION

3.1 Examination

.1 Verify, before delivery of joists, that work to receive joists is located correctly and at proper levels.

3.2 Preparation

.1 Provide necessary instructions to other trades for installation of bearings and anchors installed under work of other Sections. Assist in installation if requested.

.2 If steel surfaces are painted where connections are made by welding at the site, remove paint to bare metal for a distance of at least 50 mm beyond sides of joints.

3.3 Erection

.1 Comply with CSA S16 and work site safety plans in erection of work of this Section.

.2 Refer to drawings for the work of other Sections and locate joists to avoid interference with ceiling construction, recessed lights, mechanical and electrical services, and similar work.

.3 Install shims, packing or special shoes to support joists at proper elevation.

.4 Carry joists to centre line of beams, with a tolerance of +0 mm and 25 mm for beams with joists bearing from both sides, and +25 mm and 0 mm for beams with joists bearing from one side only.

.5 Weld each joist at bearings on structural steel members and bearing plates, or as indicated on drawings.

.6 Install framing for openings between joists as indicated on drawings.

.7 Bridging:

.1 Install steel bridging, transverse to joist spans to meet specified requirements of reference standards.

.2 Locate bridging at panel points wherever possible.

.3 Locate bridging to ensure no interference with recessed lights, and mechanical and electrical services.

.4 Top chord load distributing bridging may be used in lieu of normal top chord bridging specified above.

3.4 Field Quality Control

.1 Perform field inspection by Inspection and Testing Company to meet requirements specified under Source Quality Control of this Section, and to include:

.1 Inspection of erection and fit up, including placing joist beaming, plumbing, levelling and temporary and permanent bracing.

.2 Verification for each end of each joist that the distance from the centre of bearing to the end tension web member does not exceed the maximum dimension given on the drawings.

.3 Inspection of welded and bolted connections.

.4 General inspection of shop coating touch up.

.2 Inspection & Testing Company shall:

.1 Submit reports at least weekly when shop and site work is in progress.

.2 Distribute inspection reports as follows:

.1 2 copies to Consultant;

.2 1 copy to Contractor;

.3 2 copies to Fabricator.

.4 Sign report by inspector who performs inspection, and describe progress of Work, deficiencies found and corrective actions taken.

.5 Include deficiency list of outstanding items from previous reports, and comment on status.

3.5 Coating Touch Up

.1 After erection, give one coat of paint specified for shop coat to field bolts, field connections, burnt areas, and abrasions or damage to shop coats.

3.6 Defective Work

.1 Variations in excess of specified tolerances, and failure of materials or workmanship to meet requirements of this specification, and which cannot be repaired by approved methods, will be considered defective Work performed by this Section.

.2 Replace defective Work, as directed by Consultant.

.3 Pay for additional inspection and testing, redesign, corrective measures, and related expenses if Work has proven to be deficient.

3.7 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 05 12 23 Structural Steel

.3 Section 05 21 00 Steel Joists

.4 Section 05 50 00 Metal Fabrications

.5 Section 06 10 00 Rough Carpentry

.6 Section 07 81 16 Cementitious Fireproofing

1.3 References

.1 ASTM International, (ASTM)

.1 ASTM A653/A653M-25a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 CSA Group (CSA)

.1 CSA S16:19 Design of Steel Structures

.2 CSA S136-16 North American Specification for the Design of Cold Formed Steel Structural Members

.3 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel Structures.

.4 CSA W48:23 Filler Metals and Allied Materials for Metal Arc Welding

.5 CSA W55.3-08 Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.6 CSA W59-18 Welded Steel Construction (Metal Arc Welding)

.3 Canadian General Standards Board (CGSB)

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

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 10M Standard for Steel Roof Deck

.2 CSSBI 12M Standard for Composite Steel Deck

.3 CSSBI SSF 16-14 Acoustic Properties of Perforated Steel Deck

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Ontario, Canada. Each submission of the shop drawings shall bear the seal of the Engineer.

.1 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

.2 Indicate details of temporary shoring of steel deck.

.3 Submit design calculations if requested by Consultant.

1.5 Design Requirements

.1 Design steel deck using limit states design in accordance with CSA S136 and CSSBI 10M.

.2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, and uplift as indicated.

.3 Deflection under specified live load not to exceed 1/240 of span, except that when gypsum board ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.

.4 Design composite deck sections in accordance with the National Building Code of Canada for concrete strength indicated on drawings.

.5 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CSA S16.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Sheet Steel: ASTM A653 minimum Grade 230 with a base steel design thickness or 0.76 mm or greater and a minimum zinc-iron alloy coating designation of ZF75.

.2 Closures: in accordance with manufacturer's recommendations.

.3 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.

.4 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.2 Types of Decking

.1 Deck shall conform to the depths noted on the drawings.

.2 Steel roof deck: to CSSBI 10M non-cellular, interlocking side laps.Base steel thickness, depth & profile as shown on the drawings.

.3 Composite steel floor deck: to CSSBI 12M non-cellular, upright embossed fluted profile, interlocking side lap, base steel thickness, depth & profile as shown on the drawings. Flat sheet for cellular deck, 0.76 mm minimum base steel thickness or as noted on drawings.

PART 3 EXECUTION

3.1 General

.1 Structural steel work: in accordance with CSA S136 and CSSBI 10M.

.2 Welding: in accordance with CSA W59, except where specified otherwise.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 Erection

.1 Erect steel deck as indicated and in accordance with CSA S136, CSSBI 10M, CSSBI 12M and with reviewed erection drawings.

.2 Lap ends: to 50 mm minimum.

.3 Place and support reinforcing steel as indicated.

.4 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.

.5 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

.6 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mil scale and other foreign matter.

.7 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.

3.3 Closures

.1 Install closures in accordance with approved details.

3.4 Openings and Areas of Concentrated Loads

.1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.

.2 Frame deck openings with any one dimension between 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.

.3 For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 Connections

.1 Install connections in accordance with CSSBI recommendations as indicated.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 04 05 19 Masonry Anchorage and Reinforcing

.3 Section 04 22 00 Concrete Unit Masonry

.4 Section 04 27 00 Multiple Wythe Unit Masonry

.5 Section 05 12 23 Structural Steel

.6 Section 05 31 00 Steel Deck

.7 Section 06 10 00 Rough Carpentry

.8 Section 06 20 00 Finish Carpentry

.9 Section 09 91 13 Exterior Painting

.10 Section 09 21 23 Interior Painting

1.3 References

.1 The Ontario Building Code.

.2 ASTM International (ASTM)

.1 ASTM A53/A53M-24 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

.2 ASTM A123/A123M-17 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.4 ASTM A307-21 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.5 ASTM A385/A385M-22 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

.6 ASTM A1008/A1008M-23e1 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

.7 ASTM A1011/A1011M-23 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

.8 ASTM C1107/C1107M-20 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

.9 ASTM D1187/D1187M-97(2018) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal

.10 ASTM D6386-22 Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

.11 ASTM F3125/F3125M-23 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

.3 CSA Group (CSA)

.1 CSA G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel.

.2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA-S16.1-M Limit States Design of Steel Structures.

.4 CSA S136-12 Cold Formed Steel Structural Members.

.5 CSA W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel Structures.

.6 CSA W59-18 Welded Steel Construction

.7 CSA W178.1-18 Certification of Welding Inspection Organizations

.8 CSA W178.2-18 Certification of Welding Inspectors

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.40-97 Anticorrosive Structural Steel Alkyd Primer

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

.5 Canadian Sheet Steel Building Institute (CSSBI)

.6 Steel Structures Painting Council, Systems and Specifications Manual.

.1 CISC/CPMA 1-73a-1975 A Quick drying One-coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2-75-1975 A Quick Drying Primer for Use on Structural Steel.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Submit Shop and Erection Drawings for review.

.2 Verify site dimensions before proceeding with shop fabrication and to suit field conditions and field openings.

.3 Show and describe in detail all the work of this Section including large scale detail of members and materials, of connection and jointing details, and of anchorage devices, dimensions, thicknesses, description of materials, metal finishing, as well as all other pertinent data and information, including type, size and description of all fasteners and anchors.

.4 Indicate connections to building structure.

.5 Shop drawings for all metal fabrications shall be stamped and signed by a Professional Engineer registered in the Province of Ontario. Each submission of the shop drawings shall bear the seal of the Engineer.

1.5 Qualifications

.1 Work of this Section shall be executed by a firm thoroughly conversant with laws and regulations which govern and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturers specializing in this work and having a minimum ten (10) years proven experience in the fabrication of high quality metal fabrications. Use workmen skilled in work of this Section.

.2 Welding shall be performed by trades persons certified by The Canadian Welding Bureau under CSA Standard W47.1.

1.6 Design Requirements

.1 Design metal stair, handrail, guardrail, and landing construction and connections to OBC vertical and horizontal live load requirements.

.2 Stairs shall be designed and constructed to safely sustain a live load of 4.8 kPa evenly distributed over treads and landings with a maximum deflection of L/360. Furnish all supporting members required to connect to the building.

.3 Except where specified otherwise, and where required by applicable codes, detail and

fabricate stairs to NAAMM Metal Stairs Manual.

1.7 Examination

.1 All dimensions shall be taken from the drawings and checked against the building. Be responsible for the correctness of such measurements and report to the Consultant in writing all discrepancies between measurements at building and those shown on drawings prior to commencing work. Verify location of anchor bolts and embedded steel and ensure that work prepared by other trades is at a proper elevation, on line, level and true.

1.8 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Label, tag or otherwise mark work supplied for installation by other Sections to indicate its function, location and shop drawing description.

.3 Protect work from damage and deliver to a location at the site in order to meet the scheduling requirements.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Structural Steel Sections and Steel Plate: CSA G40.20-13/G40.21-13, Grade 350W.

.2 Architectural and Miscellaneous Mild Steel: CSA G40.20-13/G40.21-13, Grade 300W.

.3 High Strength Bolts and Nuts: ASTM F3125. Dimensions, sizes, thread, strength, quality and type of items shall be designed for the work intended. Exposed fasteners and anchors shall be same material, colour and finish as the metal to which they are applied.

.4 Sheet Steel: (Commercial Quality) ASTM A1008 stretcher leveled or temper rolled.

.5 Steel Pipe: ASTM A53 Schedule 40, Grade B.

.6 Welding Materials: CSA W59.

.7 Welding Electrodes: CSA W48 Series.

.8 Composite Metal Deck: As specified in Section 05 31 00.

.9 Sulphur: Commercial Grade for setting of steel posts.

.10 Grout: non-shrink, non-metallic, non-stain, flowable, to ASTM C1107, 15 MPa at 24 hours.

.11 Isolation Coating: Alkali resistant bituminous paint to ASTM D1187.

.12 Gaskets: Noprene, minimum 5.00 mm thick x 25 mm wide.

.13 Adhesive Anchors: HILTI or Rawl Epoxy Adhesive Anchors sized to suit loading conditions, suitable for substrate. Adhesive to be low VOC type (maximum 250 g/l) to SCAQMD Rule 1168-03, Adhesives and Sealants Applications.

2.2 Finishes

.1 Primers: All primers for metal fabrications are to be factory applied under the requirements of this Section. Refer to Finish Schedules in Section 09 91 13 and 09 91 23 for types of primers required for each application. Colour to be grey.

.2 Pre Paint Finish: For galvanized surfaces to be exposed and finish painted, to ASTM D6386.

.3 Galvanizing: hot dipped with zinc coating to CSA G164, ASTM A123 or ASTM A385.

.1 Bolts, nuts, washers, iron, and steel hardware components shall be galvanized in accordance with CSA G164 or ASTM A153.

.2 Galvanized coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips: Galvanized after all welding and grinding complete. No welding or grinding of galvanized products allowed.

.4 Zinc Rich Primer: zinc rich, organic, ready mix to CAN/CGSB 1.181. Low VOC type.

PART 3 EXECUTION

3.1 Fabrication

.1 Fabricate to reviewed shop drawings and in general to details, sizes and materials indicated on drawings and specified herein.

.2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.3 Fabricate work complete with all components required for anchoring; bolting or welding to structural frame; standing free or resting in frames or sockets; in a safe and sure manner.

.4 Where possible fit and shop assemble various sections of the work and deliver to site in largest practicable sections. Where shop fabricating is not possible, make trial assembly in shop.

.5 Ensure exposed welds are continuous for length of each joint.

.6 Grind and fill all welds after inspection and acceptance and leave ready for prime painting.

.7 Fill all open joints, depressions, seams with metallic paste filler or by continuous brazing or

welding and grind smooth to true sharp arises and profiles.

.8 Fit joints and intersecting members accurately. Make work in true planes with adequate fastenings.

.9 Supply all fastenings, anchors, accessories required for fabrication and erection of work of this Section. Make thread dimensions such that nuts and bolts will fit without re-threading or chasing threads.

.10 Welding shall be done by the shielded metal-arc method in accordance with the requirements CSA W59. The welding operators shall be currently certified under CSA W47.1 for the work they are performing.

.11 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.

.12 Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter. Where weld material is deposited in two or more layers, each layer shall be cleaned before the next layer is deposited. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by approved methods.

.13 Appearance, quality of welds made, methods of correcting defective work shall be in accordance with CSA W59.

3.2 Shop Painting

.1 Cleaning Steel:

.1 Clean steel, whether it is to be painted or not, to the degree required by CISC/CPMA 1-73a, except as specified below.

.2 Prepare galvanized items scheduled to be painted in accordance with the requirements of Section 09 91 23, and ASTM D6386.

.3 Steel to receive a shop or field paint finish shall be cleaned in accordance with Sections 09 91 23 or SSPC SP6, whichever produces a surface which has less rust and mill scale.

.4 Clean steel which is specified to be painted to CISC/CPMA 2-75 in accordance with that Standard.

.5 Clean steel which is specified to receive an organic zinc-filled epoxy primer, or zinc-rich paint, or inorganic zinc primer, in accordance with SSPC-SP 6, Commercial Blast Cleaning.

.6 Clean welds by wire brushing and wash down with clean water, to remove the

chemical residues left by the electrodes, prior to painting.

.2 The following surfaces shall not be painted:

.1 Surfaces and edges to be field welded. If painted, remove paint for field welding for a distance of at least 50 mm on all sides of the joint, to ensure proper fusion of the metal.

.2 The contact surfaces of friction type connections assembled by high strength bolts.

.3 Portions of steel members which are to be encased in or in contact with concrete or masonry.

.4 Galvanized items not specifically indicated to be painted.

.3 Preparation and priming of all metal work which will be exposed to view and which is scheduled to be finish painted, shall be in accordance with the requirements of Section 09 91 23.

.4 All other concealed or unpainted ferrous metal work shall be given one prime paint coat type CGSB 1.40 and in accordance with CISC/CPMA 2-75. Work paint into all corners and all joints. Metal parts in contact shall be primed before shop assembly. Priming damaged during erection or through lack of protection shall be cleaned and touched up.

.5 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 ° C.

.6 Metals in contact with other dissimilar metals, concrete or masonry materials shall be insulated or separated from one another to prevent corrosion, staining or electrolysis by use of bituminous paint.

3.3 Galvanizing

.1 Steel members, fabrications, and assemblies shall be galvanized after fabrication by the hot dip process in accordance with CSA G164 or ASTM A123.

.2 Galvanizing of architecturally exposed steel shall be completed by a company recognized in the application of High Quality galvanized finishes and in accordance with ASTM A385.

.3 Prepare metals to be galvanized and painted in accordance with requirements of ASTM D6386.

.4 Bolts, nuts, washers, iron, and steel hardware components shall be galvanized in accordance with CSA G164 or ASTM A153.

.5 Coating Requirements:

.1 Weight: the weight of the galvanized coating shall conform to Table 1 of CSA G164, ASTM A123 or ASTM A153 (as appropriate).

.2 Surface Finish: The galvanized coating shall be continuous, adherent, as smooth and

evenly distributed as possible and free from any defect that is detrimental to the stated end use of the coated article. The integrity of the coating shall be determined by visual inspection and coating thickness measurements.

.3 Adhesion: the galvanized coating shall be sufficiently adherent to withstand normal handling.

3.4 Miscellaneous Framing and Supports

.1 General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

.2 Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

.1 Furnish inserts for units installed after concrete is placed.

.3 Galvanize miscellaneous framing and supports where indicated.

.4 Prime miscellaneous framing and supports with primer specified in Section 09 91 13 - Exterior Painting or Section 09 91 23 - Interior Painting.

3.5 Angle Lintels

.1 Provide all loose steel angle lintels required to support openings and recesses in masonry walls, whether indicated on the drawings or not. Refer to Architectural, Structural and Mechanical drawings for locations of openings. Lintels shall be as scheduled on the Structural drawings.

.2 Steel angles: CSA G40.21, Grade 300W, sizes indicated for openings. Provide 150 mm minimum bearing at ends unless otherwise indicated.

.3 Weld or bolt back-to-back angles to profiles as indicated.

.4 Supply for installation by Sections 04 22 00 and 04 27 00.

.5 Lintels shall be prime painted unless otherwise indicated.

3.6 Steel Pan Stairs

.1 Form treads and risers from 3.3 mm steel plate. Secure treads and risers to L 35 x 35 x 5 horizontal and vertical welded to stringers. Sub-treads and risers for concrete filled metal pan stairs shall be 3.3 mm sheet steel formed as detailed. Treads to be concrete filled, with welded wire mesh reinforcing. Risers to be exposed metal, with a formed 19 mm dust cove.

.2 Form stringers from C250 x 23 unless indicated otherwise or required to meet design requirements. Stringers shall be continuous. Apply continuous welds to cranked joints. All

edges shall be ground smooth.

.3 Form stringers as described above, with 6 mm thick plate fascia welded on.

.4 Extend stringers around mid-landings to form steel base. Cope and crank stringers as necessary to line with structural steel framing at floor openings.

.5 Fascia and supporting members throughout shall be of size and weight as shown on drawings.

.6 Provide all necessary angles, channels, clips, plates and anchors as required to support all stair treads and landings and as shown on the drawings.

.7 Fabricate stair landings as detailed on the drawings with 38 mm galvanized composite metal floor deck specified in Section 05 31 00 and welded wire mesh. Spot weld deck to framing with 19 mm diameter puddle welds at 150 mm c/c along entire length of all framing members. Place reinforcing mesh.

.8 Provide clip angles for fastening of furring channels, where applied finish is indicated for underside of stairs and landings.

.9 Close ends of stringers where exposed.

.10 Make provisions for support of metal furring around perimeter of areas where gypsum board soffits are to be installed.

3.7 Railings

.1 Definition: the term railing shall be taken to mean balustrades, guards, rails and handrails.

.2 Design and fabricate railings to conform to all applicable Ontario Building Code requirements.

.3 Unless otherwise indicated, fabricate railings as follows:

.1 Fabricate handrails and guardrails as detailed.

.2 Pipe rails shall have an outside diameter of not more than 38 mm. Close open ends of tubular members with welded steel plugs.

.3 Extend handrails horizontally at top and bottom of each flight of stairs as shown on the drawings but not less than 305 mm beyond stair nosing at top of stair and 610 mm at bottom of stair.

.4 Turn handrails down at exposed ends or turn into wall as detailed.

.5 Support railings at each end, and at maximum 1070 mm centres unless indicated otherwise or required to meet loading requirements of the Ontario Building Code.

.6 Minimum wall thicknesses of tubular railings: 2.5 mm.

.7 At corners, angles and intersections, cope or mitre railings, weld and grind smooth.

.8 Pickets shall be minimum 13 mm diameter solid steel bars at 100 mm centres.

3.8 Bench Support Brackets

.1 Provide steel angle and steel post bench support framing and anchors as detailed. All rough edges to be ground smooth.

.2 Predrill bench support assemblies for anchor bolts and screws.

.3 Steel to be prime painted.

3.9 Miscellaneous Steel Trim

.1 Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

.2 Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

.1 Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

.3 Galvanize exterior miscellaneous steel trim.

3.10 Steel Weld Plates and Angles

.1 Provide steel weld plates and angles not specified in other Sections, for items supported from concrete or masonry construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete or masonry.

3.11 Installation

.1 Supervise the setting of bases, anchor bolts, and other steel to concrete connections. Cutting of base plates to accommodate anchor bolts is cause for rejection of base plates.

.2 Provide all bracing and shoring required to support the work of this Section during installation.

.3 Work shall be fabricated and erected square, plumb and true, straight, level and accurately fitted to size detailed on reviewed Shop Drawings. All joints shall be welded unless otherwise indicated. Exposed welds shall be ground smooth and/or flush. Exposed work shall be finished smooth and even, close joints and neat connections. Exposed welds continuous for full length of joints.

.4 Where anchors or fastenings, sleeves, have to be built in by other trades, supply all necessary templates, instructions and supervision to ensure satisfactory installation.

.5 Do all drilling, cutting and fitting necessary to attach this work to adjoining work and make it complete.

.6 Provide all components required for anchoring. Make anchoring in concealed manner where possible. Exposed anchors shall be approved by the Consultant, shall be neat, and of the same material, colour, texture and finish of base metal on which they occur. Exposed fastenings shall be evenly spaced.

.7 Grind all field welds smooth.

.8 Touch up shop coat of prime paint where damaged by field erection.

.9 Touch up galvanized finishes with zinc rich paint.

3.12 Fasteners and Anchors

.1 Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.

.2 Securely anchor components in place. Unless otherwise indicated, anchor components as follows:

.1 To concrete and solid masonry with expansion or epoxy adhesive type anchors.

.2 To hollow construction with toggle bolts.

.3 To thin metal with screws or bolts.

.4 To thick metal with bolts or by welding.

.5 Fill space between railing members and sleeves with non-shrink grout.

.3 Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.

.4 Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.

.5 Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.

.6 Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self-drilling and tapping screws or bolts.

3.13 Schedule

.1 General:

.1 Supply and install all metal fabrications indicated on Drawings, and not included in the work of other Sections.

.2 Coordinate and sequence the work to ensure timely delivery to the site, of all items to be built in.

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

.4 All items shall be of sizes and as detailed on drawings.

.5 Coordinate with Section 09 91 13 and 09 91 23 for preparation of exposed metal items required to have finish coatings applied in the field.

.6 Review all coordination drawings prior to installation of materials, to ensure that no interferences with the work of other Sections will occur.

3.14 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 10 00 Concrete Forming and Accessories

.2 Section 03 30 00 Cast-In-Place Concrete

.3 Section 04 22 00 Concrete Unit Masonry

.4 Section 04 27 00 Multiple Wythe Unit Masonry

.5 Section 05 50 00 Metal Fabrications

.6 Section 06 20 00 Finish Carpentry

.7 Section 07 21 13 Building Insulation

.8 Section 07 26 00 Vapour Retarders

.9 Section 07 51 00 Built-Up Bituminous Membrane Roofing

.10 Section 08 11 00 Metal Doors and Frames

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A123/A123M-24 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.2 ASTM A653/A653M-25a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.

.3 ASTM D2559 - 12a(2024) Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions

.4 ASTM F1667-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

.2 CSA Group (CSA)

.1 CSA B111-1974(R2003) Wire Nails, Spikes and Staples.

.2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA O80 SERIES-15 Wood Preservation

.4 CSA O86:24 Engineering Design in Wood

.5 CSA O121-17 Douglas Fir Plywood.

.6 CSA O141:23 Canadian Standard Lumber.

.7 CSA O151-17 Canadian Softwood Plywood

.8 CSA Z809-08 Sustainable Forest Management

.3 Underwriters Laboratories Canada (ULC)

.1 ULC 102-2018 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 National Lumber Grading Authority (NGLA)

.1 Standard Grading Rules for Canadian Lumber 2022

.5 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004 FSC Principle and Criteria for Forest Stewardship.

.2 FSC-STD-20-002-2004 Structure and Content of Forest Stewardship Standards V2-1

.3 FSC Accredited Certified Bodies.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Certified Wood: Submit listing of wood products and materials used, produced from wood obtained from forests certified by FSC Accredited Certification Body in accordance with FSC-STD-01-001.

1.5 Quality Assurance

.1 Sawn lumber shall be identified by the grade stamp of an association or independent grading agency certified by the Canadian Lumber Standards Accreditation Board.

1.6 Shipping, Handling and Storage

.1 Protect materials, under cover, both in transit and on the site.

.2 Store materials to prevent deterioration or the loss or impairment of their structural and other essential properties. Do not store materials in areas subject to high humidity and areas where masonry and concrete work are not completely dried out.

.3 Store sheathing materials level and flat, in a dry location. Protect panel edges from moisture at all times.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Timber Material shall be 'Grade Stamped'.

.2 CSA Z809 or FSC Certified.

.3 Construction Lumber: To CSA O141 Softwood Lumber graded to NLGA Standard Grading Rules for Canadian Lumber, published by the National Lumber Grades Authority. All lumber shall bear grade stamps. Moisture content of softwood lumber not to exceed 19% at time of installation.

.1 Framing lumber, plates, furring, blocking, No. 1 SPF.

.2 Nailing strips, furring and strapping: No. 4 S-P-F.

.3 Fitment framing: No. 1 S-P-F.

.4 Canadian Softwood Plywood: to CSA O151-M, standard construction, good one or both sides as required, thickness as shown or specified.

.1 Douglas Fir Plywood: To CSA O121-M, standard construction, good one side, thickness as shown on the drawings.

.2 Plywood used for exposed interior work shall have select grade veneer, one or both faces where exposed, with fire retardant finish. Fire retardant shall be in accordance with CAN/CSA-080.1, and all treated materials shall bear a ULC approval stamp.

.3 Mat formed structural panel board (oriented strand board): to CSA O437, square edge, 12.7 mm thickness.

.5 Nails, Spikes and Staples: To ASTM F1667.

.6 Bolts: 12.5 mm diameter, galvanized, complete with nuts and washers.

.7 Proprietary Fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.8 Wood Preservative to CSA O80 SERIES.

.9 Adhesive: Contractors gun grade cartridge loaded wood adhesive, general purpose, to ASTM D2559.

.10 Galvanizing: to CSA-G164. Use galvanized fasteners, and hardware for exterior work, preservative treated lumber, and materials in contact with concrete or masonry.

PART 3 EXECUTION

3.1 Installation

.1 Workmanship

.1 Execute work using skilled mechanics according to best practice, as specified here.

.2 Lay out work carefully and to accommodate work of other trades. Accurately cut and fit; erect in proper position true to dimensions; align, level, square, plumb, adequately brace, and secure permanently in place. Join work only over solid backing.

.2 Rough Hardware: Include rough hardware such as nails, bolts, nuts, washers, screws, clips, hangers, connectors, strap iron, and operating hardware for temporary enclosures.

.3 Provide treated wood nailers, blocking, cants, grounds, furring and similar members where shown and where required for screeding or attachment of other work and surface applied items. Attach to substrate as required to support applied loading.

.4 Electrical Equipment Backboard: provide backboards for mounting electrical equipment as indicated. Use 19 mm thick fir face veneer fire retardant softwood plywood on 19 x 38 mm furring around perimeter and at maximum of 305 mm intermediate spacing.

.1 Install plywood backboards with countersunk screws.

.5 Backing

.1 Backing in Metal Stud Assemblies - coordinate installation and locations with Drawings and in accordance with the following:

.1 Install 19 mm CSP G1S plywood between metal stud assemblies on all walls receiving wall-mounted equipment

.2 Minimum 2 stud spaces or 1220-mm wide x 1200-mm long panels

.3 Fit plywood between metal studs

.4 Kerf front of plywood panels to fit plywood face flush with front face of metal studs.

.6 Blocking: Provide solid wood backing to support millwork, cabinetwork, equipment, fixtures, railings and accessories and the like, as required. Coordinate with work of other

Sections and install all required backing. Any such equipment mounted on gypsum wallboard assemblies or similar assemblies shall be adequately supported.

.1 Provide solid wood blocking in all partitions where wall stops are specified in the hardware schedule.

.7 Roof Blocking, Curbs and Copings:

.1 Provide and install framing, blocking, curbs and copings as indicated on the drawings. Anchor blocking securely in permanent manner.

.2 Provide minimum 10 mm Douglas Fir plywood copings on all built-up wood copings and curbs as detailed.

.3 All wood curbs shall be filled with fibrous insulation specified in Section 07 21 13.

.4 Provide shims and blocking necessary for levelling of roof hatches and equipment curbs.

3.1 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 05 50 00 Metal Fabrications

.2 Section 06 10 00 Rough Carpentry

.3 Section 06 40 00 Architectural Woodwork

.4 Section 07 92 00 Joint Sealants

.5 Section 08 11 00 Metal Doors and Frames

.6 Section 08 14 16 Flush Wood Doors

.7 Section 08 71 10 Door Hardware

.8 Section 09 21 16 Gypsum Board

.9 Section 09 91 23 Interior Painting

.10 Section 10 28 10 Toilet and Bath Accessories

1.3 References

.1 ASTM International (ASTM)

.1 ASTM E1333-22 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emissions Rates from Wood Products Using a Large Chamber.

.2 ASTM F1667-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

.2 CSA Group (CSA)

.1 CSA B111-1974 (R2003) Wire Nails, Spikes and Staples.

.2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA O112 SERIES-M1977 (R2006) Standards for Wood Adhesives

.4 CSA O121-17 Douglas Fir Plywood.

.5 CSA O141:23 Canadian Standard Lumber.

.6 CSA O151-17 (R2022) Canadian Softwood Plywood

.7 CSA O153-13 (R2017) Poplar Plywood.

.8 CSA Z760-94 (R2001) Life Cycle Assessment

.3 American National Standards Institute (ANSI)

.1 ANSI A208.1-2009 Particleboard.

.2 ANSI A208.2-2016 Medium Density Fibreboard (MDF) for Interior Applications.

.3 ANSI/HPVA HP-1-2016 Standard for Hardwood and Decorative Plywood.

.4 ANSI/NEMA LD 3-2005 High Pressure Decorative Laminates

.4 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Quality Standards Illustrated.

.5 Canadian Plywood Association (CanPly)

.1 The Plywood Handbook 2005.

.6 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-V4-0 FSC Principle and Criteria for Forest Stewardship.

.2 FSC-STD-20-002-2004, Structure and Content of Forest Stewardship Standards V2-1

.3 FSC Accredited Certified Bodies.

.7 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.

.8 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2005.

.9 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)

.1 SCAQMD Rule 1168-03 Adhesives and Sealants Applications

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings.

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.2 Indicate materials, thicknesses, finishes and hardware.

1.5 Quality Assurance

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

.2 Plywood, particleboard and wood based composite panels in accordance with CSA and ANSI standards.

.3 Wood materials certified by Forestry Stewardship Council.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Protect materials against dampness during and after delivery.

.3 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Lumber Materials

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 AWMAC custom premium grade, moisture content as specified.

.4 Machine stress-rated lumber is acceptable.

.2 Hardwood Lumber: To NHLA requirements, moisture content of 6% maximum, maple species, AWMA Custom Grade.

.1 Bench Slats: Select Grade Maple.

2.2 Panel Materials

.1 Douglas Fir Plywood (DFP): to CSA O121, standard construction.

.1 Forestry Stewardship Council (FSC) certified.

.2 Urea-formaldehyde free.

.2 Canadian Softwood Plywood (CSP): to CSA O151, standard construction.

.1 Forestry Stewardship Council (FSC) certified.

.2 Urea-formaldehyde free.

2.3 Accessories

.1 Rough Hardware: Bolts, lag screws, anchors, nails and expansion shields required to secure this portion of work. Rough hardware hot dip galvanized conforming to latest edition of CSA G164. All fasteners used in damp or wet areas to be suitable for use in corrosive environment. Use hot dipped galvanized or other material approved by the Consultant.

.2 Nails and staples: to ASTM F1667 galvanized.

.3 Wood screws: to CSA B35.4 plain type and size to suit application.

.4 Stainless Steel hardware: Type 316 Stainless steel for exposed or wet locations, tamper proof.

.5 Splines: wood or metal to suit application.

.6 Adhesive: recommended by manufacturer, waterproof type, maximum VOC limit 30 g/L SCAQMD Rule 1168 - Adhesives and Sealants Applications.

PART 3 EXECUTION

3.1 Construction

.1 Fastening:

.1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.

.4 Replace items of finish carpentry with damage to wood surfaces including hammer

and other bruises.

.2 Interior and exterior frames: Set frames with plumb sides, level heads and sills, and secure.

3.2 Fabrication

.1 General:

.1 Field measure all dimensions.

.2 Fabricate all finish carpentry items to AWMAC premium grade, and in accordance with the reviewed shop drawings.

.3 Set nails and screws, apply stained plain wood filler to indentations, sand smooth and leave ready to receive finish.

.4 Ease edges of solid lumber components to 1.6 mm radius.

3.3 Installation

.1 Do finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 All fastenings shall be concealed.

.3 Provide heavy duty grounds as necessary for secure installation of finish carpentry work.

.4 All wood surfaces shall be sanded smooth, ready to receive finish.

.5 Scribe and cut as required, fit to abutting walls and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.6 Form joints to conceal shrinkage.

.7 Set and secure materials and components in place, rigid plumb and square.

.8 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.9 Set finishing nails to receive filler. Where screws are used to secure members, countersink screws in round, cleanly cut hole and plug with wood plug to match material being secured.

3.4 Benches

.1 Coordinate benches with Section 05 50 00.

.2 Install solid maple bench seats as detailed with countersunk stainless steel carriage bolts.

3.5 Door Installation

.1 Install doors in accordance with instructions in Section 08 11 00 and Section 08 14 16 and manufacturer's printed instructions.

3.6 Finish Hardware Installation

.1 Finish hardware will be supplied for installation under this Section.

.2 Prepare doors and frames in accordance with manufacturer's instructions and templates. Install finish hardware complete in all respects, hang doors and make adjustments necessary.

.3 Doors shall swing freely. Where thresholds are to be used, door bottom shall be finished to suit thresholds as required.

.4 Where indicated on door schedules or drawings, under-cut doors.

3.7 Miscellaneous

.1 Install Toilet and Bath Accessories as specified in Section 10 28 10, including accessories supplied by Owner.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry

.2 Section 06 20 00 Finish Carpentry

.3 Section 07 92 00 Joint Sealants

.4 Section 09 21 16 Gypsum Board

.5 Section 09 91 23 Interior Painting

.6 Section 26 27 19 Classroom Control Panel Module

1.3 References

.1 ASTM International (ASTM)

.1 ASTM F1667/F1667M-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

.2 Architectural Woodwork Manufacturer's Association of Canada (AWMAC)

.1 Architectural Woodwork Standards Manual

.3 American National Standards Institute (ANSI)

.1 ANSI A208.1-2009 Particleboard

.2 ANSI/NPA A208.2-2009 Medium Density Fibreboard (MDF)

.3 ANSI/NEMA LD 3-2005 High-Pressure Decorative Laminates (HPDL)

.4 ANSI/HPVA HP-1-2009 Standard for Hardwood and Decorative Plywood

.4 CSA Group (CSA)

.1 CSA O112 SERIES-M1977 (R2006) Wood Adhesives

.2 CSA O121-08 (R2013) Douglas Fir Plywood

.3 CSA O151-17 (R2022) Canadian Softwood Plywood

.4 CSA O153:19 Poplar Plywood

.5 CSA Z809-08 Sustainable Forest Management

.5 Canadian General Services Board (CGSB)

.1 CAN/CGSB-11.3-M, Hardboard

.6 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004 FSC Principle and Criteria for Forest Stewardship.

.2 FSC-STD-20-002-2004 Structure and Content of Forest Stewardship Standards V2-1

.3 FSC Accredited Certified Bodies.

.7 British Standard (BS)

.1 BS 1088 Marine Grade Plywood

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings conforming to AWMAC's STANDARDS (NAAWS).

.1 Show proposed assembly, connections, materials, dimensions, thickness, and finishes.

.2 Indicate materials, thicknesses, finishes and hardware.

.3 Indicate locations of service outlets in casework, [typical and special installation conditions], and connections, attachments, anchorage and location of exposed fastenings.

.4 Show location on casework elevations of backing required in supporting structure for attachment of casework.

.5 Indicate AWMAC AWS quality grade where different from predominant grade specified.

.6 Include colour schedule of all casework items, including all countertop, exposed, and semi-exposed cabinet finishes, finish material manufacturer, pattern, and color.

.3 Samples:

.1 Submit duplicate, 300 mm long samples of each type of solid wood and 300 x 300 mm samples of each type of plywood used in exposed work and scheduled to receive stained or natural finish, complete with specified finish, prior to fabrication of

cabinetwork.

.2 Veneer samples minimum 304 mm x 304 mm. Each sample set of three to represent range of colour and grain expected.

.3 Submit duplicate samples, minimum 100 x 100 mm of specified plastic laminates for verification.

.4 Submit sample of each type of cabinet hardware component used.

1.5 Quality Assurance

.1 Unless otherwise specified, carry out finish carpentry work in accordance with the requirements of "Millwork Standards" (latest issue) of Architectural Woodwork Manufacturers' Association of Canada (AWMAC), Custom Grade.

.2 Woodwork Manufacturer Qualifications:

.1 Minimum 5 years of production experience similar to this project, whose qualifications indicate ability to comply with requirements of this Section.

.3 Preinstallation Conference:

.1 Before framing completed hold a meeting with the contractor, casework manufacturer, casework installer, and framing sub-contractor.

.2 Review locations of backing required for casework installation as shown on casework shop drawings.

.3 Review method of attachment for backing to wall system as shown on architectural drawings.

.4 Mock-up: Prepare mock-ups in accordance with Section 01 45 00 – Quality Control.

.1 Provide mockups of one base cabinet, one wall hung cabinet, and one countertop. Approved mockup may be incorporated in the project.

1.6 Definition

.1 "Exposed" when referred to in this Section, shall mean all parts which can be viewed and shall include interiors of cabinets, backs of doors, shelving and gables.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Protect against damage, including damage by excessive changes in moisture content, during delivery and storage. Maintain minimum storage temperature of 16 ° C, and relative humidity of 25% to 55%.

.4 Cover plastic laminate faces at shop with heavy Kraft paper.

.5 Do not deliver finish carpentry components to site before all wet trades are completed, the building is closed in and humidity conditions on site are acceptable. Do not deliver during rain or damp weather

.6 Store materials on site in such a way as to prevent deterioration or loss or impairment of essential properties. Prevent excessive moisture gain of materials.

1.8 Protection

.1 Provide coverings as necessary to protect finish carpentry components from damage of any kind during storage and after installation.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.10 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of two years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Materials

.1 All materials CSA Z809 or FSC Certified.

.2 Solid Wood:

.1 Unless otherwise indicated, provide AWMAC Custom Grade.

.2 All wood materials shall be new, straight and clean, free of sap, knots, pitch, and other defects, except as permitted by applicable grading rules.

.3 All wood shall be kiln dried to a maximum moisture content of 7%.

.4 Softwood: to CSA O141, dressed all sides used in concealed locations.

.3 Veneers: As required by AWMAC's STANDARDS (NAAWS) for its use and Grade specified. Flat sliced maple veneers from architectural grade flitches to provide uniform grain pattern and colour throughout, free of dark streaks and blemishes. Sharp variation of grain patterns and colour between adjacent jointed pieces is not acceptable.

.4 Plywood:

.1 Veneer core plywood: hardwood with a non-telegraphing grain manufactured with exterior glue. To ANSI/HPVA HP-1-09. Grade A face, book matched, flat cut maple face and No. 3 edge, minimum five (5) plies.

.2 Soft Plywood: to CSA O151-M Standard Grade, solid two sides. Use in concealed locations only, except as indicated.

.3 Marine Grade Plywood to BS 1088.

.5 MDF: Medium Density Fiberboard meeting requirements of AWMAC's STANDARDS (NAAWS).

.6 Edgeband

.1 For wood veneer casework: Veneer of same species and cut as exposed surfaces.

.2 For plastic laminate casework: High Pressure Decorative Laminate (HPDL).

.7 Hardboard: To CGSB 11-GP-3M, Type 2, 6 mm thick or as indicated.

.8 Plastic Laminate Facing Sheet: ANSI/NEMA LD 3 High-Pressure Decorative Laminates (HPDL) PF-S and GP-S;

.1 Backing sheet: BK Grade by manufacturer of facing sheet.

.2 Core: CAN3-0188.1M, Grade R.

.3 Laminating adhesive: CAN3-O112 Series M.

.4 Core sealer: clear water resistant synthetic resin sealer.

.5 Colours: To be selected by the Consultant from full range of manufacturer's standards.

.9 Melamine Overlaid Panels:

.1 Melamine overlay, heat and pressure laminated with phenolic resin to 12.7 mm thick particle board.

.2 Overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain balancing sheet.

.3 Furniture finish: solid colour as selected by the Consultant.

.4 Edge Finishing: matching melamine and polyester overlay edge strip with self-adhesive.

.10 Plastic Laminate Faced Wood Doors

.1 Door Construction - General:

.1 WDMA I.S.1A Performance Grade: Medium Duty.

.2 Interior Solid-Core Doors

.3 Grade: Premium

.2 Construction: Three plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces are applied. Faces are bonded to core using a hot press.

.3 Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through bolting hardware.

.4 Plastic laminate facing sheet: ANSI/NEMA LD 3 High-Pressure Decorative Laminates (HPDL) PF-S and GP-S.

.5 Backing sheet: BK Grade by manufacturer of facing sheet.

.6 Core: CAN3-0188.1M, Grade R.

.7 Laminating adhesive: CAN3-O112 Series M.

.8 Core sealer: clear water resistant synthetic resin sealer.

.9 Colour: To be selected by Consultant from full range of manufacturer’s standards.

.10 Exposed Vertical and Top Edges: Match face laminate.

.11 Fabrication

.12 Factory fit doors to suit opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

.13 Factory machine doors for hardware that is not surface applied.

.11 Fasteners and Adhesive:

.1 Nails and staples: ASTM F1667, galvanized, spiral head nails.

.2 Screws: Zinc, cadmium or chrome plated steel.

.3 Splines: wood or metal, to suit application.

.4 Adhesive: Type 1 waterproof. To CSA O112-M, type as appropriate for the intended application. Complying with ANSI/WDMA I.S-1 series. Contact bond not acceptable.

.5 Avoid the use of adhesives, preservatives, synthesizing agents and finish coatings that contain formaldehyde and high V.O.C. content.

.12 Stainless Steel: Type 316 with AISI No. 4 finish, 1.80 mm thick.

.13 Classroom Control Panel Module as specified in Section 26 27 19.

.14 Cabinet Hardware: Products listed are a standard of acceptance. Products by other manufacturers, of equal quality and similar appearance may also be accepted subject to review and approval by Consultant.

.1 Draw bolt fasteners: Knape & Vogt KV 516

.2 Shelf Standards: Knape & Vogt KV80, Anochrome finish.

.3 Brackets: Knape & Vogt KV180, Anochrome finish.

.4 Hinges: Blum concealed hinges, 125° clip and 125° opening with self-closing spring. Soft close. Full or half overlay. Nickel plated steel.

.5 Hinges for 45 mm thick doors: Trudoor BB-NRP - 4.5" X 4.5" NRP Ball Bearing Hinge (Non-Removable Pin), Stainless Steel. Full Mortise, Standard Weight, Plain Bearing

.6 Cabinet Pulls: Richelieu D-Pull No: 30134-170, 96 mm c.c. brushed stainless steel.

.7 Cabinet Locks: Corbin 500DR — Deadbolt Door Lock MK & KA by room.

.8 Catches: Type optional with manufacturer.

.9 Coat Hooks: Frost 1150 Safety Coat Hook, Stainless Steel Finish with Black Epoxy Hook

.10 Coat Rod: Round Closet Rod Tubing, Knape & Vogt Model 750 5. Outside Diameter: 33 mm.: 2.0 mm wall thickness; inside diameter: 29 mm; Finish: Brilliant Chrome.

.11 Coat Rod Flanges: Knape & Vogt Model 764 Wall-Mount Flange: Anochrome.

.12 Door Bumpers: “Quietex” bumpers.

.13 Provide other hardware and hardware accessories as detailed or required.

.14 All exposed hardware to have Platinum (Mica) finish by Teknion or equivalent unless noted otherwise.

2.2 Fabrication

.1 Materials and methods of construction to meet requirements of AWMAC's STANDARDS (NAAWS) for grade or grades specified.

.1 If there is conflict between plans and/or specifications and AWMAC's STANDARDS (NAAWS), plans and specifications shall govern.

.2 Construction Type: Frameless

.3 Cabinet and door interface: Flush overlay.

.4 Exposed joints and edges:

.1 Uniformly space exposed joints unless otherwise indicated.

.2 No edge grain shall be visible; mitre external corners, house internal fasteners. Glue mitred corners.

.3 All exposed edges of plywood and particle board shall have solid wood edging, pressure glued. AWMAC No. 3 edge.

.4 Ease edges of solid lumber components to 1.6 mm radius.

.5 Mechanical Fasteners:

.1 Inconspicuously locate mechanical fasteners. Wherever possible, conceal fastenings.

.2 Countersink nail heads.

.3 Where exposed to view, countersink screw and bolt heads and fill holes with matching wood plugs.

.4 Cutting and fitting: make cut-outs in work of this Section as required to accommodate work of other Sections.

.5 Make provisions in cabinetwork to accept built-in appliances, provided by others.

2.3 Wood Casework

.1 Materials and methods of construction to meet requirements of AWMAC's STANDARDS

(NAAWS) for grade or grades specified.

.2 If there is conflict between plans and/or specifications and AWMAC's STANDARDS (NAAWS), plans and specifications shall govern.

.3 Wood Casework:

.1 Grade: AWMAC's STANDARDS (NAAWS) Custom Grade

.4 Exposed Surfaces Maple veneer book matched.

.5 Exposed interior surfaces: Veneer of same species and cut and grade as exposed exterior surfaces.

.6 Semi-exposed surfaces: veneer of same species as exposed faces

2.4 Plastic Laminate Casework

.1 Construct cabinetwork components of plastic laminate faced particle board as indicated and in accordance with AWMAC Custom grade.

.2 Tenon, dado, dowel, or rabbet interior construction with all parts well glued. Shoulder mitre all exposed corners. Open ends or skeleton frames against walls are not permitted. Unless otherwise permitted by Consultant, use unitized construction system for all components.

.3 Exposed Surfaces: High Pressure Decorative Laminate (HPDL), meeting requirements of AWMAC's Standards (NAAWS) for Grade specified.

.4 Construct door fronts of 19 mm plastic laminate faced MDF.

.5 Exposed interior surfaces: LPDL of a colour and pattern compatible with exposed surfaces

.6 Semi-exposed surfaces: LPDL

.7 Apply self-edged minimum 1.0 mm thick plastic laminate to exposed ends of countertops.

.8 Rout gables for pilaster strips where adjustable shelving is required.

.9 Construct shelving with edge moulding to match. Shelving to cabinetwork to be adjustable unless otherwise noted.

.10 Cabinet bases shall be marine grade plywood, minimum 16 mm thickness.

.11 Apply moisture repellent sealer to concealed backs of cabinetwork.

.12 Install cabinet hardware in accordance with hardware manufacturer's directions. Unless otherwise indicated, provide each door with pull and with minimum two hinges. Provide locks where indicated.

.13 Coordinate installation of wiring for electrical work with Electrical.

2.5 Laminated Plastic Countertops and Shelves

.1 Unless otherwise specified herein, comply with requirements of ANSI/NEMA LD 3 Annex 'A'.

.2 Assembly: Bond plastic laminate to core with adhesive, under pressure.

.3 Core: unless otherwise indicated: 19 mm thick.

.4 Balanced construction: plastic laminate covered components shall be of balanced construction, with plastic laminate on both faces of core. Seal core edges not covered with plastic laminate.

.5 Use largest practicable plastic laminate sheet size.

.6 Provide joints symmetrically; provide joints as corners and at changes in superficial areas; provide concealed draw bolt anchors and joints. All butt joints shall have a blind spine.

.7 Openings and cutouts:

.1 Radius internal corners at least 3 mm and chamfer edges.

.2 Where core edge is to remain exposed, cover with plastic laminate edging.

.3 Where core edge is to be concealed, seal with sealer.

.8 Back splashes: as indicated, 100 mm high.

.9 Front edges: As indicated

2.6 Finishes

.1 All exposed exterior surfaces: plastic laminate as indicated. Colours selected by the Consultant.

.2 Wood Finish: 3 coats clear polyurethane finish on all sides as specified in Section 09 91 23. Factory finish wherever practical.

.3 All exposed interior surfaces: melamine unless indicated otherwise.

.4 Cabinet and case backs unexposed to view shall be back primed with one coat of moisture repellent sealer.

.5 Apply finishes in accordance with the AWMAC Manual.

.6 Stainless Steel: Type 316 stainless steel, brushed finish.

PART 3 EXECUTION

3.1 Examination

.1 Verify mechanical, electrical, plumbing, HVAC and other building components, affecting work in this Section are in place and ready.

.2 Verify HVAC controls and systems are operating properly.

.3 Verify adequacy of backing and support framing. Advise Contractor of areas and surfaces requiring further modifications for plumb, level, even or square fitting.

3.2 Installation

.1 Install work in accordance with AWMAC Installation Manual, Custom grade.

.2 Secure all work in place, square, plumb, and level.

.3 Fasten and anchor millwork securely.

.1 Supply and install heavy duty fixture attachments for wall mounted cabinets.

.4 Accurately scribe and closely fit components to irregularities of adjacent surfaces.

.5 Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.

.6 Countersink mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end.

.7 Install plastic laminate components using concealed fastening devices.

.8 Where components are fastened with screws or bolts, countersink screw and bolt heads and provide wood plugs matching surrounding wood.

.9 Where cabinetwork abuts other building elements, provide wood trim matching cabinetwork except where otherwise detailed.

.7 Cut equipment cutouts shown on plans using templates provided.

.1 Radius internal corners at least 3 mm and chamfer edges.

.2 Where core edge is to remain exposed, cover with plastic laminate edging.

.3 Where core edge is to be concealed, seal with sealer.

.10 Where access is required to valves and other mechanical and electrical components, located behind cabinetwork, provide removable plywood access panels of size required and secure with four brass screws.

.11 Apply mildew resistant silicone sealant to perimeter of all countertops as specified in Section 07 92 00.

3.3 Adjustment

.1 Adjust all moving and operating parts to function smoothly and correctly.

.2 Fill and retouch all nicks, chips and scratches. Replace all un-repairable damaged items.

.3 Replace damaged components which, in the opinion of the Consultant, cannot be satisfactorily repaired.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion of installation, clean installed items of pencil and ink marks and broom clean the area of operation.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 04 22 00 Concrete Unit Masonry

.3 Section 04 27 00 Multiple Wythe Unit Masonry

.4 Section 06 10 00 Rough Carpentry

.5 Section 07 26 00 Vapour Retarders

.6 Section 07 27 13 Modified Bituminous Sheet Air Barriers

.7 Section 07 51 00 Built-Up Bituminous Membrane Roofing

.8 Section 07 92 00 Joint Sealants

.9 Section 08 11 00 Metal Doors and Frames

.10 Section 08 44 13 Glazed Aluminum Curtain Walls

.11 Section 08 51 13 Aluminum Windows

.12 Section 31 23 10 Excavating, Trenching and Backfilling

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C272/C272M-18(2024) Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions

.2 ASTM C423-23 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

.3 ASTM C518-21 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.4 ASTM C578-22 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

.5 ASTM C612-14(2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.6 ASTM C665-23 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

.7 ASTM C1620-16(2023) Standard Specification for Aerosol Polyurethane and Aerosol Latex Foam Sealants

.8 ASTM D1621-16(2023) Standard Test Method for Compressive Properties of Rigid Cellular Plastics

.9 ASTM D1623-17(2023) Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics

.10 ASTM D2842-25 Standard Test Method for Water Absorption of Rigid Cellular Plastics

.11 ASTM E1677-19 Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls

.12 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.13 ASTM E96/E96M-24a Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials

.2 Underwriters Laboratories Canada (ULC)

.1 ULC 701.1 Standard for Thermal Insulation, Polystyrene Boards

.2 ULC 702.1 Standard for Thermal Insulation Mineral Fibre for Buildings

.3 ULC 704 Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

.3 Underwriters Laboratories (UL)

.1 UL 1715 - Fire Test of Interior Finish Material

.4 Canadian General Services Board (CGSB)

.1 CGSB 71-GP-24M Adhesive, Flexible, for Bonding to Cellular Polystyrene Insulation.

.5 Uniform Building Code (UBC)

.1 UBC 26-3 Room Fire Test Standard for Interior of Foam Plastic Systems

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit insulation manufacturer's product literature including specified physical properties for each type of insulation specified.

.3 Submit installation instructions.

.4 Submit certification that product complies with specification requirements and is suitable for the use indicated.

1.5 Environmental Requirements

.1 Insulation shall not be produced with, or contain, any of the regulated CFC compounds listed in the Montreal Protocol of the United Nations Environmental Program.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Deliver material to the site in the original unbroken packages bearing the name of manufacturer.

.4 Store materials in an approved manner at the site preceding application and protect from damage at all times.

.5 Remove damaged or deteriorated materials from site.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.8 Warranty

.1 Provide written warranty that the actual thermal resistance of the extruded polystyrene foam insulation will not vary by more than 10% from its published thermal resistance.

.2 Warranty period is 15 years after date of Substantial Performance.

PART 2 PRODUCTS

2.1 Board Insulation

.1 Rigid insulation at perimeter of ground floor slab and below grade:

.1 Extruded expanded polystyrene to ULC S701.1 TYPE 4. HFO blowing agents. Thickness as detailed, 400 x 2440 mm boards with butt edges. Material shall have the following characteristics when tested to the reference standards:

.1 Minimum Compressive Strength: ASTM D1621: 210 kPa.

.2 Water Absorption: ASTM D2842: maximum 0.7% by volume.

.3 Water Absorption: ASTM C272: maximum 0.1% by volume.

.4 Water Vapour Permeance, ASTM E96: 52 ng/Pa•s•m^2

.5 Thermal resistance RSI: ASTM C518: 0.88/25 mm

.2 Basis of Design: Soprema XPS-30

.2 Rigid Cavity Wall Insulation:

.1 To CAN/ULC S704 Type 2, Class 3. Insulation boards shall be thickness as detailed, 600 x 2400 mm with butt edges. Non-reflective glass-mat facer Non-reflective glass-mat facer both sides.

.2 Material shall have the following characteristics when tested to the reference standards:

.1 Tensile strength ASTM D1623 > 35 kPa (5.08 psi)

.2 Flexural strength ASTM C203 > 275 kPa (40 psi)

.3 Water vapour permeance ASTM E96 (method A) > 60.0 ng/Pa•s•m² at 25.4 mm (≤ 1.05 perm at 1 in)

.4 Water absorption ASTM D2842 < 3.5 % by volume (typically < 0.6 % by volyme)

.5 Thermal resistance RSI: 76 mm thickness: 3.3 RSI (R - 18.5)

.3 Basis of Design: Soprema Sopra-ISO V PLUS.

2.2 Mineral Wool Batt Insulation

.1 Mineral Wool friction fit batts to CAN/ULC 702.1 Type 1, width and thickness as shown on details:

.1 R-Value: ASTM C518: RSI 2.46 - 89 mm thick

.2 Density: ASTM C167: >32 kg/m³ nominal.

.3 Surface Burning Characteristics: CAN/ULC S102:

.1 Unfaced: Flame Spread 0 and Smoke Developed 0

.4 Moisture Resistance: ASTM C1104: Absorption of less than 0.03 percent by volume

.5 Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.

.6 Fungi resistance: ASTM C1338: Zero mold growth

.7 Recyclability: Material to be capable of being fully recyclable at end of life with the intention of sending zero waste to landfill.

.8 Environmental Product Declaration (EPD): Material must be included on a UL Certified EPD in accordance with EN 15804 and ISO 14025

.1 GREENGUARD Gold Certified

.9 Basis of Design Product: ROCKWOOL Comfortbatt unfaced.

2.3 Batt Insulation

.1 Fibreglass friction fit batts or mineral fibre to CAN/ULC 702.1 Type 1 for wall application, width and thickness as shown on details:

.1 Owens Corning ProPink Wall Insulation, unfaced.

.2 Owens Corning Thernmafiber Ultrabatt

.3 Roxul Batt Insulation.

2.4 Spray Foam Insulation

.1 Spray Foam Insulation: to ASTM C1620, one component expanding polyurethane or polyisocyanurate foam, ULC approved and compatible with rigid insulating materials, with Class 1 fire rating to ASTM E84 for window and door frame application:

.1 Ultra Seal PF-100 Gun Foam by Nuco Inc.

.2 Handi-Foam by Fomo Products Inc.

.3 Pinkseal by Owens Corning.

.4 Hilti CF 812 Window and Door Pro.

2.5 Accessories

.1 Sealing Tape: minimum 65 mm width, polypropylene sheathing tape with acrylic adhesive.

.2 Rough Hardware: Nails and staples as required for installation of insulation and membrane materials, galvanized to CSA B111 and B34.

.3 Mechanical Fastening: galvanized screw type fasteners with 25 mm galvanized plate washers. Screws shall be 13 mm longer than the combined thickness of the insulation and sheathing.

.4 Adhesives: As recommended by material manufacturer, compatible with insulation and substrate membrane, waterproof,

.5 Vapour Retarder: As specified in Section 07 26 00.

PART 3 EXECUTION

3.1 Installation – General

.1 Install insulation of types indicated, or, where not indicated, as appropriate, to provide a continuously un-interrupted building envelope in accordance with the requirements of the reference standards.

.2 Install insulation after building substrate materials are dry.

.3 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.4 Fit insulation tightly around all structural angles, penetrations and other protrusions.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly; offset vertical joints.

.6 Insulation board materials shall be free from chipped or broken edges.

.7 Sizes of materials shall be consistent with the module of the system.

.8 Do not enclose or conceal insulation until it has been inspected by the Consultant.

3.2 Perimeter Insulation

.1 Do not proceed with installation until concrete surfaces are dry and cured, and water proofing membranes have been inspected and approved.

.2 Install perimeter insulation vertically just prior to backfilling.

.3 Prime porous concrete surfaces.

.4 Apply adhesive in gobs or pads to the back of the insulation board in accordance with manufacturer’s instructions. Joints shall be left dry with joints brought into tight contact. Apply insulation to the wall with a slight sliding motion to ensure good contact.

.5 Protect insulation from damage until time for backfilling.

.6 Following backfilling and prior to placement of underslab vapour barriers, install horizontal insulation. Install rigid insulation at perimeter of all exterior walls and for extent as indicated. Tightly butt joints.

3.3 Underslab Insulation

.1 Under slab application: Following backfilling and prior to placement of underslab vapour barriers, install horizontal insulation. Install rigid insulation for extent as indicated. Lay boards on level compacted fill. Tightly butt joints. Stagger joints in multiple layers as indicated.

.2 Extend boards as indicated on Drawings, and as follows:

.1 Lay boards on level compacted fill.

.2 Protect top surface of horizontal insulation from damage during concrete work.

3.4 Semi-Rigid Mineral Wool Insulation

.1 Install insulation in accordance with manufacturer's written recommendations.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Do not compress insulation to fit into spaces.

.4 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of chimneys and vents.

.6 Do not enclose insulation until before inspection and receipt of Consultant's written approval.

3.5 Cavity Wall Insulation

.1 Coordinate with Section 04 27 00,

.2 Install polyisocyanurate glass mat faced insulation boards on outer surface of inner wythe of wall cavity on bed of adhesive as recommended by the manufacturer..

3.6 Batt Insulation

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces. Ensure that insulation is kept dry and not compressed.

.2 Install insulation in spaces as shown on drawings.

.3 Insulation shall be placed in all metal stud and header assemblies that will be inaccessible after their installation into the wall. Refer to Section 05 41 00.

.4 Install batt insulation in built up wood roof curbs where detailed.

.5 Pack loose insulation in crevices between exterior masonry and door and window frames and about lintels, frames, beams around ducts at holes and other places where shown or required to eliminate air infiltration.

.6 Pack loose insulation into voids around mechanical and electrical pipes and ducts where they pass through walls and slabs.

3.7 Spray Foam Insulation

.1 Completely fill all joints and penetrations in exterior walls, at door and window frames and where indicated, with expanding spray foam insulation, in accordance with manufacturer's instructions.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 07 21 13 Building Insulation

.3 Section 07 92 00 Joint Sealants

.4 Section 31 23 10 Excavating, Trenching and Backfilling

1.3 References

.1 ASTM International (ASTM)

.1 ASTM E96/E96M-24a Standard Test Methods for Water Vapor Transmission of Materials

.2 ASTM E154/E154M-08a(2025) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

.3 ASTM E1643-18a Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

.4 ASTM E1745-17(2023) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

.5 ASTM F1249-20 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

.2 American Concrete Institute (ACI)

.1 ACI 302.1R Guide for Concrete Floor and Slab Construction

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer's product data including certification that materials meet the requirements of the reference standards, and application instructions.

1.5 Project Conditions

.1 Products specified are not intended for uses subject to abuse or permanent exposure to the elements.

.2 Do not apply membranes on frozen ground.

1.6 Quality Assurance

.1 Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.

.2 Obtain vapour retarder materials from a single manufacturer regularly engaged in manufacturing the product.

.3 Provide products which comply with all federal, provincial and local regulations controlling use of volatile organic compounds (VOCs).

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

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

.4 Store materials in a clean dry area in accordance with manufacturer's instructions. Stack membrane on smooth ground or wood platform to eliminate warping.

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

.6 Ensure membrane is stamped with manufacturer’s name, product name, and membrane thickness at intervals of no more than 220 cm.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Sheet Vapour Barrier for Below Concrete Slabs on Grade

.1 Vapour retarder membrane shall be manufactured from virgin polyolefin resins, and when tested according to all requirements of ASTM E1745, shall meet the following minimum performance requirements:

.1 Maximum Water Vapour Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249).

.1 As received: 0.0063 perms.

.2 After Wetting and Drying: 0.0052 perms.

.3 Resistance to Plastic Flow and Temperature: 0.0057 perms.

.4 Effect Low Temperature and Flexibility: 0.0052 perms.

.5 Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0052 perms.

.2 Puncture Resistance (ASTM D1709): >3,200 grams.

.3 Tensile Strength ASTM E154, Section 9: 72 Lb. Force/Inch

.4 Basis of Design Product:

.1 Perminator 15 mil, as manufactured by W.R. Meadows

.2 Seam Tape:High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 100 mm.

.1 Basis of Design Product: Perminator Tape by W.R. Meadows

.3 Pipe Collars: Construct pipe collars from vapour retarder material and pressure sensitive tape per manufacturer's instructions.

.4 Pipe Collars: Construct pipe collars from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION

3.1 Vapour Retarders Below Slabs

.1 Install sheet vapour retarder below all concrete slabs on grade.

.2 Prepare surfaces in accordance with manufacturers recommendations.

.3 Level, tamp, or roll earth or granular material beneath the slab base.

.4 Install vapour retarder below floor slab immediately prior to concrete reinforcement placement and in accordance with ASTM E1643

.5 Unroll vapour retarder with the longest dimension parallel with the direction of the pour.

.6 Lap vapour retarder over footings and seal to foundation walls.

.7 Overlap joints 150 mm and seal with manufacturer's tape.

.8 Seal all penetrations (including pipes and conduits) with manufacturer's pipe boot.

.9 No penetration of the vapour retarder is allowed except for reinforcing steel and permanent utilities.

.10 Repair damaged areas by cutting patches of vapour retarder, overlapping damaged area 150 mm and taping all four sides with tape.

.11 Restrict traffic over vapour retarder.

.12 Prior to placing concrete inspect vapour retarder and repair all tears and punctures.

3.2 Inspection

.1 Arrange for inspection of vapour retarders immediately prior to covering, by local building department and Consultant.

.2 Make all required repairs identified during inspection.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 27 00 Multiple Wythe Unit Masonry

.2 Section 06 10 00 Rough Carpentry

.3 Section 07 21 13 Building Insulation

.4 Section 07 51 00 Built-Up Bituminous Membrane Roofing

.5 Section 07 62 00 Sheet Metal Flashing and Trim

.6 Section 07 92 00 Joint Sealants

.7 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)

.1 ASTM D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

.2 ASTM D624-00(2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

.3 ASTM D4541-22 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

.4 ASTM E96/E96M-24a1 Standard Test Methods for Water Vapor Transmission of Materials

.5 ASTM E330/E330M-14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

.6 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

.7 ASTM E1186-22 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

.8 ASTM E2178-21a Standard Test Method for Air Permeance of Building Materials

.9 ASTM E2357-25 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

.2 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing

.3 National Air Barrier Association (NABA)

.1 National Air Barrier Association's (NABA) Quality Assurance Program (QAP)

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit manufacturer’s complete set of standard details for air barriers.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.5 Performance Requirements

.1 Select and install wall components and assemblies to resist air leakage caused by static air pressure across exterior wall assemblies, including windows, glass, doors, and other interruptions to integrity of wall systems; to maximum air leakage rate of 0.01 L/s.m² when subjected to pressure differential of 75 Pa as measured in accordance with ASTM E783, and ASTM E330.

.2 Select and install wall components and assemblies to resist air leakage caused by dynamic air pressure across exterior wall assemblies, including windows, glass, doors and other interruptions to integrity of wall systems; to maximum air leakage rate of 0.013 L/s.m² when subjected to hourly wind design loads in accordance with NBC, using 1 in 10 year probability, as measured in accordance with ASTM E783 and ASTM E330.

.3 If ongoing testing is required throughout air barrier system installation, perform qualitative testing methods in accordance with ASTM E1186 and ASTM D4541.

.4 Provide continuity of air barrier materials and assemblies in conjunction with materials described in other Sections.

1.6 Quality Assurance

.1 Quality Assurance Program: Submit evidence of current Contractor accreditation and Installer certification under the National Air Barrier Association's (NABA) Quality Assurance Program (QAP).

.2 Preconstruction Meeting: Convene a minimum of two weeks prior to commencing work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction and chemical/fire safety plans. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

.3 Mock-Ups: Build mock-up representative of primary air barrier assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Consultant. Mock-up shall be dimensions no less than 2.5 metres long by 2.5 metres high and include the materials and accessories proposed for use in the exterior wall assembly. Mock-ups shall be suitable for testing as specified in the following paragraph.

.4 Mock-Up Tests for Air and Water Infiltration: The third party testing agency shall test the mock-up for air and water infiltration in accordance with ASTM E1186 (air leakage location), ASTM E783 (air leakage quantification) at a pressure difference of 75 Pa, and ASTM E1105 (water penetration). Use smoke tracer to locate sources of air leakage. If deficiencies are found, the air barrier Contractor shall reconstruct mock-up for retesting until satisfactory results are obtained. Deficiencies include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.

.1 Perform the air leakage test and water penetration test of mock-up prior to installation of cladding and trim but after installation of all fasteners for cladding and trim and after installation of other penetrating elements.

.5 Mock-Up Tests for Membrane Adhesion: Test mock-up for transition membrane adhesion in accordance with ASTM D4541 (modified), using a type II pull tester except that the membrane shall be cut through to separate the material attached to the disc from the surrounding material. Perform test after curing period recommended by the material manufacturer. Record mode of failure and area where the material failed in accordance with ASTM D4541. When the material manufacturer has established a minimum adhesion level for the product on the substrate, the inspection report shall indicate whether this requirement has been met. Where the material manufacturer has not declared a minimum adhesion value for their product/substrate combination, the value shall simply be recorded.

1.7 Sequencing

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.8 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Material

.1 Materials: as required to achieve specified performance criteria; meeting specified reference standards and functionally compatible with adjacent materials and components.

.2 Air barrier membrane components and accessories must be obtained as a single source from the membrane manufacturer to ensure total system compatibility and integrity.

2.2 Membranes

.1 Self-adhered air barrier membrane shall SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, and having the following physical properties:

.1 Thickness: 1.0 mm minimum.

.2 Air leakage: <0.01 L/s.m² @ 75 Pa to ASTM E283

.3 Vapour permeance: 1.6 ng/Pa.m².s to ASTM E96

.4 Low temperature flexibility: -30° C to CGSB 37-GP-56M

.5 Elongation: 200% to ASTM D412.

.2 Acceptable Products:

.1 Blueskin SA by Henry Company.

.2 Perm-A-Barrier by W.R. Grace & Co.

.3 Air Shield by W.R. Meadows

.4 ExoAir 110 by Tremco

.5 Sopraseal Stick 1100T by Soprema

2.3 Adhesives and Primers

.1 As recommended by manufacturer.

2.4 Mastics and Termination Sealants

.1 As recommended by manufacturer.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 General

.1 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

3.3 Examination

.1 Examine all surfaces to ensure conformance to the manufacturer's recommended surface conditions.

3.4 Preparation

.1 Prepare substrate surfaces in accordance with air barrier material manufacturer's instructions.

.2 All surfaces which are to receive flexible air barrier must be smooth, clean, dry, frost-free and in sound condition. All moisture, frost, grease, oils, loose mortar, dust, or other foreign materials which may impede the adhesion of the air barrier must be removed.

.3 New mortar must be cured 14 days and must be dry before air barrier membrane is applied.

.4 Concrete must be cured 28 days and dry before air barrier membrane is applied.

.5 Remove any and all sharp protrusions and repair any defects such as spalled or loose aggregate areas.

.6 Do not proceed with air barrier application until all substrate defects are repaired.

3.5 Installation

.1 Install air barrier materials continuously over substrate in accordance with manufacturer's instructions. Partial application is not acceptable, and the insulation specified elsewhere is not intended to perform as the sole air barrier.

.2 Prime surfaces and apply membrane in strict accordance with manufacturer's printed directions.

.3 Primed surfaces not covered by air barrier membrane during the same working day must be reprimed.

.4 Apply membrane by heating the surface in contact with the substrate with a trigger-activated propane torch, type as recommended by the manufacturer.

.5 Cut sheet membrane into manageable sizes, position membrane for alignment prior to removing protective film.

.6 Install membrane horizontally, in a shingle fashion starting at lowest point. Position membrane and remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps. Promptly roll the membrane surface and all laps with a countertop roller to ensure proper surface bond and effect the seal.

.7 Tie-in to window frames, door frames, roofing systems, cladding, concrete walls, and at the interface of dissimilar materials as indicated or as necessary to achieve a continuous air seal throughout the building envelope. Seal with air barrier tape. Refer to manufacturer’s standard details.

.8 All joints, interconnections, and penetrations of the air barrier components including lighting fixtures shall be indicated on manufacturer’s standard details.

.9 Ensure all projections are properly sealed with a trowel or caulk application of specified sealant.

3.6 Inspection and Repair

.1 Inspect membrane thoroughly before covering and make any corrections to punctures, tears, voids and other obvious defects which would impede the membrane from performing as intended.

.2 Notify Consultant when sections of work are complete so as to allow for review prior to installation of insulation. Remove, replace or repair materials not satisfactory to the Consultant and wait for re-inspection before covering work.

3.7 Cleaning and Protection

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Protect air barrier materials from damage during installation and the remainder of the construction period, according to material manufacturer's written instructions.

.3 Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the material manufacturer.

.4 Clean adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

End of Section

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

.1 Comply with requirements of Division 1.

1.2 RELATED WORK

.1	Steel Deck	Section 05 31 00
.2	Rough Carpentry:	Section 06 10 00
.3	Sheet Metal Flashing and Trim	Section 07 62 00
.4	Roof Drains:	Division 22

1.3 DESCRIPTION

.1 Roof System R1 (from top to bottom):

.1 9mm Ballast/ Aggregate, Snow White Calcite

.2 Type II asphalt flood coat.

.3 4 plies Type IV fibreglass roof felt membrane in Type 2 Asphalt.

.4 1 ply # 15 asphalt saturated roofing felt in Type 2 Asphalt.

.5 6.4mm DensDeck Prime underlayment Board in Type 2 Asphalt

.6 Tapered Insulation, where indicated

.7 Insulation 2-75mm layers (sloping insulation where required).

.8 Vapour retarder.

.9 12.7mm DensDeck Prime underlayment Board.

.10 Roof Structure steel deck

1.4 QUALITY ASSURANCE

.1 Roof system components shall be classified and listed by ULC as Class 'A'.

.2 Applicators Qualifications: Member in good standing of the Ontario Industrial Roofing Contractors Association (OIRCA) or a member in good standing of the Canadian Roofing Contractors' Association or having a minimum 5 year documented experience in type of work specified herein and approved by Consultant.

.3 Reference Standards: Where work required is not specified or shown in detail meet applicable requirements of CRCA Roofing Specification Manual, latest issue.

.4 Ensure compatibility between all roofing materials used.

.5 Use the same manufacturers for roofing felts and flashing materials.

.6 Only roofing contractors pre-qualified by the DCDSB shall be accepted.

1.5 QUALITY CONTROL

.1 Comply with requirements of Section 01 45 00.

.2 The Owner may appoint and pay out of cash allowance included in Section 01 21 00 for independent inspection agency to inspect work of this Section as directed by the Consultant.

.3 Independent testing agency may direct Contractor to make up to three test cuts of completed membrane and inspect samples on site to evaluate number of plies, overlap and quantity of bitumen, and, if preliminary observations warrant, carry out further detailed laboratory testing to determine exact quantities along with bitumen softening point, hardness number viscosity and ductility. Contractor shall immediately fill voids left by test cuts (maximum three); carefully cut out further materials so that each layer or ply of each roofing component overlaps preceding layer by minimum 50 mm and when all specified layers have been mopped in overcoat with bitumen over entire area with 100 mm side and end overlap.

.4 Installed roof system shall meet dynamic uplift resistance in accordance with CSA A123.21-14.

1.6 SUBMITTALS

.1 Submit detailed product data for each product to be used.

.2 Prior to start of work submit description of each roof system component to be used and provide verification that all components are classified and listed by ULC as Class 'A'.

.3 Submit shop drawings for tapered insulation.

1.7 PRODUCT HANDLING

.1 Store materials on raised platforms in approved manner at site preceding application, and protect from inclement weather at all times. Roofing felts which have become wet shall not be used.

.2 Store roofing felts and insulation in heated atmosphere, 21°C for 24 hours, before application in cold weather. Polywrap roofing felts.

.3 Do not store gravel on roof ahead of demand. Bring gravel to roof only as it is required for spreading as work proceeds.

1.8 JOB CONDITIONS

.1 Protection

.1 Protect work of other Sections from damage. Cover vertical surfaces with tarpaulins at hoisting locations.

.2 **No open flame, torch applied roofing is permitted**.

.3 Locate kettles at grade level away from building, and so as to prevent smoke damage to building.

.4 Protect bitumen and felts against contact with water from any source until applied and fully cured.

.5 Protect completed portions of roofing and existing roofs scheduled to remain in place from damage due to traffic and materials handling until completion of work.

.2 Environmental Conditions

.1 Do not apply roofing materials during precipitation or over damp or otherwise unsuitable surfaces.

.2 Apply materials only when air temperature is within limits specified by manufacturer.

.3 Materials and application methods used when temperature is below 5°C must be approved by the Consultant prior to start of work.

1.9 WARRANTY

.1 At no cost to the Owner, remedy any defects in work, including work of this and other Sections, due to faults in materials or workmanship provided under this Section as well as Section 07 62 00 appearing within a period of 2 years from date of Substantial Performance.

.2 Provide a written fifteen (15) year No Dollar Limit roof system warranty issued by the Principal roof materials manufacturer. The warranty shall cover all labour, materials and workmanship. The warranty shall be non-cancelable: include costs for this warranty, future inspections by the manufacturer and all other charges concerning the warranty at no further expense to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Asphalt-primer: CGSB 37-GP-9Ma.

.2 Asphalt: meeting requirements of CSA A123.4-04 (R2013), Type 2 for slopes up to 1:15, Type 3 for slopes greater than 1:15.

.3 Overlay: to ASTM C1177, 12.7 mm thick DensDeck Prime by Georgia Pacific.

.4 Screw fasteners for overlay board: FM approved, disk type: Insulfixx by Fabco, Roofgrip by Buildex or equivalent product by other manufacturer approved by Consultant.

.5 Vapour Retarder: Polyethylene-reinforced, self-adhering SBS modified asphalt vapour

barrier as manufactured by IKO Industries Ltd.; Johns Manville; or Soprema Inc.; or approved equal.

.6 Felt Underlay: Asphalt saturated organic perforated No. 15 felt to CAN/CSA-A123.3-05.

.7 Roofing Felts: Inorganic glass felts: ASTM D-2178, Type IV.

.8 Roof Insulation: Rigid polyisocyanurate board, glass faced top and bottom, to CAN/ULC-S704 Class 2, Type III: ENRG 3 CGF by Johns Manville or Atlas ACFoam-III; or Sopra-Iso PLUS by Soprema, or IKOTherm III by IKO; with a minimum RSI of 5.7 per 25 mm thickness.

.9 Sloping Insulation: Tapered rigid polyisocyanurate slope unless otherwise shown 1:50; by Posislope, Accu-Plane or Everest, or Sopra-ISO Tapered by Soprema or other manufacturer approved by Consultant.

.10 Engineered Polyisocyanurate Drain Sumps: Sump area shall as be designated to provide a 25mm to 0mm slope and be as engineered and manufactured by Posi-Slope Enterprises or Soprema or equivalent product by other manufacturer approved by Consultant.

.11 Cover Board: to ASTM C1177, 6.4 mm thick DensDeck Prime by Georgia Pacific.

.12 Cant Strip: 100 × 100 mm rigid fibreboard, mopping grade, by Posislope or equivalent product by other manufacturer approved by Consultant.

.13 Flashing Base Sheet: Self adhered, 180 gm Prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane as manufactured by Johns Manville; or Soprema Inc.; or equivalent product by other manufacturer approved by Consultant.

.14 Flashing Cap Sheet: Granulated cap ply, 250 gm Prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane as manufactured by IKO Industries Ltd.; Johns Manville; or Soprema Inc.; or approved equal.

.15 Aggregate: Hard, durable, screened and washed Snow White calcite, 600 lbs / 100 sq ft, free of organic matter, soluble elements, opaque to ultra-violet light. Size 9 to 12 mm, no fines.

.16 Roof Pedestals: Paver Pedestal H150 by Soprema. Provide 110mm extensions by same supplier as required to meet slopes and elevations indicated on roof plan. Provide slope corrector pieces as required, cushions at all pedestals for stability, and peripheral support kits at every perimeter pedestal

.17 Pavers: 600 × 600 × 50 mm thick standard grey precast concrete paving slabs to CSA A231.1-06, to be used with 500 × 500 × 25 mm thick extruded polystyrene roof insulation spacers.

.18 Mechanical Insulation fasteners: #14 hardened steel polymeric coated screws, 25 mm longer than roof assembly thickness, with 75 mm diameter galvalume coated steel plates, approved

.19 Nails: Large head galvanized steel or aluminum roofing nails of sufficient length to penetrate and provide a secure fastening.

.20 Fastening bars: Cold rolled galvanized sheet steel, 2 mm ASTM A653 coating designation Z275 commercial, with slotted holes at 25 mm o.c.

.21 Isolation Material: 25mm thick dimpled rubber isolation material, to be installed below full extents of all concrete pads below heat pump (chiller) units. GenieMat F25, IsoSep 25HD or equivalent product by other manufacturer approved by Consultants.

2.2 BITUMEN

.1 Maintain bitumen temperatures within range specified. Regulate temperatures by means of thermostatic heating control attached to kettle. Kettle temperature shall not exceed flash point of bitumen:

.1 Maximum kettle temperature: 260°C

.2 Minimum application temperature: 190°C.

.2 In cold weather, maximum kettle temperature may be increased if required to facilitate pouring of bitumen. Check with Consultant before raising temperature.

.3 Provide separate kettles for each type of asphalt required. Heating different types of asphalt in one kettle is not permitted.

PART 3 - EXECUTION

3.1 SUBSTRATES AND PREPARATION

.1 Examine materials over which work of this Section is applied and ensure that roof decks are free of snow, ice, loose or adhering materials which would impair this work.

.2 Substrate shall be clean, dry and suitable for roofing application.

.3 Start of work of this Section shall indicate acceptance of substrate conditions.

.4 Prime concrete and masonry substrates in contact with roofing membrane and felt flashings. Allow primer to dry before applying succeeding components.

.5 Install acoustic insulation at acoustic roof deck, supplied only by Section 05 31 23.

3.2 DECK OVERLAYMENT

.1 Install sheathing board to top of steel deck where required. Provide minimum 12 fasteners and plates per full sheet (1.2 × 2.4 m), in pattern recommended by board manufacturer.

.2 Install sheathing boards in largest size possible with all joints tightly butted.

.3 Install sheathing parallel to deck flutes with end joints staggered.

3.3 VAPOUR RETARDER

.1 Apply membrane in accordance with system manufacturer's instructions and the following requirements.

.2 Prime metal, concrete and masonry surfaces with a uniform coating of the specified primer.

.3 Once the membrane roll is relaxed, position the roll over the substrate. Once aligned, reroll the membrane from both ends. Peel back one end of the silicone release sheet and roll the membrane into place pulling the release sheet at a 45° angle

.4 Overlap each preceding sheet by 75mm (3") lengthwise following the reference line and by 150mm (6") at each end. Stagger end laps by at least 300mm (12"). Stagger end laps a minimum of 900mm (3 feet)

.5 Where roofing abuts curbs and other vertical surfaces, extend vapour retarder up and over cant strip and mechanically secure.

.6 Vapour retarder shall be continuous and complete in all locations. Seal at penetrations. Coordinate with other Sections as required to ensure continuity at all locations.

3.4 INSULATION

.1 Install insulation in thickness required. Install insulation in double layer where total insulation thickness exceeds 75 mm; stagger joints in second layer from joints in first layer. Butt boards together tight without gaps. Ensure that top surface of insulation is smooth, even and without steps. Do not install more insulation, than that which can be covered with roof membrane the same day.

.2 Where there is no overlay board mechanically fastened, mechanically fasten base layer of insulation to steel deck with minimum 8 fasteners and plates per 1.2 × 2.4 m sheet. Increase fastening patterns by 50% along the roof perimeter and 70% at roof corners.

.3 Adhere succeeding (top) layers of insulation to the bottom insulation layer. Mechanical fasteners will not be approved for securing the top layers of insulation.

.4 Install pre-manufactured drain sumps, 1.2 m square around each roof drain; install tapered filler pieces to allow for smooth transition.

.5 Provide sloping insulation to slopes and configurations shown. Bond insulation to substrate with hot bitumen.

.6 Install the cover board insulation in a full mopping of hot bitumen. Stagger side and end joints.

.7 Secure cant strip with hot bitumen.

3.5 ROOFING MEMBRANE: 1+4

.1 Over cover board provide felt underlayment, consisting of 1-ply of asphalt saturated organic felt in full mopping of hot asphalt.

.2 Over the felt underlayment, apply 4-plies of roofing felts in full moppings of hot asphalt

applied at a rate of 1.25 kg/m^2 lapping each sheet 700 mm over preceding sheet and mopping full the width of each sheet. Unless otherwise specified, carry roofing felts to top of cant strips and cut to a neat straight line.

.3 Lay felts free of air pockets, wrinkles, fishmouths, prominent lap joints or tears, with end joints staggered and lapped minimum of 250 mm.

.4 Apply felts with suitable equipment. Lay felts so that the flow of water is over or parallel to laps and never against them. Thoroughly embed the full width of each felt in bitumen. Terminating felts and cross-stripping in ends is not acceptable.

.5 Cut felts to fit closely around openings and projections.

.6 Do not walk or run equipment over newly laid felts until bitumen has solidified.

.7 Provide two additional plies of felt on lap joints and drain sumps.

3.6 BITUMINOUS FLASHINGS

.1 Seal roofing system against water penetration where roof terminates and at interruptions and penetrations, protrusions by means of two ply modified bitumen flashings.

.2 Base Sheet: Apply the self-adhesive membrane to all parapets and over areas as shown in accordance with manufacturer's directions, lapping the sheets 75 mm laterally and 150 mm at ends. Extend the base flashing 225 mm onto the roof surface. Carry the base sheet to the top of coping and mechanically secure. Seal all laps and joints with a Leister and roller.

.3 Cap Sheet: Position flashing sheets to ensure any field lap is centred on the flashing sheet and the lap of the base flashing sheet is centred under the cap sheet. Apply the self-adhesive membrane to all parapets and over areas as shown in accordance with manufacturer's directions Unless overlap widths differ between cap and base sheets, make sure joints between the two layers are staggered by at least 305mm. Overlap cap sheet side laps by 75mm (3") and end laps by 152mm (6"). Cut off comers at end laps to be covered by next roll. All overlap surfaces must be granule-free or degranulated. Seal all laps and joints with a Leister and roller.

.4 Where the roof meets the exterior wall, rising above roof, carry bituminous flashings up the wall a minimum of 300 mm and secure along the top edge with a fastening bar.

3.7 EXPANSION AND CONTROL JOINTS

.1 Construct expansion and control joints as shown. Where not shown comply with CRCA recommended details.

3.8 FLOOD COAT AND AGGREGATE

.1 Over completed roof membrane pour hot bitumen at 3 kg/m^2 into which while hot, embed the aggregate at a rate of 20 kg/m^2 covering the roof membrane completely and uniformly.

.2 At the roof perimeters for a minimum width of 2.5 m and at all corners, out minimum distance of 3.5 m, sweep back all loose ballast and apply a second pour bitumen and

aggregate for a total aggregate coverage of 30 kg/m^2.

.3 Do not install aggregate until Consultant has inspected the roof membrane.

.4 At locations indicated provide precast pavers in lieu of aggregate. Place pavers on top of insulation spacers.

3.9 SLEEVE AND VENT PIPE FLASHINGS

.1 Secure the metal cone down to the steel deck. The cone shall extend up past the finished level of the roofing a minimum of 50 mm. Install the roofing vapour retarder so that it envelopes the insulation a minimum of 150 mm. Butt insulation up against the metal cone.

.2 Carry the roof membrane to the penetration and neatly trim.

.3 Set the flashing flanges in a bed of mastic on top of the membrane.

.4 Install 3-ply felt flashing extending beyond the flange 150 mm, 225 mm and 300 mm respectively.

3.10 ROOF DRAINS

.1 Make watertight connection at roof drains.

.2 Flash with 3-ply felt flashing. Extend first ply 150 mm, second ply 225 mm and third ply 300 mm beyond flange.

3.11 PAVERS

.1 Provide pavers where indicated on architectural roof plans and drawings, and where indicated on mechanical details for roof top units

END

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3.11 PAVERS

.3 Provide pavers where indicated on architectural roof plans and drawings, and where indicated on mechanical details for roof top units

END

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 27 00 Multiple Wythe Unit Masonry

.2 Section 06 10 00 Rough Carpentry

.3 Section 07 51 00 Built-Up Bituminous Membrane Roofing

.4 Section 07 92 00 Joint Sealants

.5 Section 08 91 13 Roof Equipment Screen Louvres

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-25a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM D523-25 Standard Test Method for Specular Gloss

.3 ASTM F1667/F1667M-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

.2 CSA Group (CSA)

.1 CSA S136-16 North American Specification for the Design of Cold-Formed Steel Structural Members

.3 Canadian General Services Board (CGSB)

.1 CAN/CGSB 1.108-M Bituminous Solvent Type Paint

.2 CAN/CGSB-37.5 Cutback Asphalt Plastic Cement

.3 CAN/CGSB-51.32 Sheathing, Membrane, Breather Type.

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI Standard Practice for Sheet Steel Cladding.

.2 CSSBI 20M-91 Sheet Steel Cladding for Architectural and Industrial Applications.

.3 CSSBI B16-94 Prefinished Sheet Steel for Building Construction.

.5 Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual.

.6 Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA)

.1 SMACNA Architectural Sheet Metal Manual, latest edition.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Submit sheet metal shop drawings, outlining metal dimensions, profiles, and securement methods (including fastener types, spacing, locations, etc.).

.3 Submit duplicate 300 x 300 mm samples of each type of sheet metal material, colour and finish when requested by the Consultant.

1.5 Design and Performance Requirements

.1 Appearance: neatly and evenly lay out and install components. Exposed fastening devices not permitted.

.2 Effects of Wind: resist positive and negative wind pressures without detrimental effects.

.3 Water Control: prevent passage of water.

.4 Thermal Movement: accommodate expansion and contraction of component parts without buckling, failure of joints, undue stress on fasteners and other detrimental effects.

.5 Compatibility: components shall be compatible with dissimilar metals and materials with which they are in contact or fastened to so as to prevent corrosion, staining and other detrimental effects. If required, treat or separate contact surfaces with inert and non-staining insulation material to achieve compatibility.

1.6 Quality Assurance

.1 Work of this Section shall be performed by a qualified sheet metal contractor with a minimum of 5 years of experience in the type of work required and specified. Submit proof of experience where requested by the Consultant.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Materials shall be handled and stored on the job in such a manner that no damage shall be done to the material or the structures.

.3 Materials showing evidence of improper handling and storage shall be rejected and removed from the site at no additional expense to the Owner.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.9 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of five years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

.2 Submit manufacturer's warrantee that pre-finished materials will not lose film integrity for 25 years and will not chalk or fade for 20 years following date of Substantial Performance.

PART 2 PRODUCTS

2.1 General

.1 Ensure compatibility of all materials in contact with roof membrane.

2.2 Materials

.1 Sheet Metal: galvanized sheet steel, commercial quality to ASTM A653 Grade 'A' with a minimum yield stress of 230 MPA, and a working stress of 144 MPA, to CSA S136. Material shall have Z275 designation zinc coating.

.1 Minimum 24 gauge for sheet metal flashings and minimum 22 gauge for metal starter strips/securement cleats.

.2 Prefinished material shall be colour coated with manufacturer's standard finish system equivalent to Valspar WeatherXL coating system, utilizing silicone modified polyester resin, minimum dry film thickness of 1.0 ± 0.1 mils when tested to ASTM D1005.

.1 Colour for all sheet metal flashing and trim shall be as selected by the Consultant from full range of manufacturer's standard colours.

.2 Up to three colours may be selected.

.3 Continuous hook on strips and metal bellows: 0.65 mm galvanized sheet steel, zinc coating designation ZF275.

.4 Isolation Coating: Alkali resistant exterior bituminous paint to CAN/CGSB 1.108-M.

.5 Plastic Cement: To CAN/CGSB 37.5.

.6 Nails, Bolts, Screws and Other Fastenings: To ASTM F1667 same metal finish as sheet metal. Size of fastenings shall suit the applicable conditions.

.1 Colour matched, hex head screw type fasteners with neoprene (rubber) backed washers shall be utilized where exterior, exposed, fasteners are required to be installed through sheet metal flashings.

.7 Underlay: Bituminous based self-adhered membrane for underlayment membrane below sheet metal flashing layers, where new roof membrane flashings are not present. Ensure membrane is compatible with roof membrane flashing materials.

.8 Cleats: Of same material, and temper as sheet metal, minimum 50 mm wide. 24 gauge,

PART 3 EXECUTION

3.1 General

.1 Install sheet metal work in accordance with CRCA specifications and as detailed.

.2 Use concealed fastenings except where approved before installation.

3.2 Fabrication

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA specifications and as indicated.

.2 Form pieces in 2440 mm maximum lengths.

.3 Hem exposed edges on underside 13 mm. Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating (two coats) to metal surfaces to be in contact with concrete or mortar or dissimilar metals.

.6 Install underlay under sheet metal in accordance with CRCA "FL" series details. Lap joints 100 mm.

.7 All seams shall be of the "slip lock type" that permit adequate movement without resulting in deformation or loosening of metal flashings. Lapped joints or exposed raw edges will not be accepted. Exposed edges shall be "double back" at least 13 mm. At eaves and parapets, metal shall be hooked over continuous starter strips minimum 1 gauge thicker than the metal used for flashing. Secure starter strips at 300 mm on centre or closer as required.

.8 Where metal terminates under fascia boards, secure metal at 610 mm centres using specified fasteners. At curbs to openings or at sleepers, provide locked or standing seams at corners. Solder mitred corners, pop rivet or form standing seams.

.9 Exposed fasteners shall be strictly limited wherever possible, and colour match, hex head screw type fasteners with neoprene (rubber) backed washers be utilized where exterior, exposed, fasteners are required to be installed through sheet metal flashings.

.10 Secure metal flashings in reglets at 610 mm centres and further secure metal to vertical surfaces at locks as required.

.11 All flashings shall be installed in straight lines. Irregular or badly fitted work will not be accepted. Exposed fastenings will only be permitted where concealed fastening is not possible. Provide neoprene washers for exposed fasteners.

.12 Imperfections in metal flashing work such as holes, dents, creases, or oil-canning will not be accepted.

.13 Fabricate and install scuppers as detailed and in accordance with CRCA detailing requirements, and formed out of copper or aluminum metal, with fully soldered/welded seams, in-filled corners, and continuous flange for tie-in to roof membrane layer(s)/flashing layer(s).

3.3 Caulking of Flashings

.1 Sealants shall be as specified in Section 07 92 00 - Joint Sealants.

.2 Caulk all joints in flashing.

.3 Dissimilar metals in contact, or metals in contact with adjacent surfaces shall be separated from one another to prevent corrosion, staining, or electrolysis by use of approved methods and materials.

.4 Do caulking between metal flashing and concrete.

.5 Caulking compound shall be applied in strict accordance with the manufacturer's application instructions. Use proper surface primers where necessary.

.6 Colour of caulking compound shall be the integral colour of the abutting material.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 05 12 23 Structural Steel

.2 Section 05 21 00 Steel Joists

.3 Section 05 31 00 Steel Deck

.4 Section 07 84 00 Firestopping

1.3 References

.1 ASTM International (ASTM)

.1 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.2 ASTM E119-22 Standard Test Methods for Fire Tests of Building Construction and Materials

.3 ASTM E605/E605M-19 Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members

.4 ASTM E736/E736M-19(2023) Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

.5 ASTM E759/E759M-92(2023) Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members

.6 ASTM E760/E760M-92(2020) Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members

.7 ASTM E761/E761M-92(2020) Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members

.8 ASTM E859/E859M-23 Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members

.9 ASTM E937/E937M-93(2020) Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members

.10 ASTM G21-15(2021)e1 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

.2 Underwriters Laboratories Inc. (ULC)

.1 Fire Resistance Directory (Latest Edition)

.2 ULC 101 2014 Standard Methods of Fire Endurance Tests of Building Construction and Materials

.3 ULC 102 2018 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.3 Uniform Building Code (UBC)

.1 UBC Standard No. 7-6 – Thickness and Density Determination for Spray Applied Fireproofing

.2 UBC Standard No. 7-7 – Methods for Calculating Fire Resistance of Steel, Concrete and Wood Construction

.4 Association of the Wall and Ceiling Industry (AWCI)

.1 AWCI Technical Manual 12-A: Standard Practice for the Testing and Inspection of Spray Applied Fire-Resistive Materials.

.2 AWCI Technical Manual 12: Design Selection Utilizing Spray Applied Fire-Resistive Materials.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer's instructions for proper application of aggregate slurry fireproofing.

.3 Fire Testing: Submit evidence that the aggregate slurry fireproofing has been subjected to full-scale UL 263/ASTM E119 fire testing at Underwriters Laboratories Inc., or another accredited laboratory, by the manufacturer.

.4 Submit test results in accordance with ULC 101 for fire endurance and ULC 102 for surface burning characteristics.

.5 Test Data: Independent laboratory test results for fireproofing shall be submitted for the following performance criteria:

.1 Compressive Strength per ASTM E761

.2 Bond Strength per ASTM E736

.3 Deflection per ASTM E759

.4 Bond Impact per ASTM E760

.5 Air Erosion per ASTM E859

.6 Corrosion Resistance per ASTM E937

.7 Abrasion Resistance

.8 Impact Penetration

.9 High Speed Air Erosion per ASTM E859

.10 Surface Burning Characteristics per ASTM E84

.11 Combustibility per ASTM E1354 Cone Calorimeter

.12 Mould Resistance per ASTM G21

.6 Thickness Schedule: Provide schedule indicating material to be used, structural elements to be protected with spray applied fireproofing, hourly rating and material thickness provided and appropriate references.

.7 For assemblies not tested and rated, submit engineered proposals based on related designs using accepted fireproofing design criteria. Criteria must include statement that building structures and structural elements have been reviewed, and are included in the design of the proposed fire proofing. Proposals shall be prepared by an Engineer registered in the province of Ontario.

1.5 Quality Control

.1 Refer to Section 01 45 00- Quality Control.

.2 Cooperate with inspection and testing agency and repair or restore all areas of fireproofing removed by the agency for laboratory analysis.

.3 Testing will be in accordance with AWCI Publication: Inspection Procedure for Field Applied Sprayed Fire Protection Materials and ASTM E605

1.6 Quality Assurance

.1 Fireproofing work shall be performed by a firm acceptable to the aggregate slurry fireproofing material manufacturer.

.2 Products, execution, and fireproofing thicknesses shall conform to the applicable code requirements for the required fire-resistance ratings.

.3 Contractor, fireproofing subcontractor and independent testing laboratory shall attend a pre-installation conference to review the substrates for acceptability, method of application, applied thicknesses, inspection procedures and other issues.

.4 Submit evidence that the aggregate slurry fireproofing has been tested per ASTM E119 by Underwriters Laboratories Inc or another accredited testing laboratory. Include evidence that the fire testing was sponsored by the manufacturer and that the material tested was produced at the manufacturer's facility under the supervision of laboratory personnel.

.5 Mock-up

.1 Apply fireproofing to approximately 5 square metres of surface to be treated, including deck and steel structure.

.2 Allow 24 hours for inspection of mock-up by Testing Agency and Consultant before proceeding with fireproofing work.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Deliver materials in original unopened packages, fully identified as to manufacturer, brand or other identifying data and bearing the proper independent testing laboratory labels for Surface Burning Characteristic and Fire Resistance Classification.

.4 Store material off the ground, under cover, and in a dry location until ready for use. All bags that have been exposed to water before use shall be found unsuitable and discarded. Stock of material is to be rotated and used prior to its expiration date.

1.8 Protection

.1 Ensure the work area is adequately ventilated, in compliance with manufacturer's requirements.

.2 Ensure continuous and proper ventilation of the work area, through a fresh air intake and the extraction of foul air, during the course of the application process and for 24 hours thereafter.

.3 Install temporary partitions in order to prevent any overspray outside of the work area from the sprayed-on insulation material.

.4 Protect all adjacent surfaces and equipment against any damage that may be caused by dispersion and overspray of insulation material beyond prescribed limits.

.5 Ensure all structures are well protected, in accordance with the manufacturer's recommendations.

.6 Clean equipment in areas designated for this purpose.

1.9 Project Conditions

.1 Ensure all concrete and masonry materials are cured.

.2 A minimum air and substrate temperature of 4 °C shall be present before application of spray applied fireproofing. Maintain a minimum air and substrate temperature of 4 °C during and for 24 hours after application of the fireproofing. Provide enclosures with heat to maintain temperature.

.3 Provide ventilation to achieve a minimum total fresh air exchange rate of 4 times per hour until the material is substantially dry.

1.10 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.11 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of two years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Systems

.1 Cementitious fireproofing shall be aggregate slurry mixture Monokote MK-6/HY or MK-10HB as manufactured by GCP Applied Technologies Inc.

.2 ULC labelled and listed cementitious fireproofing, asbestos free, qualified for use in specified standards as manufactured by one of the following is acceptable subject to submission and review of proposed materials, technical data and application procedures:

.1 Cafco Industries Inc./Isolatek

.2 A/D Fire Protection Systems

2.2 Materials

.1 Fireproofing material shall meet the following physical performance standards:

.1 Dry Density: The field density shall be measured in accordance with ASTM Standard E605. Minimum average density shall be that required by the manufacturer, or as

listed in the UL Fire Resistance Directory for each rating indicated, or as required by the authority having jurisdiction, or a minimum average 240 kg/m^3 whichever is greater.

.2 Deflection: Material shall not crack or delaminate from the surface to which it is applied when tested in accordance with ASTM E759.

.3 Bond Impact: Material subject to impact tests in accordance with ASTM E760 shall not crack or delaminate from the surface to which it is applied.

.4 Bond Strength: Fireproofing, when tested in accordance with ASTM E736, shall have a minimum average bond strength of 9.6 kN/m2 and a minimum individual bond strength of 7.2 kN/m2.

.5 Air Erosion: Maximum allowable total weight loss of the fireproofing material shall be 0.00 g/m2 when tested in accordance with ASTM E859. Sample surface shall be “as applied” (not pre-purged) and the total reported weight loss shall be the total weight loss over a 24 hour period from the beginning of the test.

.6 High Speed Air Erosion: Materials to be used in plenums or ducts shall exhibit no continued erosion after 4 hours at an air speed of 12.7 m/s when tested per ASTM E859.

.7 Compressive Strength: The fireproofing shall not deform more than 10% when subjected to compressive forces of 71 kPa when tested in accordance with ASTM E761.

.8 Abrasion Resistance: No more than 15 cm3 shall be abraded or removed from the fireproofing substrate when tested in accordance with the test methods developed by the City of San Francisco, Bureau of Building Inspection.

.9 Impact Penetration: The fireproofing material shall not show a loss of more than 6 cm3 when subjected to impact penetration tests in accordance with the test methods developed by the City of San Francisco, Bureau of Building Inspection.

.10 Surface Burning Characteristics: Material shall exhibit the following surface burning characteristics when tested in accordance with ASTM E84:

.1 Flame Spread 0

.2 Smoke Development 0

.11 Corrosion Resistance: Fireproofing applied to steel shall be tested in accordance with ASTM E937 and shall not promote corrosion of steel.

.12 Resistance to Mould: The fireproofing material shall be formulated with a mould inhibitor. Fireproofing material shall be tested in accordance with ASTM G21 and shall show resistance to mould growth for a period of 28 days for general use.

.13 Combustibility: Material shall have a maximum total heat release of 20 MJ/m2 and a maximum 125 kw/m22 peak rate of heat release 600 seconds after insertion when tested in accordance with ASTM E1354 at a radiant heat flux of 75 kw/m^2 with the use of electric spark ignition. The sample shall be tested in the horizontal orientation.

.14 Fire Resistance Classification: The spray applied fireproofing material shall have been tested and reported by Underwriters Laboratories of Canada, or another accredited laboratory, in accordance with the procedures of ANSI/ASTM E119 and shall be listed in the Underwriters Laboratories Fire Resistance Directory.

.2 Mixing water shall be clean, fresh, potable and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material. Provide water with sufficient pressure and volume to meet the fireproofing application schedule.

2.3 Accessories

.1 Provide accessories to comply with manufacturer's recommendations and to meet fire resistance design and code requirements. Such accessories include, but are not limited to, any required or optional items such as bonding agents, mechanical attachments; application aids such as metal lath, scrim, or netting; and accelerator.

PART 3 EXECUTION

3.1 Inspection

.1 All surfaces to receive spray applied fireproofing shall be provided free of oil, grease, loose mill scale, dirt or other foreign substances which may impair proper adhesion of the fireproofing to the substrate. Where necessary, cleaning or other corrections of surfaces to receive fireproofing shall be the responsibility of the supplier of the incompatible surface.

.2 Application of the fireproofing shall not begin until the contractor, applicator and fireproofing testing laboratory (inspector) have examined surfaces to receive fireproofing and determined that the surfaces are acceptable to receive the fireproofing material.

3.2 Preparation

.1 Prior to application of the fireproofing material, a bonding agent, approved by the fireproofing material manufacturer, shall be applied to all substrates to receive fireproofing.

.2 Other trades shall install clips, hangers, support sleeves and other attachments required to penetrate the fireproofing, prior to application of the fireproofing materials.

.3 Other trades shall not install ducts, piping, equipment or other suspended items until the fireproofing is complete.

3.3 Application

.1 Clean all structural steel, joists, and metal deck to remove all loose scale or oily coatings, in accordance with manufacturer's recommendations. Remove existing coatings, paint, etc. if necessary to satisfy design criteria for fireproof assemblies.

.2 Apply bonding adhesive or primer to substrate if recommended by manufacturer.

.3 Apply fireproofing over substrates, building up to required thickness with as many passes or stages necessary to provide monolithic blanket of uniform density and texture. Total thickness shall be in accordance with submitted and approved designs.

.4 At ducts, pipes and similar items, passing through fire rated assemblies and structural members, extend fireproofing 150 mm on either side along the penetrating item.

3.4 Tests and Inspections

.1 Installed assembly will be tested and inspected for conformance with specifications by an independent inspection and testing company retained and paid for by the Owner.

3.5 Patching

.1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before Substantial Performance.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 22 00 Concrete Unit Masonry

.2 Section 05 31 00 Steel Deck

.3 Section 07 81 16 Cementitious Fireproofing

.4 Section 07 92 00 Joint Sealants

.5 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)

.1 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.2 ASTM E119-20 Standard Test Methods for Fire Tests of Building Construction and Materials

.3 ASTM E136-19a Standard Test Method for Behavior of Material in a Vertical Tube Furnace at 750° C

.4 ASTM E814-13a (2017) Standard Test Method for Fire Tests of Penetration Firestop Systems

.5 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems

.6 ASTM E2307-20 Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus

.2 Underwriter's Laboratories of Canada (ULC)

.1 ULC 101-2014 Standard Methods of Fire Endurance Tests of Building Construction and Materials

.2 ULC 102.2-2018 Method of Test for Surface Burning Characteristics of Flooring,

Floor Coverings, and Miscellaneous Materials and Assemblies

.3 ULC 115-2018 Standard Method of Fire Tests of Firestop Systems

.3 National Fire Protection Association (NFPA)

.1 NFPA 252 Standard Methods of Fire Test and Door Assemblies

.4 South Coast Air Quality Management District (SCAQMD) California State

.1 SCAQMD Rule 1168-03: Adhesives and Sealants.

.5 Ontario Building Code

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings: Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

.4 Samples: Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: in accordance with ULC 101 for fire endurance and ULC 102 for surface burning characteristics.

.2 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.5 Definitions

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including

electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

1.6 Quality Assurance

.1 One installer shall install all firestopping on the project. Each trade shall not firestop their own service penetrations. Installer shall be certified by fire stopping manufacturer.

.2 Qualifications:

.1 Qualified Installer: specializing in fire stopping installations with 5 years documented experience approved and trained by manufacturer.

.3 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Consultant to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.4 Site Meetings:

.1 As part of Manufacturer's Services described in 3.5- Field Quality Control, schedule site visits, to review Work, at stages listed.

.2 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.

.3 Twice during progress of Work at 25% and 60% complete.

.4 Upon completion of Work, after cleaning is carried out.

.5 Single Source Responsibility: Obtain through-penetration fire-stop systems for each kind of penetration and construction condition indicated from a single manufacturer.

.5 Field-Constructed Mockup: Prior to installing fire-stopping, erect mockups for each different through-penetration fire-stop system indicated to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.

.1 Locate mockups on site in locations indicated or, if not indicated, as directed by Consultant.

.2 Notify Consultant one week in advance of the dates and times when mockups will be erected.

.3 Obtain Consultant's acceptance of mockups before start of final unit of Work.

.4 Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.

.5 Accepted mockups in an undisturbed condition at time of Substantial Performance may become part of completed unit of Work.

1.7 Sustainable Requirements

.1 Materials shall be Low VOC type conforming to SCAQMD Rule 1168-03. Maximum VOC level of firestopping materials shall be 250 g/l.

1.8 Project Conditions

.1 Environmental Conditions: Do not install fire-stopping when ambient or substrate temperatures are outside limits permitted by fire-stopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

.2 Ventilation: Ventilate fire-stopping per fire-stopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.9 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.4 Storage and Protection:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.10 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 All fire stopping shall consist of ULC listed firestop system.

.2 Applications: Provide fire-stopping systems composed of materials specified in this Section that comply with system performance and other requirements.

.3 General: Provide fire-stopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

.4 All firestopping material shall be:

.1 From one manufacturer;

.2 Intumescent where an appropriate system exists.

.5 Fire stopping and smoke seal systems: ULC listed in accordance with ULC 115.

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of ULC 115 and not to exceed opening sizes for which they are intended.

.6 Service penetration assemblies: ULC listed systems tested to ULC 115.

.7 Service penetration fire stop components: ULC listed and certified by test laboratory to ULC 115.

.8 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.9 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.10 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.11 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.12 Water: potable, clean and free from injurious amounts of deleterious substances.

.13 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.14 F-Rated Through-Penetration Fire-stop Systems: Provide through-penetration fire-stop systems with F ratings indicated, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

.15 T-Rated Through-Penetration Fire-stop Systems: Provide through-penetration fire-stop

systems with T ratings, in addition to F ratings, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupy-able floor areas. T-rated assemblies are required where the following conditions exist:

.1 Where fire-stop systems protect penetrations located outside of wall cavities.

.2 Where fire-stop systems protect penetrations located outside fire-resistive shaft enclosures.

.3 Where fire-stop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.

.4 Where fire-stop systems protect penetrating items larger than a 100 mm diameter nominal pipe or 10,000 mm² in overall cross-sectional area.

.16 Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs. Sealants for vertical joints: non-sagging.

.17 For fire-stopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

.1 For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration fire-stop systems.

.2 For floor penetrations with annular spaces exceeding 100 mm or more in width and exposed to possible loading and traffic, provide fire-stop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

.3 For penetrations involving insulated piping, provide through-penetration fire-stop systems not requiring removal of insulation.

.18 For firestopping exposed to view provide products with flame-spread values of less than 25 and smoke-developed values of less than 450.

.19 Compatibility: Provide fire-stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by fire-stopping manufacturer based on testing and field experience.

.20 Accessories: Provide components for each fire-stopping system that are needed to install fill materials and to comply with "System Performance Requirements". Use only components specified by the fire-stopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance-rated systems. Accessories include but are not limited to the following items:

.1 Permanent forming/damming/backing materials including the following:

.1 Semi-refractory fibre (mineral wool) insulation.

.2 Ceramic fibre.

.3 Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.

.4 Fire-rated formboard.

.5 Joint fillers for joint sealants.

.2 Temporary forming materials.

.3 Substrate primers.

.4 Collars.

.5 Steel sleeves.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications.

3.2 Preparation

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.2 Ensure that substrates and surfaces are clean, dry and frost free.

.3 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.4 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour retarder.

.5 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 Installation

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing and as necessary to maintain fire resistance ratings of floor and wall assemblies.

.2 Provide fire stopping for all disciplines.

.3 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.4 Fill spaces between openings, ducts, pipes and unused sleeves passing through fire separations with firestop material and install firestopping systems in accordance with the appropriate ULC system number for the products and type of penetration.

.5 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.6 Tool or trowel exposed surfaces to neat finish.

.7 Remove excess compound promptly as work progresses and upon completion.

3.4 Sequences of Operation

.1 Proceed only when submittals have been reviewed by Consultant.

.2 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.5 Field Quality Control

.1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 Employ a ULC accredited Designated Responsible Individual (DRI) to inspect and label all fire stop applications on site.

.3 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Article 1.4 - Submittals.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in Article 1.6 - Quality Assurance.

3.6 Commissioning

.1 Employ a ULC accredited Designated Responsible Individual (DRI) to inspect and label all fire stop applications on site. Submit DRI's written reports within 3 days of review, verifying compliance of Work.

.2 Perform a thorough examination of the fire stopping system to determine if the assembly is installed as per its ULC listing.

.3 Allow for destructive testing of installed firestopping. Repair all tested assemblies.

.4 The examination shall take place prior to close-up to confirm assembly components and installation configuration.

.5 Any and all deviations from the ULC listed system shall be considered grounds for rejection and replacement.

3.7 Schedule

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated partitions and walls.

.2 Perimeter of fire-resistance rated partitions.

.3 Intersection of fire-resistance rated partitions.

.4 Joints between exterior wall or curtain wall assemblies and fire rated floor assemblies.

.5 Perimeter voids in exterior wall or curtain wall assemblies at fire rated floor assemblies.

.6 Control and sway joints in fire-resistance rated partitions and walls.

.7 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

.10 All electrical boxes installed in fire rated gypsum board assemblies.

.11 All locations required by the Ontario Building Code.

.12 Any other locations indicated.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 04 22 00 Concrete Unit Masonry

.3 Section 04 27 00 Multiple Wythe Unit Masonry

.4 Section 06 10 00 Rough Carpentry

.5 Section 06 20 00 Finish Carpentry

.6 Section 06 40 00 Architectural Woodwork

.7 Section 07 21 13 Building Insulation

.8 Section 07 27 13 Modified Bituminous Sheet Air Barriers

.9 Section 07 51 00 Built-Up Bituminous Membrane Roofing

.10 Section 07 62 00 Sheet Metal Flashing and Trim

.11 Section 07 84 00 Firestopping

.12 Section 08 11 00 Metal Doors and Frames

.13 Section 08 44 13 Glazed Aluminum Curtain Walls

.14 Section 08 5113 Aluminum Windows

.15 Section 08 92 00 Louvred Equipment Enclosures

.16 Section 08 80 05 Glazing

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C510-16(2022) Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants

.2 ASTM C661-15(2022) Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer

.3 ASTM C679-15(2022) Standard Test Method for Tack-Free Time of Elastomeric Sealants

.4 ASTM C719-22 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

.5 ASTM C793-05(2017) Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants

.6 ASTM C794-18(2022) Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

.7 ASTM C834-17 Standard Specification for Latex Sealants

.8 ASTM C919-22 Standard Practice for Use of Sealants in Acoustical Applications

.9 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants

.10 ASTM C1087-23 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems

.11 ASTM C1183/C1183M-13(2018) Standard Test Method for Extrusion Rate of Elastomeric Sealants

.12 ASTM C1193-16 Standard Guide for Use of Joint Sealants

.13 ASTM C1246-17(2022) Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants After Cure

.14 ASTM C1247-20 Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids

.15 ASTM C1248-22 Standard Test Method for Staining of Porous Substrate by Joint Sealants

.16 ASTM C1311-22 Standard Specification for Solvent Release Sealants

.17 ASTM C1330-23 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.18 ASTM D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

.19 ASTM D2203-01(2023) Standard Test Method for Staining from Sealants

.20 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.21 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit product data for all sealant materials and accessories including:

.1 Preparation instructions and recommendations.

.2 Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.

.3 Joint Sealant Schedule: Indicate joint sealant location, joint sealant type, manufacturer and product name, and colour, for each application. Utilize joint sealant designations included in this Section.

.4 Samples:

.1 Samples for Colour Selection: For each joint sealant type.

.5 Greenguard Certificates: For each sealant and accessory product specified to meet volatile organic emissions standards of the Greenguard Children and Schools Certification.

1.5 Quality Assurance

.1 Installer Qualifications: Company with minimum of three years of experience specializing in work of this section, employing applicators trained for application of joint sealants required for this project, with record of successful completion of projects of similar scope, and approved by manufacturer.

.2 Single Source Responsibility: Provide joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.

.3 Caulking work shall be carried out in strict accordance with manufacturer's printed directions.

.4 Adhesion: Use ASTM C719 and ASTM C794 to determine requirements for joint preparation, including cleaning and priming.

.5 Compatibility: Use ASTM C1087 to determine materials forming joints and adjacent materials do not adversely affect sealant materials and do not affect sealant colour

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.7 Project Conditions

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Ventilate area of work by use of approved portable supply and exhaust fans

1.8 Scheduling

.1 Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.

.2 Ensure sealants are cured before covering with other materials.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Manufacturer

.1 Basis-of-Design Products: Provide joint sealant products manufactured by Tremco, Inc., Commercial Sealants and Waterproofing, 220 Wicksteed Avenue, Toronto, www.tremcosealants.com, or comparable products of other manufacturer approved by Consultant.

2.2 Materials – General

.1 VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24):

.1 Architectural Sealants: 250 g/L.

.2 Sealant Primers for Nonporous Substrates: 250 g/L.

.3 Sealant Primers for Porous Substrates: 775 g/L.

.2 Low-Emitting Sealants for Interior Applications: Provide sealants and sealant primers complying with the 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."

.3 Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with adjacent materials, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.

.4 Joint Sealant Standard: Comply with ASTM C920 and other specified requirements for each joint sealant.

2.3 Silicone Joint Sealants

.1 SJS#1: Single-Component, Nonsag, Non-Staining, Moisture-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use NT; SWRI validated.

.1 Basis of Design Product: Tremco Spectrem 1.

.2 Volatile Organic Compound (VOC) Content: 1 g/L maximum.

.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.

.4 Staining, ASTM C1248: None on concrete, marble, granite, limestone, and brick.

.5 Colour: As selected by Consultant from manufacturer's standard line.

.2 SJS#2: Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.

.1 Basis of Design Product: Tremco Tremsil 200 Sanitary.

.2 Volatile Organic Compound (VOC) Content: 1 g/L maximum.

.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.

.4 Colour: White and Clear.

2.4 Urethane Joint Sealants

.1 UJS#1: Single-Component, Nonsag, Moisture-Cure, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT; Greenguard certified.

.1 Basis of Design Product: Tremco Dymonic 100.

.2 Volatile Organic Compound (VOC) Content: 40 g/L maximum.

.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.

.4 Tensile Strength ASTM D412: 350 to 450 psi

.5 Percent Elongation ASTM D412: 800 to 900%

.6 Modulus at 100% ASTM D412: 75 to 85 psi

.7 Tear Strength ASTM D412: 65 to 75 psi

.8 Smoke Development ASTM E84: 5

.9 Colour: As selected by Consultant from manufacturer's standard line.

.2 UJS#2: Single-Component, Nonsag, Moisture-Cure, Polyurethane Hybrid Joint Sealant: ASTM C920, Type S, Grade NS, Class 35, Use NT; Greenguard certified.

.1 Basis of Design Product: Tremco Dymonic FC.

.2 Extrusion Rate ASTM C1183: 93.1 mL/min

.3 Weight Loss ASTM C1246: Pass

.4 Tack Free Time ASTM C679: 3 to 4 hours.

.5 Volatile Organic Compound (VOC) Content: 10 g/L maximum.

.6 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.

.7 Colour: As selected by Consultant from manufacturer's standard line.

.3 UJS#3: Immersible, Single-Component, Pourable, Traffic Grade Polyurethane Joint Sealant: ASTM C920, Type S, Grade P, Class 50, Use T and I.

.1 Basis of Design Product: Tremco Vulkem 45 SSL.

.2 Volatile Organic Compound (VOC) Content: 110 g/L maximum.

.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.

.4 Colour: As selected by Consultant from manufacturer's standard line.

2.5 Latex Joint Sealants

.1 LJS#1: Latex Joint Sealant: Siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

.1 Basis of Design Product: Tremco Tremflex 834.

.2 Volatile Organic Compound (VOC) Content: 35 g/L maximum.

.3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.

.4 Colour: White, paintable.

2.6 Solvent Release-Curing Sealants

.1 BJS#1: Butyl-Rubber-Based Joint Sealant: ASTM C1311.

.1 Basis of Design Product: Tremco Tremco Butyl Sealant.

.2 Volatile Organic Compound (VOC) Content: 250 g/L maximum.

.3 Colour: As selected by Consultant from manufacturer's standard colours.

2.7 Acoustical Sealants

.1 AJS#1: Acoustical/Curtainwall Sealant: Single-component, non-hardening, non-sag, paintable synthetic rubber-tested to reduce airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing of similar assemblies according to ASTM E90.

.1 Basis of Design Product: Tremco Acoustical/Curtainwall Sealant.

.2 Volatile Organic Compound (VOC) Content: 160 g/L maximum.

.3 Colour: White, paintable.

2.8 Joint Sealant Accessories

.1 Cylindrical Sealant Backing: ASTM C1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.

.2 Bond Breaker Tape: Polymer tape compatible with joint sealant and adjacent materials and recommended by sealant manufacturer.

.3 Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

.4 Cleaners: Chemical cleaners acceptable to joint sealant manufacturer.

.5 Masking tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 EXECUTION

3.1 Examination

.1 Examine joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Verify joint surfaces are clean, dry, and adequately cured. Proceed with joint sealant work once conditions meet sealant manufacturer's written recommendations.

3.2 Preparation

.1 Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer. Comply with ASTM C1193.

.1 Remove curing compounds, laitance, form-release agents, dust, and other contaminants.

.2 Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.

.3 Protect elements surrounding the Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.

3.3 Application

.1 Sealant and Primer Installation Standard: Comply with ASTM C1193 and manufacturer's written instructions.

.2 Joint Backing: Select joint backing materials recommended by sealant manufacturer as compatible with sealant and adjacent materials. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.

.1 Install joint backing to maintain the following joint ratios:

.1 Joints up to 13 mm wide: 1:1 width to depth ratio.

.2 Joints greater than 13 mm wide: 2:1 width to depth ratio; maximum 13 mm joint depth.

.2 Install bond breaker tape over substrates when sealant backings are not used.

.3 Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

.4 Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

.5 Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.

.1 Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.

.2 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

.3 Tool exposed joint surface concave using tooling agents approved by sealant manufacturer for application.

.6 Installation of Acoustical Sealant: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations on both sides of assemblies with a continuous bead of acoustical sealant. Comply with ASTM C919 and with manufacturer's written recommendations.

3.4 Field Quality Control

.1 Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer's instructions and with ASTM C1193, Method A.

.1 Perform 5 tests for the first 300 m of joint length for each kind of sealant and joint substrate, and one test for each 300 m of joint length thereafter or 1 test per each floor per building elevation, minimum.

.2 For sealant applied between dissimilar materials, test both sides of joint.

.2 Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

.3 Submit report of field adhesion testing to Consultant indicating tests, locations, dates, results, and remedial actions taken.

3.5 Exterior Joint Sealant Schedule

.1 Exterior concealed transition joints in air barrier.

.1 UJS#1: Single-component non-sag urethane sealant.

.2 Compatibility: Compatible with air barrier components specified in Section 07 27 13.

.2 Exterior construction joints in cast-in-place concrete.

.1 UJS#1: Single-component non-sag urethane sealant.

.3 Exterior movement joints in brick masonry.

.1 UJS#1: Single-component non-sag urethane sealant.

.4 Exterior joints between different materials listed above.

.1 UJS#1: Single-component non-sag urethane sealant.

.5 Exterior perimeter joints at frames of doors, windows, storefront frames, curtain wall frames, and louvers.

.1 SJS#1: Single-component neutral-curing non-staining silicone sealant.

.6 Exterior joints within aluminum curtain walls, and window systems:

.1 SJS#1: Single-component neutral-curing non-staining silicone sealant.

.7 Exterior joints within structural glazing, aluminum storefront framing, curtain walls, and window systems:

.1 Refer to Section 08 44 13 and Section 08 51 13.

.8 All other exterior non-traffic joints.

.1 UJS#1: Single-component non-sag urethane sealant.

.9 Exterior horizontal traffic and traffic isolation joints:

.1 UJS# 3: Single-component pourable urethane sealant.

3.6 Interior Joint Sealant Schedule

.1 Interior vertical movement joints in interior concrete and unit masonry.

.1 UJS#1: Single-component non-sag urethane sealant.

.2 Interior movement joints in interior unit masonry.

.1 UJS#1: Single-component non-sag urethane sealant.

.3 Interior perimeter joints of exterior aluminum frames.

.1 UJS#1: Single-component non-sag urethane sealant.

.4 Interior perimeter joints of interior frames.

.1 UJS#2: Single-component non-sag urethane sealant.

.5 Interior sanitary joints between plumbing fixtures and casework and adjacent walls, floors, and counters.

.1 SJS#2: Mildew-Resistant, Single-Component, nonsag, acid-curing silicone joint sealant.

.6 Interior traffic joints in floor and between floor and wall construction.

.1 UJS#3: Single-component pourable urethane sealant.

.7 Interior non-moving joints between interior painted surfaces and adjacent materials.

.1 LJS#1: Siliconized acrylic latex

.2 Joint-Sealant Colour: Paintable.

.8 Interior concealed sealants at thresholds and sills.

.1 BJS#1: Butyl-rubber-based joint sealant.

.9 Interior exposed and non-exposed acoustical applications.

.1 AJS#1: Acoustical joint sealant.

3.7 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.

.1 Remove masking tape immediately after tooling joint without disturbing seal.

.2 Remove excess sealant from surfaces while still uncured.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 04 27 00 Multiple Wythe Unit Masonry

.3 Section 04 22 00 Concrete Unit Masonry

.4 Section 07 92 00 Joint Sealants

.5 Section 09 30 13 Ceramic Tiling

1.3 References

.1 ASTM International (ASTM)

.1 ASTM B209-14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.2 ASTM B221-14 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.3 ASTM D882-26 Standard Test Method for Tensile Properties of Thin Plastic Sheeting

.4 ASTM D2000-18 Standard Classification System for Rubber Products in Automotive Applications

.5 ASTM D2852-16 Standard Specification for Styrene-Rubber (SR) Plastic Drain Pipe and Fittings

.6 ASTM D4833/D4833M-07(2026) Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

.7 ASTM E1399/E1399M-97(2022) Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems

.8 ASTM E1745-17(2023) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

.2 Aluminum Association (AA).

.1 DAF-45 Designation System for Aluminum Finishes.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit detailed shop drawings of each component specified showing fabrication and installation requirements. Indicate lengths, fasteners, accessories, anchors, seals, butt joints and locations, finishes and profiles required for each condition.

.3 Submit manufacturer's specifications and technical data, including installation instructions, and, as required, catalog cuts and templates to explain construction and to provide for incorporation of the product into the project.

.4 Submit 150 mm long samples of each type and finish of expansion joint cover assemblies.

1.5 Definitions

.1 Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

.2 Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

.3 Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint.

.4 Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.6 Design Requirements

.1 Joint movement: design to permit unrestricted lateral movement of up to +/-50% of joint width without disengagement of cover.

.2 Allowable load on floor joint cover plate shall be 4.8 kN/m^2 uniform load and 136 kilogram concentrated load with maximum 82.7 mN/m^2 stress (6063-T5 aluminum extrusions) at full open position. Deflection shall be 3 mm at neutral position.

.3 Centering Bars shall have nylon spheres which fully engage in the base members' tracks.

.4 Design exterior expansion joint cover assemblies to accommodate joint movements within service temperature range of -35 ° C to 65 ° C.

1.7 Quality Assurance

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.8 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Aluminum: ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 6061-T6, sheet and plate.

.2 Finish: Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

.3 Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

.4 Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

.5 Moisture Barrier: 7-ply laminate reinforced Polyethylene.

.6 Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible vapour seals and filler materials, drain tubes, adhesive and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 Architectural Joint Systems- General

.1 General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

.2 Design architectural joint systems for the following size and movement characteristics:

.1 Nominal Joint Width: As indicated on Drawings

.2 Maximum Joint Width: As indicated on Drawings

.3 Minimum Joint Width: As indicated on Drawings

.4 Lateral Shear Movement Capability: +50%

2.3 Architectural Joint Systems for Building Exteriors

.1 Architectural Joint Systems for Exterior Walls:

.1 Basis-of-Design Product: Construction Specialties, Inc. ASM-X Series

.2 Type: Snap-on cover.

.1 Exposed Metal: Aluminum.

.1 Finish: Class II, clear anodic.

.2 Secondary Seal: 7-ply laminate reinforced Polyethylene ASTM E1745. Gray.

.3 Duroflex Gasket Single Durometer – 80 Shore A, ASTM D2000. Colour: Black

.4 Tensile Strength: 275 lbs., ASTM D882

.5 Puncture Strength: 79 lbs., ASTM D4833

.6 PPT Resistance: 62 lbs., ASTM D2582

2.4 Architectural Joint Systems for Building Interiors

.1 Architectural Joint Systems for Interior Floors:

.1 Basis-of-Design Product: Construction Specialties, Inc. GFS Series.

.1 Meets ASTM E1399 Applications.

.2 Extruded aluminum frame. Clear Anodized.

.3 Extruded flexible gasket.

.4 Filer: Black

.5 Standard loading up to 500 lbs

.6 Fire rated.

.2 Architectural Joint Systems for Interior Ceilings:

.1 Basis-of-Design Product: Construction Specialties, Inc. FCF Series.

.1 Meets ASTM E1399 Applications

.2 Extruded aluminum frame. Clear Anodized.

.3 Extruded flexible gasket.

.4 Filer: Black

.3 Architectural Joint Systems for Interior Walls:

.1 Basis-of-Design Product: Construction Specialties, Inc. ASM-X Series

.2 Type: Snap-on cover.

.1 Exposed Metal: Aluminum.

.1 Finish: Class II, clear anodic.

.2 Secondary Seal: 7-ply laminate reinforced Polyethylene ASTM E1745. Gray.

.3 Duroflex Gasket Single Durometer – 80 Shore A, ASTM D2000. Colour: Black

.4 Tensile Strength: 275 lbs., ASTM D882

.5 Puncture Strength: 79 lbs., ASTM D4833

.6 PPT Resistance: 62 lbs., ASTM D2582

2.5 Fabrication

.1 Fabricate components in longest practical lengths.

.2 Prefabricate transition pieces and corner fittings as required.

.3 Miter and weld joints as applicable.

.4 Resilient filler strip shall be key-locked or bonded to aluminum retainers.

.5 Provide necessary and related parts, devices, water barrier, anchors, form clips, and other items required for water-resistant installations.

.6 Provide corners, tees, transitions, curb risers, etc. assembled with connection mitered and secured to ensure proper fit and alignment as applicable.

.7 Cover plates shall have serrated exposed surface.

.8 Shop assemble components and package with anchors and fittings. Provide components in single lengths where possible; minimize site splicing.

2.6 Finishes

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Protect mechanical finishes on exposed surfaces from damage by applying a strippable,

temporary protective covering before shipping.

.3 Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Comply with manufacturer's instructions and recommendations for all phases of work, including preparation of substrate, applying materials, and protection of installed units.

3.2 Examination

.1 Make a thorough examination of all surfaces receiving the work of this Section and before starting the installation, notify the Consultant, in writing, of any defect which would affect the satisfactory completion of the work of this section.

3.3 Preparation

.1 Examine the Contract Drawings and specifications in order to insure the completeness of the work required under this Section.

.2 Verify all measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work of this Section with the work of related trades, with particular attention given to the installation of items embedded in concrete and masonry so as not to delay job progress.

.3 Provide all templates as required to related trade for location of all support and anchorage items.

3.4 Installation

.1 Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

.2 Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.

.1 Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

.2 Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Consultant where discrepancies occur that will affect proper joint installation and performance.

.3 Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.

.4 Locate in continuous contact with adjacent surfaces.

.5 Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.

.6 Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.

.7 Locate anchors at interval recommended by manufacturer, but not less than 76 mm from each end and not more than 610 mm o.c.

.3 Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

.1 Provide in continuous lengths for straight sections.

.2 Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.

.3 Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

.4 Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.

.5 Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

.6 Water Barrier: Provide water barrier at exterior joints. Provide drainage fittings.

3.5 Adjusting

.1 Adjust joint cover to freely accommodate joint movement.

3.6 Protection

.1 Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

.2 Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Performance of the Work.

3.7 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 04 22 00 Concrete Unit Masonry

.2 Section 04 27 00 Multiple Wythe Unit Masonry

.3 Section 06 10 00 Rough Carpentry

.4 Section 07 92 00 Joint Sealants

.5 Section 08 14 16 Flush Wood Doors

.6 Section 08 71 10 Door Hardware

.7 Section 08 80 05 Glazing

.8 Section 08 88 13 Fire Resistant Glazing

.9 Section 09 21 16 Gypsum Board

.10 Section 09 91 13 Exterior Painting

.11 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM C177-19e1 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

.3 ASTM C518-21 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.4 ASTM C553-13(2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.5 ASTM C591-22 Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

.6 ASTM C1289-22a Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

.7 ASTM D6386-22 Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

.8 ASTM D7396-14(2020) Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting

.9 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.10 ASTM E330/E330M-14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 Canadian General Standards Board (CGSB)

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

.3 CSA Group (CSA)

.1 CSA-G40.20-13/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-18 Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000

.2 CSDMA Recommended Specifications for Commercial Steel Doors and Frames, 2006.

.3 CSDMA Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.5 Underwriters Laboratories Canada (ULC)

.1 CAN/ULC-S104:2015 (R2025) Standard Method for Fire Tests of Door Assemblies

.2 CAN/ULC 105:2016 (R2026) Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104

.3 CAN/ULC 106:2015 (R2025) Standard Method for Fire Tests of Window and Glass Block Assemblies

.4 CAN/ULC-S701.1:2025 Standard for Thermal Insulation, Polystyrene, Boards

.5 CAN/ULC-S702.1:2021 Standard for Thermal Insulation, Mineral Fibre, for Buildings

.6 CAN/ULC 704.1:2026 Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced

.6 Underwriters Laboratories (UL)

.1 UL10B Fire Tests of Door Assemblies

.2 UL10C Standard for Positive Pressure Fire Tests of Door Assemblies

.7 National Fire Protection Association (NFPA)

.1 NFPA 80-22 Standard for Fire Doors and Other Opening Protectives

.2 NFPA 252-2017 Fire Tests of Door Assemblies

.8 American National Standards Institute (ANSI)

.1 ANSI 250.4-2018 Test Procedure and Acceptance Criteria for — Physical Endurance for Steel Doors, Frames and Frame Anchors

.2 ANSI 250.10-2011 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Provide shop drawings

.1 Indicate each type of door, frame, steel, construction and core.

.2 Indicate fire ratings.

.3 Indicate material thicknesses, mortises, reinforcements, anchorages, location of exposed fasteners, openings, arrangement of hardware, and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 System Description

.1 Design exterior frame assembly to accommodate expansion and contraction when subjected to minimum and maximum surface temperature of -35° C to 35° C.

1.6 Defining Opening Sizes

.1 Width - Widths of openings shall be measured from inside to inside of frame jamb rabbets.

(Referred to as "frame rabbet width" or "nominal door width")

.2 Height - Heights of openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame. (Referred to as "frame rabbet height" or "nominal door height")

.3 Door Sizes - Doors shall be sized so as to fit the above openings and allow a 3 mm nominal clearance at jambs and head of frame. A clearance of 13 mm maximum shall be allowed between the bottom of the door and the finished floor (exclusive of floor coverings).

.4 Tolerances - Doors and frame product shall be manufactured and installed in accordance with the CSDMA's, "Recommended Dimensional Standards for Commercial Steel Doors and Frames".

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

1.8 Requirements of Regulatory Agencies

.1 Steel fire rated doors and frames: labeled and installed by an organization accredited by Standards Council of Canada in conformance with ULC 104 or NFPA 252 for ratings specified or indicated.

.2 Provide fire labeled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with ULC 104 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.9 Testing and Performance

.1 Fire labeled products shall be provided for those openings requiring fire protection ratings as scheduled on the drawings. Products shall be tested in strict conformance with ULC 104 and listed by Underwriters Laboratory of Canada Ltd. or Warnock Hersey under an active Factory Inspection Program.

.2 Product quality shall meet the standards established by the Canadian Steel Door Manufacturer’s Association.

.3 Door construction shall meet acceptance criteria of ANSI A250.10 and shall be certified as meeting Level A (1,000,000 cycles) and Twist Test Acceptance Criteria deflection not to exceed 6.4 mm/13.6 kg force, total deflection at 136.1 kg force not to exceed 64 mm and permanent deflection not to exceed 3.0 mm when tested in strict conformance with ANSI A250.4. Test shall be conducted by an independent nationally recognized accredited

laboratory.

.4 Core materials for insulated doors shall attain a thermal resistance rating of RSI 2.17 when tested in accordance with ASTM C177 or ASTM C518.

1.10 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Acceptable Materials

.1 Steel doors and frame product manufactured in accordance with this Specification by CSDMA members, are eligible for use on this project.

.2 Steel: Commercial grade steel to ASTM A653, CS, Type B, Coating Designation ZF75 (A25) minimum. Minimum steel thicknesses shall be in accordance with Appendix 1 of the CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products unless noted otherwise.

.3 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653, ZF75.

.4 Door Core Materials

.1 Interior Doors: Structural small cell, 24.5mm maximum kraft paper ‘honeycomb’. Weight 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness. ULC approved.

.2 Exterior Doors: Polyisocyanurate: Rigid, modified polyisocyanurate, closed cell board. Density; 32 kg/m3 minimum, thermal values; RSI 2.17 minimum, in accordance with ASTM C591 (un-faced) or ASTM C1289 (faced).

.5 Primers:

.1 Touch-up prime CAN/CGSB-1.181, organic zinc rich, rust inhibitive.

.1 Maximum VOC limit 50 g/L to GC-03.

2.2 Adhesives

.1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.

.2 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.3 Polyisocyanurate: heat resistant, epoxy resin based, low viscosity, contact cement.

.4 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, low VOC sealant/adhesive or U.L.C. approved equivalent.

2.3 Accessories

.1 Glazing Stops: Minimum 0.9 mm base thickness sheet steel with wipe zinc finish to ASTM A525. Fasteners to be #6 x 32 mm cadmium plated oval head scrulox self-drilling type screws. Tamper proof screws.

.2 Exterior top caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Door silencers: single stud rubber/neoprene type.

.4 Fiberglass: to ULC 702, loose batt type, minimum density of 24 kg/m³.

.5 Metallic paste filler: to manufacturer's standard.

.6 Sealant: As specified in Section 07 92 00.

2.4 Fabrication - Frame Products

.1 General

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frame product shall be 1.60 mm welded type construction, thermally broken.

.4 Interior frame product shall be 1.60 mm. Interior frames, transoms, sidelights and window assemblies shall be welded type construction.

.5 Blank, reinforce, drill and tap frames for templated hardware and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.6 Prepare frames to receive electrical conduit for door operators where indicated and required.

.7 Protect mortised cutouts with steel guard boxes.

.8 Provide anchorage appropriate to floor, wall and frame construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb. For rebate opening heights up to and including 1520 mm provide two (2) anchors, and an additional anchor for each additional 760 mm of height or fraction thereof, except as indicated below. Frames in previously placed concrete, masonry or structural steel shall be provided with anchors

located not more than 150 mm from the top and bottom of each jamb, and intermediate anchors at 660 mm on centre maximum. Fasteners for such anchors shall be provided by others.

.9 Minimum reinforcing, anchor and other component thickness shall be in accordance with Table 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".

.10 Each interior door opening shall be prepared for single stud rubber door silencers, three (3) for single door openings, two for double door openings, except on gasketed frame product.

.11 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.12 Fire-rated frame products shall be provided for those openings requiring fire protection as determined and scheduled by the Consultant. Frames, transom and sidelight assemblies shall be listed for conformance with ULC 104. Window assemblies shall be listed for conformance with ULC 106. All fire-rated frame products shall bear the label of and be listed by a nationally recognized testing agency having a factory inspection service. Labeling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify the manufacturer. Fire-rated frame products shall be constructed as listed for labeling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.

.2 Welded Type

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Where frame product is to be installed prior to the adjacent partition, a floor anchor shall be securely attached to the inside of each jamb profile. Each floor anchor shall be provided with two holes for securing to the floor. For conditions that do not permit the use of a floor anchor, an additional wall anchor, located within 150 mm of the base of the jamb, shall be substituted.

.6 Weld in two temporary jamb spreaders per door opening to maintain proper alignment during shipment and handling, which shall not be used for installation.

.7 Glazing stops shall be formed steel channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.8 When required due to site access, when advised by the contractor responsible for coordination or installation, as specified on the drawings or due to shipping limitations, frame product for large openings shall be fabricated in sections as designated on the approved submittal drawings, with splice joints for field assembly and welding by others.

.9 Prior to shipment, mark each frame product with an identification number as shown on the approved submittal drawings.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Manufacturer's nameplates on frames and screens are not permitted

2.5 Fabrication - Doors

.1 General

.1 Interior doors: insulated steel construction with honeycomb core laminated to minimum 1.19 mm nominal thickness steel face sheets under pressure.

.2 Exterior doors: insulated steel construction with polyisocyanurate core laminated to minimum 1.19 mm nominal thickness steel face sheets under pressure.

.3 Voids between vertical stiffeners shall be filled with fiberglass batt type insulation.

.4 Doors: swing type, flush.

.5 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E330.

.2 Longitudinal edges shall be mechanically inter-locked, adhesive assisted. Seams: visible grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.3 Doors shall be mortised, blanked, reinforced, drilled and tapped at the factory for templated hardware and electronic hardware, in accordance with the approved hardware schedule and templates provided by the hardware supplier.

.4 Holes 12.7 mm diameter and larger shall be factory prepared, except mounting and through-bolt holes, which are by others, on site, at time of hardware installation. Holes less than 12.7 mm diameter shall be factory prepared only when required for the function of the

device (for knob, lever, cylinder, thumb or turn pieces) or when these holes over-lap function holes.

.5 Doors shall be reinforced where required, for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware.

.6 Provide top and bottom of doors with inverted, recessed, welded steel channels. Exterior doors shall be provided with rigid PVC top caps.

.7 Minimum reinforcing and component thickness shall be in accordance with Table 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Fire-rated doors shall be provided for those openings requiring fire protection and temperature rise ratings, as indicated. Such products shall be listed for conformance with ULC 104. All fire-rated doors shall bear the label of and be listed by a nationally recognized testing agency having a factory inspection service. Labeling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify the manufacturer. Fire-rated doors shall be constructed as listed for labeling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.

.10 Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.

.11 Manufacturer's nameplates on doors are not permitted.

2.6 Glazing Stops

.1 Glazing stops shall be accurately fitted, butted at corners with removable stops located on push side of door.

.2 Provide tamper proof screws on all doors and screens.

2.7 Finishes

.1 Doors and frames shall wipe coat zinc, ready for painting.

PART 3 EXECUTION

3.1 Manufacturer’s Instructions

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 Installation

.1 Install doors and frames to CSDMA Installation Guide, NAAMM-HMMA 840, Installation Guide for Commercial Steel Doors and Frames.

.2 Fire-rated door and frame product shall be installed in accordance with NFPA-80.

.3 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 10 - Door Hardware. Coordinate with Section 08 71 10 for preparation and installation of automatic door operators.

.4 Adjust operable parts for correct clearances and function.

.5 Install glazing and door silencers.

.6 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows:

.1 Hinge side: 1.0 mm.

.2 Latch side and head: 1.5 mm.

.3 Finished floor and thresholds: 13 mm.

.7 Caulk perimeter of frames. Refer to Section 07 92 00 – Joint Sealants.

3.3 Finish Repairs

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 20 00 Finish Carpentry

.2 Section 08 11 00 Metal Doors and Frames

.3 Section 08 71 10 Door Hardware

.4 Section 08 80 05 Glazing

.5 Section 08 88 13 Fire Resistant Glazing

.6 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)

.1 ASTM D1761-20(2025) Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials

.2 ASTM D5456-26 Standard Specification for Evaluation of Structural Composite Lumber Products

.3 ASTM E90-23 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.4 ASM E413-22 Classification for Rating Sound Insulation

.5 ASTM E1332-22 Standard Classification for Rating Outdoor-Indoor Sound Attenuation

.6 ASTM E2235-04(2020) Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods

.2 CSA Group (CSA)

.1 CSA O115-M1982 (R2001) Hardwood and Decorative Plywood.

.2 CSA O132.2 Series-90 (R1998) Wood Flush Doors

.3 Canadian General Services Board (CGSB)

.1 CAN/CGSB-71.19 Adhesive, Contact, Sprayable

.2 CAN/CGSB-71.20 Adhesive, Contact, Brushable

.4 American National Standards Institute (ANSI)

.1 ANSI A208.1 Standard for Particleboard.

.5 Underwriters Laboratories Canada (ULC)

.1 CAN/ULC-S104:2015 (R2025) Standard Method for Fire Tests of Door Assemblies

.6 National Fire Protection Association (NFPA)

.1 NFPA 80 Standard for Fire Doors and Other Opening Protectives.

.2 NFPA 252 Standard Method of Fire Test for Door Assemblies.

.7 Architectural Woodwork Manufacturers Association of Canada (AWMAC): Quality Standards for Architectural Woodwork

.8 Window and Door Manufacturer's Association (WDMA)

.1 ANSI/WDMA I.S. 1A-21 Interior Architectural Wood Flush Doors

.9 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-06 Architectural Coatings.

.2 SCAQMD Rule 1168-03 Adhesives and Sealants Applications.

.10 Green Seal Environmental Standards

.1 Standard GS-11-97 Architectural Paints.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer's printed product literature, specifications and data sheets for door materials and adhesives.

.3 Submit shop drawings and door schedules.

.1 Indicate door types and sizes, core construction and cutouts.

.4 Submit samples.

.1 Submit one 300 x 300 mm corner sample of each type wood door.

.2 Show door construction, core, glazing detail and faces.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 Quality Assurance

.1 The “Quality Standards” of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), 1991 Edition, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification.

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

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

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

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

.6 Regulatory Requirements: Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.

.7 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.8 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 16 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Wood door delivery, storage and handling shall be in accordance with Part 6, Item 3, of the AWMAC Quality Standards.

.4 Do not deliver wood doors until the building and storage areas are sufficiently dry so that the wood doors will not be damaged by excessive changes in moisture content.

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

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.8 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of two years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Manufacturers

.1 Acceptable Manufacturers: Member in good standing of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) with minimum 5 years of production experience similar to this project, whose qualifications indicate ability to comply with requirements of this Section.

2.2 Materials

.1 All door materials to conform to CSA O132.2.

.2 Doors shall be constructed of solid laminated wood core with 3.0 mm thick Grade A face, book matched, flat cut maple, 50 mm stiles and 76 mm top and bottom rails. Stiles to be No. 3 maple edge.

.3 Core shall consist of low density wood blocks, random lengths with staggered joints. All cores shall be drum sanded both sides. Particleboard cores are not acceptable.

.4 Door thickness: as indicated.

.5 Adhesive: To CSA 0132.2, Type II, water resistant, for interior use.

2.3 Fire Rated Wood Doors

.1 Wood doors: tested in accordance with ULC 104 and NFPA 252 to achieve rating as scheduled.

PART 3 EXECUTION

3.1 Fabrication

.1 Fabricate doors in accordance with CSA 0132.2.

.2 Provide No. 3 vertical edge strips to match face veneer.

.3 Bevel vertical edges of single acting doors 3.0 mm on lock side and 1.6 mm on hinge side.

.4 Prepare doors for hardware.

.5 Fabricate doors with reinforced openings for louvres, door grilles and glazed lites. Provide manufacturer’s standard trim and stops.

.6 Sand and prepare doors to receive clear urethane finish as indicated on the Room Finish and Door Schedules.

3.2 Installation

.1 Unwrap and protect doors in accordance with CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed instructions and CSA-0132.2 Series, Appendix A.

.3 Install labelled fire rated doors to NFPA 80.

.4 Install glazing in accordance with Section 08 80 05 and 08 88 13.

.5 Adjust hardware for correct function.

.6 Doors to receive clear urethane finish as specified in Section 09 91 23.

3.3 Final Adjustment

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry

.2 Section 07 21 13 Building Insulation

.3 Section 07 27 13 Modified Bituminous Sheet Air Barriers

.4 Section 07 92 00 Joint Sealants

.5 Section 08 50 00 Aluminum Windows

.6 Section 08 71 10 Door Hardware

.7 Section 08 80 05 Glazing

.8 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A36/A36M-19 Standard Specification for Carbon Structural Steel

.2 ASTM A276/A276M-23 Standard Specification for Stainless Steel Bars and Shapes

.3 ASTM A1008/A1008M-21a 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

.4 ASTM A1011/A1011M-23 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

.5 ASTM B221-21 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.6 ASTM C612-14(2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.7 ASTM C864-05(2019) Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

.8 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants

.9 ASTM E283/E283M-19 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

.10 ASTM E330/E330M-14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

.11 ASTM E331-00(2023) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

.12 ASTM E413-22 Classification for Rating Sound Insulation.

.13 ASTM E547-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Differential.

.14 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

.15 ASTM E1105-15(2023) 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

.16 ASTM E1300-16 Standard Practice for Determining Load Resistance of Glass in Buildings

.2 The Aluminum Association, Inc (AA)

.1 DAF-45 Designation System for Aluminum Finishes.

.3 American Architectural Manufacturers Association (AAMA)

.1 AAMA 501 Methods of Test for Exterior Walls

.2 AAMA 609 & 610.2 Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

.3 AAMA 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

.4 AAMA 2603 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

.5 AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and

Panels

.6 AAMA CW-11 Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing

.7 AAMA CW-DG-1 Aluminum Curtain Wall Design Guide Manual

.8 AAMA MCWM-1 Metal Curtain Wall Manual

.9 AAMA T1R-A1 Sound Control for Fenestration Products.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.20-M89 Structural Design of Glass for Buildings.

.5 CSA Group (CSA)

.1 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.

.2 CSA S157-05/S157.1-05 (R2010) Strength Design in Aluminum.

.3 CSA W59.2-M1991 (R2008) Welded Aluminum Construction.

.6 Ontario Ministry of Municipal Affairs and Housing (MMAH)

.1 Ontario Building Code

.2 MMAH Supplementary Standard SB-10, Energy Efficiency Requirements.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples: Submit duplicate 300 mm long sample sections of all component parts of aluminum extrusions, finished in specified colours.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Indicate materials and profiles and provide full-size, scaled details for components.

.3 Indicate interior trim and exterior junctions with adjacent construction.

.4 Indicate junctions between combination units. Indicate elevations of units. Indicate core thicknesses of components.

.5 Indicate: Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, accessories and caulking materials. Indicate location of caulking.

.6 Indicate arrangement of hardware and required clearances to surrounding structure.

.7 Indicate assembly details and dimensions of fabrication.

.8 Indicate installation details and sequencing, method of glass installation, and location and method of sealing air and vapour barrier to curtain wall frame components.

.9 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, and field welding required.

.10 Indicate methods of accommodating thermal expansion and contraction, provisions for structural deflections, contractions, expansion and other normal movements.

.11 Indicate design loads and maximum support reactions.

.4 Submit test reports from approved independent testing laboratories, certifying compliance with specified performance characteristics and physical properties, for:

.1 Energy efficiency (MMAH SB-10 compliance for complete assembly including glass units)

.2 Structural design.

.3 Wind load resistance.

.4 Thermal resistance.

.5 Air infiltration.

.6 Water tightness

.7 Condensation resistance.

.8 Anodized finish, weathering characteristics.

.9 Design and components not complying with above requirements will not be accepted.

.5 Design Calculations:

.1 Submit design calculations of curtain wall system. Be responsible for the design of all components and accessories thereof and connections in accordance with the requirements of the Ontario Building Code.

.2 Make thorough examination of all drawings and details, check interfacing with work of other Contracts and other factors influencing the engineering design and performance of the work and be fully cognizant of requirements.

.3 The engineering design calculations and drawings for the curtain wall shall be prepared by a registered Professional Engineer registered to practice in Ontario. The said Engineer shall affix his seal and signature to the design calculations and drawings.

.4 Design to withstand without failure the positive and negative forces imposed by wind, earthquake, temperature and shrinkage stress, deflections of the supporting or adjacent structures, all with deflection limitations governed by the design of the supporting structure. The external pressure of suction due to wind on part or all of the surface of the units shall be calculated in accordance with the requirements of the Ontario Building Code.

.6 Operations and Maintenance Data: At completion of the project submit manufacturer's maintenance, cleaning and maintenance instructions for curtain walls for inclusion into Operation and Maintenance Manuals specified in Section 01 78 00.

1.5 Quality Assurance

.1 The installers executing the work of this Section shall have had at least ten years continuous Canadian experience in the successful manufacture and installation of work of the type and quality shown and specified and shall be approved by the systems manufacturer.

.2 Design Engineer for curtain wall systems shall have a minimum five years of experience in the design of similar systems. Submit proof of experience on request.

.3 Pre-installation Conference: Conduct a pre-installation conference to review and verify project requirements, substrate conditions, manufacturer's installation instructions and warranty requirements. Meeting shall be attended by manufacturer's representative, sealant manufacturer's representative, installer, Contractor and Consultant.

.4 Perform work in accordance with AAMA CW-DG-1.

.5 Perform welding work in accordance with CSA W59.2.

1.6 Performance Requirements

.1 Structural members including intermediate mullions and horizontals, shall be designed to withstand loading in accordance with the Ontario Building Code.

.2 Design 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 building structural loads.

.4 Deflection, shortening or creep of structural support framing.

.3 Design system to accommodate expansion and contraction within system components caused by cycling temperature range of 10° C over a 12 hour period, without causing detrimental effect to system components.

.4 Structural performance shall be based on ASTM E330 and CSA S157-05/S157.1 “Strength Design in Aluminum” and a maximum deflection of 1/175 of the span of unsupported span with full recovery of glazing materials.

.5 Design system as thermally broken, pressure-equalized vented and drained assembly.

.6 Insulating glass units in combination with curtain wall framing shall be designed by the supplier to comply with ASTM E1300.

.7 Insulating glass units in combination with curtain wall framing shall be designed by the supplier to comply with energy efficient requirements specified in MMAH Supplementary Standard SB-10.Submit engineered shop drawings, calculations and certificates certifying compliance with that standard.

.8 Air infiltration shall not exceed 0.0003 $m^3/s.m^2$ when tested in accordance with ASTM E283 at a pressure differential of 298.77 Pa.

.9 Water penetration: To ASTM E331: None, with static pressure of 718.2 Pa.

.10 Drain water entering joints, condensation occurring in glazing channels or migrating moisture occurring within system, to exterior by weep drainage network.

.11 Provide continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air and vapour barrier.

.12 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.

1.7 Protection

.1 Protect the work of this trade from damage. Protect work of other trades resulting from the work of this Section.

.2 Provide at the factory, strippable coatings on all exposed surfaces of aluminum. This coating and protective wrappings shall remain on the surfaces through the period that other trades' works proceed on the building and shall be removed on completion of the building.

.3 Make good all damaged work caused by failure to provide adequate protection. Remove unsatisfactory work and replace at no expense to the Owner.

1.8 Sequencing

.1 Co-ordinate work of this Section with air barrier placement, flashing placement, and other related components or materials.

1.9 Project Conditions

.1 Do not install sealants when ambient and surface temperature is less than 5 °C. Maintain this minimum temperature during and after installation of sealants.

1.10 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions. Handle work of this section in accordance with AAMA CW-10.

.3 Store materials indoors in dry location. Ensure materials do not come in contact with ground or other damp substrates.

.4 Cover exposed pre-finished surfaces with pressure-sensitive, heavy protection paper or apply strippable plastic coating before shipping to job site. Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.11 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.12 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of five years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

.2 Provide a warranty stating that the anodized finish will be non-fading, nonconvertible, and permanently a part of the metal surface for a period of five years after acceptance of the building. The warranty shall state that any item showing failure during the warranty period will be replaced or refinished to the original condition, at no cost to the Owner.

PART 2 PRODUCTS

2.1 Manufacturers

.1 Manufacture: Aluminum sections and products manufactured by Kawneer Company Canada Ltd. form the basis of the drawings and specifications. The following

manufacturers are considered as acceptable alternates subject to approval by the Consultant, of supporting technical literature, samples, drawings, engineering data and performance data:

.1 Alumicor

.2 Commdoor

.3 CRL United States Aluminum

.4 Oldcastle

.5 Windspec

2.2 Materials

.1 System Description: Vertical, glazed, pre-finished aluminum curtain wall system including thermally broken tubular steel reinforced aluminum sections. Double- glazed, hermetically sealed vision glass and insulated spandrel panels. Related flashings, anchorage and attachment devices.

.2 Assembled system to permit re-glazing of individual glass and infill panel units without requiring removal of structural mullion sections.

.3 Extruded aluminum: To ASTM B221, AA 6063-T54 or 6063-T6 alloy and temper.

.4 Member Wall Thickness: Each framing member shall provide structural strength to meet or exceed specified performance requirements.

.5 Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

.6 Curtain wall framing shall be designed to suit glass thickness indicated.

.7 Extruded aluminum sills to size and shape to suit wall conditions, complete with end drip deflectors, cover plates and necessary anchors.

.8 Flashings: Pre-finished aluminum where exposed to view. Finish: To match curtain wall sections. Secured with concealed fasteners.

.9 Fasteners: Where exposed shall be stainless steel, to ASTM A276, 300 series or 400 series stainless steel cadmium plated of sufficient size and quantity to suit their intended purpose.

.10 Steel Reinforcement, Weld Plates, Structural Sections and Anchors: Complying with ASTM A36 for structural shapes, plates and bars; ASTM A1008 for cold-rolled sheet and strip or ASTM A1011 for hot-rolled sheet strip.

.11 Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

.12 Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides for silicone adhesion. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

.13 Pressure plates: Mechanically fastened fibreglass pressure plate of sufficient size and strength to provide adequate bite on glass and infill panels.

.14 Exterior pressure plate cover: Extruded aluminum, standard sizes and profiles as detailed and to suit job conditions. Snap-on. Finish to match curtain wall framing.

.15 Glass and Glazing: Glass and Glazing shall be as specified in Section 08 80 05.

.16 Weathering and glazing gaskets: to ASTM C864, extruded silicone compatible EPDM rubber that provides for silicone adhesion.

.17 Weathering and glazing gaskets: Exterior glazing system.

.18 Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, containing no asbestos, formulated for 0.762 mm thickness per coat

.19 Sealant: Single-Component, Nonsag, Moisture-Cure, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT as specified in Section 07 92 00 – Joint Sealants.

.20 Adhesives: as recommended by manufacturer of materials to be bonded.

.21 Spandrel Panel Insulation: To ULC 702 Type 1 or ASTM C612 Type IVB, semi rigid stone wool insulation board, unfaced, square edged. Density 56 kg/m$^{3.}$ Thickness as indicated.

.1 Curtainrock. by Roxul

.2 MinWool Curtainwall by Johns Manville

.3 Fasteners and adhesive

.1 Adhesive types as recommended by insulation manufacturer for application.

.2 Insulating clips to be adhesive bonded pin and disc type.

2.3 Curtain Wall System

.1 Curtain wall framing profile: 65 mm wide thermally broken with interior tubular section insulated from exterior pressure plate. Mullion depths: 152 mm depth. Exterior caps: 19 mm. Stick system with shear block connections. Pressure-equalized rain screen design

with drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system.

.1 Basis of Design: Kawneer 1600 Wall System 1 Curtain Wall

.2 Glazing: all locations: 25 mm thick glass except at spandrel glass.

.3 Spandrel Panels: Aluminum Composite Material (ACM) Panels 4 mm thickness. Finish to match curtain wall framing. Sem-rigid mineral wool insulation. Interior prefinished aluminum back pan.

2.4 Doors

.1 Exterior Doors

.1 To size indicated on schedules and drawings.

.2 Thermally broken medium stile with intermediate horizontal rails where detailed.

.3 The door stile and rail face dimensions of the entrance door will be as follows:

.1 Vertical Stile 103.2 mm,

.2 Top Rail 103.2 mm,

.3 Bottom Rail 179.4 mm

.4 Major portions of the door members to be 3.2 mm nominal in thickness and glazing molding to be 1.3 mm thick.

.5 Reinforce doors for continuous hinges.

.6 Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.

.7 Provide adjustable glass jacks to help center the glass in the door opening.

.8 Provide flush stops for insulating glass in exterior doors.

.9 Exterior glass: 25 mm sealed units, insulating glass specified in Section 08 80 05.

2.5 Door Hardware

.1 Provide the following hardware for aluminum doors, as appropriate to location and configuration:

.1 Exterior Doors:

.1 1 ½ pair stainless steel ball bearing butt hinges.

.1 Door width: Over 915 mm: 127 mm x 114mm hinge.

.2 Adams Rite 1850A deadlock with interior thumbturn.

.1 Cylinder provided under Section 08 71 10.

.3 Style CO-12 Architects Classic Pull with clear anodized finish.

.4 Concealed heavy duty closer 2030 LCN.

.5 Kawneer controller locking system for paired doors.

.6 Extruded aluminum threshold for barrier free access, 102 mm wide x 12 mm high. Thermally broken.

.7 Weather-seal to head and jambs. Aluminum with sponge neoprene a minimum of 6.0 mm thick, width to suit frame. Type TW2000.

.8 Meeting stiles: adjustable astragal utilizing wool pile with polymeric fin.

.9 Door sweeps to be Sealeze EB 395 EPDM blade gasket x door width.

.10 Automatic Door Operator: To be supplied by Finish Hardware Supplier. Refer to Section 08 71 10.

.11 Electric Strike: (by security Contractor)

.12 Card Readers (by security Contractor)

2.6 Fabrication

.1 Fabricate in accordance with manufacturer's written instructions.

.2 Take field measurements prior to fabrication.

.3 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly without adversely affecting installation and dynamic movement of perimeter seal.

.4 Design and fabricate coupling mullions to eliminate seam joints on exterior, to provide functional split, to permit modular construction and to allow for thermal expansion.

.5 Framing joints to be accurately machined, fit, assembled, secured and sealed to provide tight, hairline, flush, neat weathertight joints and corners.

.6 Prepare components to receive anchor devices. Install anchors.

.7 Arrange fasteners and attachments to ensure concealment from view.

.8 Reinforce framing members for external imposed loads.

.9 Fabricate glazed pockets and insulation cavities with vents and drains, and pressure equalize to form rain screen assembly. Fabricate frames square to profiles shown and prepare for glazing. Fill frames with manufacturer's insulation.

.10 Design and fabricate necessary brackets and anchorage devices so that, when installed, they will compensate for unevenness and dimensional difference in the structure to which they are secured, will allow full expansion and contraction of framing members as a result of such expansion and contraction of framing members and will adequately sustain themselves, the curtain wall framing, superimposed wind and rain loads and all other stresses.

.11 Welding of component members will be permitted providing it does not in any way mar the surface appearance and with joints made tight, in true plane, ground and sanded smooth, flush with base metal. Do all welding on concealed surface.

.12 Provide thermal break to maintain the interior surface of frames and glass free from condensation and frosting under conditions of minimum -12° C outside temperature with 24° C inside temperature at 35% relative humidity. All frame members to have extruded silicone compatible elastomeric thermal break integrated with the inner and outer aluminum extrusions by a roll-crimping process to form a rigidly interconnected assembly without the use of fasteners or other thermal bridging elements.

.13 Equip sill base with splice plate back up sections at joint in long runs. Seal ends and jambs to provide neat, weather tight joints.

.14 Provide adequate, shielded drainage and pressure equalization where required.

.15 Aluminum Sills: Extruded to size and shape as detailed, complete with end drip deflectors, expansion cover plates and necessary anchors.

.16 Form continuous flashings with intermediate clips, anchorages and reinforcing and as much as possible, be shop assembled. Provide all filler and closure pieces as required.

2.7 Air Barriers and Vapour Retarders

.1 Equip curtain wall framing with factory-installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:

.1 Material: Identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.

.2 Material width: Adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

2.8 Aluminum Finishes

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

.2 Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

.3 Factory Finishing:

.1 Permanodic AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear).

2.9 Isolation Coating

.1 Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials to provide isolation coating. Isolate aluminum from following:

.1 Dissimilar metals, except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar, masonry and other alkaline materials.

.2 Coating material shall be low VOC type conforming to SCAQMD Rule 1113-96.

PART 3 EXECUTION

3.1 Examination

.1 Verify dimensions, tolerances and method of attachment with other work on site.

.2 Verify that wall openings and adjoining air barrier materials are prepared and ready to receive work of this Section and match reviewed shop drawings.

.3 Commence installation only when variations or discrepancies on the Site which will prevent satisfactory installation of this Section's work are corrected.

3.2 Installation

.1 Install curtain wall system in accordance with manufacturer's written instructions and reviewed shop drawings and AAMA MCWM-1 Metal Curtain Wall Manual. Install in accordance with manufacturer’s written instructions to achieve vented and drained, pressure-equalized rain screen assembly.

.2 Provide all fastenings or anchors to be built in under other Sections. Coordinate location and connection details for intermediate support framing with Section 05 12 23.

.3 Attach to exterior wall panels to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.4 Provide alignment attachments and shims to permanently fasten system. Clean weld surfaces. Apply protective primer to field welds and adjacent surfaces.

.5 Align assembly and install plumb and level, square, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

.6 Provide thermal isolation where components penetrate or disrupt building insulation.

.7 Install sill flashings.

.8 Co-ordinate attachment and seal of perimeter air barrier and vapour barrier materials.

3.3 Site Tolerances

.1 Maximum variation from plumb: 1.6 mm per .91 m non-cumulative or 12.7 mm per 30.48 metres, whichever is less.

.2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.

.3 Maximum sealant space between curtain wall and adjacent construction: 12.7 mm.

3.4 Semi Rigid Curtain Wall Insulation

.1 Install board insulation in curtain wall construction as indicated, in accordance with curtain wall manufacturer's written instructions.

.2 Place insulation within panel, adhered to exterior face of interior sheet, over entire area with impale fasteners spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching glass.

.3 Arrange fasteners and attachments to ensure concealment from view.

.4 Maintain cavity width of dimension indicated between insulation and glass.

.5 Seal voids and gaps.

3.5 Door Installation

.1 Install in accordance with reviewed shop drawings.

.2 Install and adjust hardware in accordance with hardware templates and manufacturer’s instructions.

.3 All hardware shall be installed by technicians skilled in the application of architectural hardware and satisfactory to the aluminum door supplier. Instruction sheets, details and templates shall be read and understood before installation.

.4 Coordinate installation of electrically operated hardware with Electrical and Security subcontractors.

.5 Coordinate installation of Automatic Door Operators with Section 08 71 10.

3.6 Glazing

.1 Install glass in accordance with Section 08 80 05 - Glazing, to glazing method required to achieve performance criteria and to recommendations of manufacturer.

3.7 Caulking

.1 Refer to Section 07 92 00 – Joint Sealants. Install perimeter sealant to method required to achieve performance criteria.

3.8 Field Quality Control

.1 Manufacturer's field services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.2 Schedule site visits to review work at stages listed:

.1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 25% and 60% complete.

.3 Upon completion of work, after cleaning is carried out.

.3 Field Tests: Consultant shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer’s representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

.1 Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.

.1 Air Leakage Tests: Conduct tests in accordance with ASTM E783. Allowable air leakage shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, whichever is greater.

.2 Water Infiltration Tests: Conduct tests in accordance with ASTM E1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 383 Pa.

.2 Evaluate installed system by thermo-photographic scan.

.4 Obtain reports within three days of review and submit immediately to Consultant.

3.9 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Remove protective material from pre-finished aluminum surfaces.

.3 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.4 Perform cleaning of aluminum components in accordance with AAMA 609 & 610.2.

.5 Remove excess sealant by moderate use of solvent acceptable to sealant manufacturer.

.6 Visible manufacturer's identification labels are not permitted.

3.10 Protection

.1 Protect finished work from damage.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry

.2 Section 07 21 13 Building Insulation

.3 Section 07 26 00 Vapour Retarders

.4 Section 07 27 15 Modified Bituminous Sheet Air Barriers.

.5 Section 07 92 00 Joint Sealants

.6 Section 08 44 13 Glazed Aluminum Curtain Walls

.7 Section 08 80 05 Glazing

1.3 References

.1 ASTM International (ASTM)

.1 ASTM E283/E283M-19 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

.2 ASTM E330 / E330M – 14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

.3 ASTM E547-00(2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference

.2 American Architectural Manufactures Association / Window and Door Manufactures Association (AAMA / WDMA)

.1 ANSI / AAMA / NWWDA 101 / I.S.2-97 Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors; 101 / I.S.2 / NAFS-02 Voluntary Performance Specification for Windows, Skylights and Glass Doors;

.2 AAMA/WDMA/CSA 101/I.S.2/A440-17 Standard/Specification for Windows, Doors, and Unit Skylights; AAMA/WDMA/CSA 101/I.S.2/A440-17 NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights

.3 National Fenestration Rating Council (NFRC):

.1 NFRC 101: Procedure for Determining Fenestration Product Thermal Properties.

.4 CSA Group (CSA)

.1 CSA A440-17 North American Fenestration Standard/Specification for Windows, Doors, and Skylights

.5 Ontario Ministry of Municipal Affairs and Housing (MMAH)

.1 Ontario Building Code

.2 MMAH Supplementary Standard SB-10, Energy Efficiency Requirements.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

.3 Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances and installation details.

.4 Samples for Initial Selection: For units with factory-applied colour finishes including samples of hardware and accessories involving colour selection.

.5 Samples for Verification: For aluminum windows and components required.

.6 Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

.7 Submit test reports from approved independent testing laboratories, certifying compliance with specified performance characteristics and physical properties, for:

.1 Energy efficiency (MMAH SB-10 compliance for complete assembly including glass units)

.2 Windows classifications.

.3 Anodized finish, weathering characteristics.

.4 Air infiltration

.5 Water tightness.

.6 Wind load resistance.

.7 Condensation resistance.

.8 Forced entry resistance.

.9 Mullion deflection.

.8 Provide operation and maintenance data for aluminum windows for incorporation into Operations and Maintenance Manuals specified in Section 01 78 00 - Closeout Submittals.

1.5 Definitions

.1 Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.6 System Description

.1 Performance Requirements: Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Insulating glass units in combination with aluminum window framing shall be designed by the supplier to comply with energy efficient requirements specified in MMAH Supplementary Standard SB-10.

1.7 Performance Requirements

.1 General Performance: Aluminum-framed window system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

.2 Provide aluminum windows of performance indicated that comply with CSA A440.

.3 Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

.1 Performance Class and Grade, Fixed Windows: AW-PG70-FW

.2 Performance Class and Grade, Operable Windows: CW-PG45-AP.

.4 Wind load resistance for fixed and operating windows shall meet the C5 rating when tested with configurations in accordance with CSA A440.

.5 Energy Efficiency:

.1 Thermal transmittance simulation results using NFRC 100 or AAMA 507 are based upon argon-filled 25.4 mm clear low-emissivity coated glass with warm edge spacer.

.1 Fixed Windows: For 25.4 mm glass with Center of Glass (COG) U-factor of 0.24 Btu/(hr·ft2·°F) and warm edge spacer, when simulated using NFRC 100 or AAMA 507, the thermal transmittance (U-factor) shall not be more than 0.30 Btu/(hr·ft2·°F) per NFRC 100.

.2 Project-Out: U-Factor not more than .45 BTU/hr/sf/°F per AAMA 507 or NFRC100 when using project specified glass.

.6 Condensation Resistance Factor (CRF):

.1 When tested in accordance with AAMA 1503, the condensation resistance factor (CRF) shall not be less than:

.1 Fixed Windows:

.1 CRFf: not less than 77 with clear glass.

.2 CRFg: not less than 72 with clear glass.

.2 Operable Windows:

.1 CRFf: not less than 58 with clear glass.

.2 CRFg: not less than 61 with clear glass.

.7 Uniform Load Deflection:

.1 Fixed Windows: A minimum static air pressure difference of 3352 Pa shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of L/175 of the span of any framing member. The test specimen shall meet the C5 rating when tested in accordance with CAN/CSA-A440.

.2 Operable Windows : A minimum static air pressure difference of 2155 Pa shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of L/175 of the span of any framing member.

.8 Air Infiltration:

.1 Fixed Windows: The test specimen shall be tested in accordance with ASTM E283 at a minimum size of 1524 x 2515. Air infiltration rate shall not exceed 0.10 cfm/ft2 at a static air pressure differential of 300 Pa. The test specimen shall meet the Fixed rating of less than 0.25 (m3/h)/m at 75 Pa when tested in accordance with CAN/CSA-A440-00 Windows.

.2 Operable Windows: The test specimen shall be tested in accordance with ASTM E283 at a minimum window size of 1219.2 x 812.8 mm. The air infiltration rate shall not exceed 0.10 cfm/ft2 at a static air pressure differential of 300 Pa.

.9 Water Resistance:

.1 Fixed Windows: The test specimen shall be tested in accordance with ASTM E547 and ASTM E331 at a minimum size of 1524 x 2515 mm. There shall be no leakage as defined in the test method at a static air pressure differential of 720 Pa.

.2 Operable Windows: The test specimen shall be tested in accordance with ASTM E547 and ASTM E331 at a minimum window size of 1219.2 x 812.8 mm. There shall be no leakage as defined in the test method at a static air pressure differential of 580 Pa.

.10 Uniform Load Structural:

.1 Fixed Windows: A minimum static air pressure difference of 5028 Pa shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load with permanent set not to exceed 0.2% of span length.

.2 Operable Windows: A minimum static air pressure difference of 3232 Pa shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load.

.11 Component Testing: Window components shall be tested in accordance with procedures described in AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS) and AAMA 910.

.12 Forced Entry Resistance: All windows shall conform to ASTM F588, Grade 10.

.13 Thermal Barrier Test: Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

.14 Operating windows shall meet performance criteria for ease of operation, sash strength and stiffness in accordance with CSA A440.

.15 Opening mechanisms shall control the free swinging of the openable part of the window so as to limit any clear unobstructed opening to a size that will prevent the passage of a sphere having a diameter more than 100 mm.

1.8 Quality Assurance

.1 Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for this project and other projects of similar size and scope.

.2 Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

.3 Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

.4 Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.9 Site Conditions

.1 Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings

.2 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

1.10 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.

.3 Receive and store materials as recommended by materials manufacturer.

.4 Maintain containers and labels in undamaged condition.

1.11 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.12 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of five years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

.2 Provide a warranty stating that the anodized finish will be non-fading, nonconvertible, and permanently a part of the metal surface for a period of five years after the date of Substantial Performance. The warranty shall state that any item showing failure during the warranty period will be replaced or refinished to the original condition, at no cost to the Owner.

PART 2 PRODUCTS

2.1 Manufacturer

.1 Basis-of-Design Product: Kawneer Company Inc.

.1 Kawneer Series AA6600 Windows - Fixed and Project Out

.1 Fixed: 152 mm AA6600 frame depth

.2 Project-Out: 85.7 mm Project-Out vent depth.

.2 The following manufacturers are considered as acceptable alternates subject to approval by the Consultant, of supporting technical literature, samples, drawings, engineering data

and performance data:

.1 Alumicor

.2 Commdoor

.3 CRL United States Aluminum

.4 Oldcastle

.3 It is a mandatory requirement that all aluminum windows, curtain walls and aluminum doors, frames and screens specified in Sections 08 44 13 and 08 50 00 be supplied by the same manufacturer.

2.2 Materials

.1 Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 1.8 wall thickness at any location for the main frame and sash members.

.2 Thermal Barrier: The thermal barrier shall be Kawneer consisting of two parallel glass fiber-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.

.3 Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

.4 Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

.5 Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

.6 Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 Glazing

.1 Glass and Glazing Materials: Refer to Section 08 8-0 05-Glazing for glass units and glazing requirements applicable to glazed aluminum window units.

.2 Glazing System: Glazing method shall be a dry type in accordance with manufacturer’s standards. Exterior glazing shall be TPE gasket. Interior glazing shall be snap-in type glazing beads with an interior TPE gasket in accordance with AAMA 702 or ASTM C864.

2.4 Hardware

.1 General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash weight and dimensions.

.2 Projected Window Hardware:

.3 Locking: Dual Handle Multi-Point Locks

.1 Cast White Bronze Cam Locks

.4 Hinging

.1 4-Bar Hinges

.5 Limit Stop

.6 Roto Operator

2.5 Accessories

.1 Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

.2 Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

.3 Sealants and joint fillers for joints at perimeter of window system as specified in Section 07 92 00 Joint Sealants.

.4 Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

.5 Interior Trims: Extruded aluminum, 6063-T6 alloy and temper, extruded to profiles and details indicated. The interior face trim minimum wall thickness shall be 1.57 mm. The face trim shall snap-fit onto concealed mounting clip.

.6 Exposed fasteners shall not be accepted. The mounting clip shall be extruded aluminum of 6063-T6 alloy and temper. The minimum wall thickness shall be 1.57 mm. The trim clips shall be provided in 102 mm lengths and spaced a maximum of 457 mm center to center.

.7 Coupling Mullions: Shall be extruded aluminum of 6063-T6 alloy and temper of profile and dimensions indicated on drawings. Mullions shall provide structural properties to resist wind pressure required by performance criteria and standards.

.8 Insect Screens: Extruded aluminum frames, 6063-T6 alloy and temper, joined at corners:

18 x 16 mesh fiberglass screen cloth; frames finished to match aluminum windows; splines shall be extruded vinyl, removable to permit rescreening.

2.6 Fabrication

.1 Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

.1 Profiles that are sharp, straight, and free of defects or deformations.

.2 Accurately fit joints; make joints flush, hairline and weatherproof.

.3 Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

.4 Physical and thermal isolation of glazing from framing members.

.5 Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

.6 Provisions for field replacement of glazing.

.7 Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

.8 Window Vent and/or Vent Frame Joinery: Mitered and Mechanically clipped and/or staked. Factory sealed vent and /or vent frame and corner joints.

.2 Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

.3 Fabricate aluminum windows that are re-glazable without dismantling sash or framing.

.4 Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact. Thermal barriers shall be designed in accordance with AAMA TIR A8.

.1 Thermal Barrier: The thermal barrier shall consist of two parallel glass fiber-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.

.5 Glazing Stops: Provide snap-on glazing stops coordinated with Section 08 80 005 - Glazing and glazing system indicated. Provide glazing stops to match frame.

.6 After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 Aluminum Finishes

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

.2 Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

.3 Factory Finishing:

.1 Permanodic AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear).

PART 3 EXECUTION

3.1 Examination

.1 Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances.

.2 Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight window installation.

.1 Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

.2 Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

.1 Install windows hardware, accessories, and other components in accordance with manufacturer’s instructions and reviewed shop drawings.

.2 Install aluminum framed window system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

.3 Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

.4 Install aluminum framed window system and components to drain condensation, water penetrating joints, and moisture migrating within system to the exterior.

.5 Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

3.3 Field Quality Control

.1 Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

.2 Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

.3 Testing Services: Testing and inspecting of installed windows shall take place as follows:

.1 Testing Methodology: Testing Standard shall be per AAMA 502 including reference to ASTM E783 for Air Infiltration Test and ASTM E1105 for Water Penetration Test.

.1 Air Infiltration Test: Conduct test in accordance with ASTM E 783 at a minimum uniform static test pressure of 75 Pa for CW or 300 Pa for AW. The maximum allowable rates of air leakage for field testing shall not exceed 1.5 times the project specifications.

.2 Water Infiltration Test: Water penetration resistance tests shall be conducted in accordance with ASTM E 1105 at a static test pressure equal to 2/3 the specified water test pressure.

.4 Testing Extent: Consultant shall select window units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present.

.5 Test Reports: Shall be prepared according to AAMA 502.

3.4 Adjusting

.1 Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.

3.5 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

.3 Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

.4 Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

.5 Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 20 00 Finish Carpentry

.2 Section 08 11 00 Metal Doors and Frames

.3 Section 08 14 16 Flush Wood Doors

.4 Section 08 44 13 Glazed Aluminum Curtain Walls

1.3 References

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/DHI A115.1G-1994 Installation Guide for Doors and Hardware

.2 ANSI/ICC A117.1-2017 Accessible and Usable Buildings and Facilities

.3 ANSI/BHMA A156.1-2013 American National Standard for Butts and Hinges

.4 ANSI/BHMA A156.2-2011 Bored and Preassembled Locks and Latches

.5 ANSI/BHMA A156.3-2014 Exit Devices

.6 ANSI/BHMA A156.4-2013 Door Controls - Closers

.7 ANSI/BHMA A156.5-2014 Auxiliary Locks and Associated Products

.8 ANSI/BHMA A156.6-2010 Architectural Door Trim

.9 ANSI/BHMA A156.8-2010 Door Controls - Overhead Stops and Holders

.10 ANSI/BHMA A156.10-2011 Power Operated Pedestrian Doors

.11 ANSI/BHMA A156.12-2013 Interconnected Locks and Latches

.12 ANSI/BHMA A156.13-2012 Mortise Locks and Latches Series 1000

.13 ANSI/BHMA A156.15-2011 Release Devices - Closer Holder, Electromagnetic and Electromechanical.

.14 ANSI/BHMA A156.18-2012 Materials and Finishes

.15 ANSI/BHMA A156.19-2013 Power Assist and Low Energy Power - Operated Doors

.16 ANSI/BHMA A156.21-2014 Thresholds

.17 ANSI/BMHA A156.22-2012 Door Gasketing and Edge Seal Systems

.2 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): Standard Hardware Location Dimensions

.3 National Wood Window and Door Association (NWWDA)

.4 Door Hardware Institute (DHI)

.5 Accessibility for Ontarians with Disabilities Act (AODA)

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.

.3 Samples:

.1 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.2 After approval samples will be returned for incorporation in the Work.

.4 Hardware List:

.1 Submit contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Manufacturer's Instructions: Submit manufacturer's installation instructions.

.6 Provide operation and maintenance data for door closers, locksets, door holders, electrified hardware and fire exit hardware for incorporation into Operations and Maintenance Manuals specified in Section 01 78 00 - Closeout Submittals.

1.5 Quality Assurance

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Receive the delivery of the Finishing Hardware and identify all items against the Finishing Hardware Schedule. Ensure each hardware item is accompanied by the correct template, installation instructions, special tools, fastening devices and other loose items. Advise the finish hardware supplier and Consultant in writing of errors or omissions.

.5 Storage and Protection: Store finishing hardware in locked, clean and dry area.

.6 Remove all hardware from doors and frames prior to painting. After painting is complete and dry, reinstall all hardware to manufacturer’s recommendations.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.8 Warranty

.1 Warrant all hardware against defects of workmanship and material, for a period of one year, except for door closers which shall be warranted for ten years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Materials

.1 All hardware shall be supplied as specified in the Finishing Hardware Schedule.

.2 All finishes shall be as indicated in the Finishing Hardware Schedule by international codes.

.3 All door handles shall be lever type meeting requirements of the referenced accessibility standards and the Ontario Building Code.

.4 Power Door Operators and controls shall be CSA approved and shall meet the requirements of the Ontario Building Code and the Accessibility for Ontarians with Disabilities Act (AODA).

2.2 Fastenings

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.3 Electrified Devices

.1 Electrified exit devices shall conform to all traditional exit device standards as specified above. 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 with electric latch retraction shall provide for a remote means of unlocking for momentary or maintained periods of time.

.3 Exit devices with electrified trim shall be fail-secure unless otherwise specified.

2.4 Keying

.1 Keying: All permanent cylinders to be grandmaster-keyed as directed by the Owner. The factory shall key all locks and cylinders and maintain keying records. The factory shall establish a System Information Document (SID) to designate primary system administrators and require a separate letter of authorization for all future shipments of keyed products.

.2 Remove all construction cores and install all permanent cores. Unless otherwise directed by the Owner.

.3 Construction master/change keys are to be delivered by the contractor directly to The Owner.

.4 Ship all permanent cylinders and keys separately. Identify door number and keyset symbol on each envelope for direct factory delivery to the owner.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 Examination

.1 Before installing any hardware, carefully check all architectural drawings of the work requiring hardware, verify door swings, door and frame materials and operating conditions, and assure that all hardware will fit the work to which it is to be attached.

.2 Check all shop drawings and frame and door lists affecting hardware type and installation, and certify to the correctness thereof, or advise the hardware supplier and Consultant in writing of required revisions.

3.3 Templates

.1 Check the hardware schedule, drawings and specifications, and furnish promptly to the applicable trades any patterns, templates, template information and manufacturer's literature required for the proper preparation for and application of hardware, in ample time to facilitate the progress of the work.

3.4 Installation

.1 Installation of hardware shall be in accordance with ANSI A115.1G, manufacturer's templates and instructions.

.2 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.

.3 Mounting Heights: Install door hardware at heights indicated in the following applicable publications unless; specifically indicated or required by local governing regulations, requirements to match for 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/ICC A117.1 Accessibility Guidelines for Buildings and Facilities

.4 NWWDA

.5 AODA

.4 Power door operator products and accessories are required to be installed by an AAADM certified technician as approved by the manufacturer. Adjust for proper opening and closing operation after final balancing of HVAC system.

.5 Coordinate installation of electric door strikes, keypad locks, card readers, washroom duress systems, and other electronic door control and security devices with Electrical contractor including supply and installation of wiring and all terminations.

.6 All hardware shall be installed by carpenters, skilled in the application of architectural hardware and satisfactory to the hardware supplier. Refer to Section 06 20 00 - Finish Carpentry. Instruction sheets, details and templates shall be read and understood before installation.

.7 Install all materials as listed in the Finishing Hardware Schedule on the doors and frames listed. Interchanging of hardware will not be allowed.

.8 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.9 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.10 Remove construction cores when directed by Owner's Representative.

.11 After installation, templates, installation instructions and details shall be put in a file and turned over to the Owner, when building is Substantially Performed.

3.5 Field Quality Control

.1 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.

.2 Hardware supplier to attend site meetings as required to ensure proper execution of the guidelines set forth herein.

.3 Hardware supplier will perform final field inspection of installed door hardware after final adjustment of all products and will document and report any deficiencies or omissions for correction and written acceptance by the Contractor.

3.6 Adjusting

.1 Adjust door hardware, operators, closers and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.7 Demonstration

.1 Instruct Owner's maintenance personnel in the proper adjustment, operation and maintenance of mechanical and electromechanical door hardware, electronic devices and maintenance of finishes.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.3 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.4 Remove protective material from hardware items where present.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 07 92 00 Joint Sealants

.2 Section 08 11 00 Metal Doors and Frames

.3 Section 08 14 16 Flush Wood Doors

.4 Section 08 44 13 Glazed Aluminum Curtain Walls

.5 Section 08 51 13 Aluminum Windows

.6 Section 08 88 13 Fire Resistant Glazing

.7 Section 10 28 10 Toilet and Bath Accessories

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C162-23 Standard Terminology of Glass and Glass Products.

.2 ASTM C542-05(2024) Standard Specification for Lock-Strip Gaskets

.3 ASTM C1048-25 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

.4 ASTM C1376-21a Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass

.5 ASTM D790-25 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

.6 ASTM D1929-23 Standard Test Method for Determining Ignition Temperature of Plastics

.7 ASTM D2240-15(2021) Standard Test Method for Rubber Property—Durometer Hardness

.8 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.9 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior

Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

.10 ASTM E1300-24 Standard Practice for Determining Load Resistance of Glass in Buildings

.2 American National Standards Institute (ANSI).

.1 ANSI Z97.1 American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.1-17 Safety Glazing

.2 CAN/CGSB-12.8-17 Insulating Glass Units

.4 CSA Group (CSA)

.1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.

.5 Consumer Product Safety Commission

.1 CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials.

.6 Environmental Choice Program (ECP).

.1 CCD-045-95 Sealants and Caulking.

.7 Flat Glass Manufacturers Association (FGMA).

.1 FGMA Glazing Manual - 1997.

.8 Glass Association of North America (GANA)

.1 GANA Glazing Manual 50th Anniversary Edition-2008.

.2 GANA Sealant Manual-2008.

.3 GANA Guide to Architectural Glass (2010).

.4 GANA/PGC International Protective Glazing Manual (2010).

.9 Ontario Ministry of Municipal Affairs and Housing (MMAH)

.1 Ontario Building Code

.2 MMAH Supplementary Standard SB-10, Energy Efficiency Requirements.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.

.3 Certificates: submit product certificates signed by manufacturer certifying materials and assemblies comply with specified performance characteristics and criteria and physical requirements.

.4 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.5 Samples: Submit duplicate 300 x 300 mm size samples of glass and sealant material.

.6 Manufacturer's Instructions: Submit manufacturer's installation instructions.

.7 Provide maintenance data for glazing for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

1.5 Quality Assurance

.1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.

.2 Safety glass products shall comply with the testing requirements of CAN/CGSB-12.1, Type 2 for Tempered Glass.

.3 Provide safety glass permanently marked with the company name or logo and CAN/CGSB-12.1 if the product meets categories 1 and 2, or mark as CAN/CGSB 12.1M-1 if the product meets the requirements of Category 1 only.

.4 Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or referenced standards.

.1 GANA Publications

.2 AAMA Publications

.3 IGMA/IGMAC Publications

.5 Insulating Glass products are to be permanently marked either on spacers or at least one insulating unit component with appropriate certification label of the Insulating Glass Manufacturers Alliance (IGMA) or Insulating Glass Manufacturers Association of Canada (IGMAC)

.6 Single-source fabrication responsibility: All glass fabricated for each type shall be processed and supplied by a single fabricator.

.7 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.8 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 System Description

.1 Performance Requirements: Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Insulating glass units in combination with aluminum window, storefront or curtain wall framing specified elsewhere shall be designed by the supplier to comply with energy efficient requirements specified in MMAH Supplementary Standard SB-10.Submit engineered shop drawings, calculations and certificates certifying compliance with that standard.

1.7 Design Requirements

.1 Design glass, glazing channels, connections, attachments and glazing accessories to withstand loads designated by the Ontario Building Code and to accommodate all building deflections.

.2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a design pressure of 1.2 kPa as measured in accordance with ANSI/ASTM E330.

.3 Limit glass deflection to 1/200 with full recovery of glazing materials.

.4 Glass thicknesses indicated are minimum and are for detailing only. Confirm glass thickness by analyzing project conditions, including in-service conditions and loads. Provide glass lites for various size openings in nominal thicknesses indicated but not less than required to meet performance requirements of referenced standards including energy efficiency requirements of MMAH-SB-10. Coordinate glass thicknesses with manufacturers of framing systems.

1.8 Project Conditions

.1 Install glazing when ambient temperature is 10 ° C minimum. Maintain ventilated environment for 24 hours after application.

.2 Maintain minimum ambient temperature before, during and for 24 hours after installation of glazing compounds.

1.9 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Provide glass units with interleaving protection between lites. Keep glass and interleaving dry and store cases in clean, cool, dry areas with temperatures above the dew point. Circulation of cool, dry air in storage areas is essential. Open cases and inspect units periodically for moisture accumulation.

.4 Do not store glass in direct sunlight without an opaque protective covering over same.

1.10 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.11 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of ten years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

.2 Warrant insulating glass units for ten years from date of Substantial Performance against seal failure, interpane dusting, or interpane misting.

.3 Warrant low-emissivity coatings when applied to the second or third surfaces of an insulating glass unit, for ten years against peeling or coating deterioration due to product failure.

PART 2 PRODUCTS

2.1 Materials-Flat Glass

.1 Tempered Safety Glass: To CAN/CGSB-12.1, transparent, 10 mm thick unless indicated otherwise. Type 2-tempered.

.1 Class B-float.

.2 Category 1

.3 Edge treatment: ground, bevel edge.

2.2 Insulating Glass Units

.1 Performance requirements for insulating glass units specified herein are the minimum permitted requirements. Provide engineered shop drawings and calculations showing that glazed assemblies including framing and glazing products in combination, meet or exceed the minimum requirements of MMAH Supplementary Standard SB-10.

.2 Insulating Glass Units: To CAN/CGSB-12.8-M, double glazed sealed units, not less than 25 mm thick. Minimum 12.7 mm air space

.1 Exterior Units: Insulating Glass Type 1:

.1 Outboard Lite: 6 mm clear tempered with Solarban 67 low-e coating on second surface.

.2 12.7 mm air space, argon filled.

.3 Inboard Lite: 6mm clear

.4 Performance: All performance data shall be calculated according to ASHRAE standard procedures and verified using the LBL “Window 4.1” program:

.1 Winter nighttime U value: 0.24

.2 Summer Daytime U value: 0.22

.3 Shading Coefficient: 0.33

.4 Solar Heat Gain Coefficient: 0.29

.5 Relative Heat Gain: 68.7

.6 LSG: 1.86

.7 Visible Light Transmittance: 54%

.8 Ultraviolet Transmittance: 11%

.5 Product: Vitro 6mm Solarban 67 (2) on Clear + 12.7 mm Argon + 6mm Clear

2.3 Fire Rated Glass

.1 Refer to Section 08 88 13

2.4 Glazing Products

.1 Select appropriate glazing sealants, tapes, gaskets and other glazing materials of proven compatibility with other materials that they contact. These include glass products, insulating glass unit seals and glazing channel substrates under installation and service conditions, as demonstrated by testing and field experience.

.2 Setting blocks: Neoprene 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.

.3 Spacer shims: Neoprene 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.

.4 Glazing tape:

.1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D 2240; coiled on release paper; black colour.

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

.5 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, colour as selected.

.6 Lock-strip gaskets: to ASTM C542.

.7 Glazing Gaskets: To ASTM C864.

.8 Sealant: as specified in Section 07 92 00 – Joint Sealants. Low VOC.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 Examination

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 Preparation

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.4 Installation – General

.1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

3.5 Installation: Exterior Wet/Dry Method (Preformed Tape and Sealant)

.1 Cut glazing tape to length and set against permanent stops, 6 mm below sight line. Seal corners by butting tape and dabbing with sealant.

.2 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.

.3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape and heel head of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.

.5 Install removable stops with spacer strips inserted between glazing and applied stops 6 mm below sight line.

.6 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, maximum 9 mm below sight line.

.7 Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.6 Installation: Interior - Dry Method

.1 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, maximum 9 mm below sight line.

.2 Apply cap bead of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

.3 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.4 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.5 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.6 Place glazing tape on free perimeter of glazing.

.7 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.8 Knife trim protruding tape.

.9 Glaze hollow metal doors and pressed steel screens. Glass type as indicated.

3.7 Glazed Doors and Sidelights

.1 Doors and sidelights in a barrier-free path of travel consisting of a sheet of glass shall be marked with a continuous opaque strip conforming to Article 3.3.1.18 of the Ontario Building Code.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Perform cleaning to remove construction and accumulated environmental dirt.

.3 Remove traces of primer, caulking.

.4 Remove glazing materials from finish surfaces.

Remove labels after work is complete.

Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.9 Protection of Finished Work

.1 After installation, mark light with an "X" by using removable plastic tape.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 07 92 00 Joint Sealants

.2 Section 08 11 00 Metal Doors and Frames

.3 Section 08 14 16 Flush Wood Doors

.4 Section 08 80 05 Glazing

1.3 References

.1 National Fire Protection Association (NFPA)

.1 NFPA 80 - 2022 Standard for Fire Doors and Other Opening Protectives

.2 NFPA 252 - 2022 Standard Methods of Fire Tests of Door Assemblies.

.3 NFPA 257 - 2022 Standard on Fire Test for Window and Glass Block Assemblies.

.2 Underwriters Laboratories, Inc. (UL)

.1 UL 9 Fire Tests of Window Assemblies.

.2 UL 10B for Fire Tests of Door Assemblies.

.3 UL 10C Positive Pressure Fire Tests of Door Assemblies.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S104:2015 (R2025) Standard Method for Fire Tests of Door Assemblies

.2 CAN/ULC S106:2015 (R2025) Standard Method for Fire Tests of Window and Glass Block Assemblies

.4 Consumer Products Safety Commission (CPSC)

.1 CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials.

.5 Glass Association of North America (GANA)

.1 GANA – Glazing Manual

.2 FGMA – Sealant Manual

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples: Submit 150 x 150 mm glass samples.

.3 Product Data: Submit latest edition of manufacturer's product data.

.4 Provide maintenance data for fire resistant glazing for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

1.5 System Description

.1 Performance Requirements: Provide a fire rating glazing manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

.1 Fire Rating: Fire resistant glazing shall be fire rated from 20-180 minutes with hose stream and is impact safety rated to meet CPSC 16 CFR 1201 Category I and II.

.2 Fire resistant glazing shall be tested in accordance with NFPA 80, NFPA 252, NFPA 257, UL 9, UL 10B, UL 10C, ULC 104 and ULC 106.

.3 Testing Laboratory: Fire test shall be conducted by a nationally recognized independent testing laboratory.

.2 Listings and Labels: Fire rated glazing shall be under current follow-up service by a nationally recognized independent testing laboratory approved by OSHA and maintain a current listing or certification. Assemblies shall be labeled in accordance with limits of listings.

1.6 Project Conditions

.1 Field Measurements: Verify actual measurements for openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.9 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of five years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Fire Rated Glazing

.1 Material:

.1 Fire protective impact safety rated laminated glass ceramic with hose stream, fire rating as indicated.

.2 Conforming to CAN/ULC S104 and CAN/ULC S106

.2 Product and Manufacturer:

.1 PYRAN Platinum L as manufactured by SCHOTT Technical Glass Solutions

.2 Keralite Select L as manufactured by VETROTECH SAINT-GOBAIN NORTH AMERICA INC

.3 Firelite Plus Premium as manufactured by Nippon Glass.

.3 Design Requirements:

.1 Thickness: 8 mm thick.

.2 Weight: 19.5 kg/m^2

.3 Sound Transmission Rating: 36 STC.

.4 Appearance: Neutral colouration free of amber tints.

.5 Fire Rating: Fire rated from 20-180 minutes with hose stream.

.6 Impact Safety Rating: Meet CPSC 16 CFR 1201 Category I & II.

.7 Cradle to Cradle Certification: Must be C2C Silver Certified.

.8 Polished finish.

.9 ANZI Z97 Impact Safety Filmed and Laminated

.10 Environmental Impact: Manufacturing process and final composition free from toxins or hazardous heavy metals.

.4 Each piece of fire-rated glazing material shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory and fire rating.

2.2 Accessories

.1 Glazing Accessories: Manufacturer recommended fire rated glazing accessories as follows:

.1 Glazing tape: Closed cell polyvinyl chloride (PVC) foam, Pemko Manufacturing Company, FG3000S90 or Unifax Corporation Fiberfrax Alumino-Silicate fiber glazing tape.

.2 Setting blocks: Calcium silicate or hardwood.

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

2.3 Related Products

.1 Glazing shall be installed in an equally rated framing system.

2.4 Source Quality

.1 Obtain fire rated glazing products from a single manufacturer.

.2 Fabrication Dimensions: Fabricate to required dimensions.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Comply with manufacturer's product data including product technical bulletins and installation instructions.

3.2 Examination

.1 Verify substrate conditions, have been previously installed under other sections, and are acceptable for product installation in accordance with manufacturer's instructions.

3.3 Installation

.1 Comply with referenced GANA manuals and instructions of manufacturers of glass, glazing sealants and glazing compounds.

.2 Protect glass from edge damage during handling and installation. Inspect glass during installation and set aside pieces with edge damage that could affect performance.

.3 Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

.4 Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

.5 Arrange two setting blocks located at quarter points of glass with edge block no more than 150 mm from corners.

.6 Glaze vertically into labeled fire rated frames or fire rated walls with the same fire rating as the glass and push against tape for full contact at perimeter of pane or unit.

.7 Place glazing tape on free perimeter of glazing in same manner described above.

.8 Install removable stop and secure without displacing the tape.

.9 Install so that appropriate markings remain permanently visible.

.10 Field cutting or tampering is strictly prohibited.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Protect glass from contact with contaminating substances resulting from construction operations. Remove such substances by method approved by manufacturer.

.3 Wash glass on both faces not more than four days prior to date schedule for inspections intended to establish date of Substantial Performance. Wash glass by method recommended by glass manufacturer.

.4 Remove temporary coverings and protection of adjacent work areas.

.5 Remove construction debris from project site and legally dispose of debris.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 05 12 23 Structural Steel

.2 Section 07 62 00 Sheet Metal Flashing and Trim

.3 Section 07 92 00 Joint Sealants

1.3 References

.1 ASTM International (ASTM)

.1 ASTM B209/B209M-21a Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.2 ASTM B211/B211M-23 Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire

.3 ASTM B221-21 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.2 CSA Group (CSA)

.1 CAN/CSA S157-17/S157.1-17 (R2022) Strength Design in Aluminum

.2 CAN/CSA S136-16 (R2026) North American Specification for the Design of Cold-Formed Steel Structural Members

.3 Architectural Aluminum Manufacturers Association (AAMA)

.1 AAMA 611-24-Specification for Anodized Architectural Aluminum

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings: Submit shop drawings showing the location, finished appearance and dimensions of each type of louver. Show all material, thicknesses, connections, fastenings, shapes and finishes.

.3 Structural Requirements: Unless otherwise noted, design all materials to withstand a minimum wind load of 955 PA and as required by the applicable building code, and recommended by the louver manufacturer.

.1 Ensure louvre members deflect no more than L/180 of span between supports when subjected to wind load applied horizontally to louver face.

.2 Delegated Design Submittals: Furnish complete design calculations and details, fabrication and erection shop drawings and site review for fixed louvers, bearing the seal of a Professional Engineer registered in the Province of the Work, in accordance with applicable Building Code and Contract Documents.

.4 Coating Samples: Submit samples of factory applied coatings and finishes for Consultant's initial selection.

.5 Samples: Submit for approval 305mm long sample lengths of each type of louver blade and frame extrusion prior to full scale production, showing finish colour.

.6 Provide operation and maintenance data for louvred equipment enclosures for incorporation into Operations and Maintenance Manuals specified in Section 01 78 00 - Closeout Submittals.

.1 Include specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.5 Administrative Requirements

.1 Pre-Construction Conference: Arrange a site meeting attended by the Contractor, the Subcontractor, the Consultant, materials supplier(s), and other relevant personnel before commencement of work for this Section.

.1 Review methods and procedures related to installation, including manufacturer's written instructions;

.2 Examine substrate conditions for compliance with manufacturers installation requirements;

.3 Review temporary protection measures required during and after installation.

1.6 Quality Assurance

.1 Structural Requirements: Design all materials to withstand wind and snow loads as required by the applicable building code.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturer / Supplier: Obtain materials from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties.

.3 Installers: Execute Work of this Section using qualified personnel skilled in installation of work of this Section, having a minimum of three (3) years proven experience of installations similar in material, design, and extent to that indicated for this Project.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Delivery: At the time of delivery, visually inspect all materials for damage. Note any damaged boxes, crates, or louver sections on the receiving ticket and immediately report to the shipping company and the material manufacturer.

.4 Storage: Store louvre raised off the ground and cover with a weather proof flame resistant sheeting or tarpaulin.

.5 Handling:

.1 Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.

.2 Louvre sections may be hoisted by attaching straps to the jambs and lifting the section while it is in a vertical position.

.3 Louvre sections should only be lifted and carried by the jambs. Heads, sills and blades are not to be used for lifting or hoisting louver sections.

1.8 Project Conditions

.1 Verify dimensions by field measurements before fabrication and indicate measurements on shop drawings where fixed louvers are indicated to fit walls and other construction.

.2 Establish dimensions and proceed with fabricating fixed louvers where field measurements cannot be made without delaying the work; allow for trimming and fitting.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.10 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of one year from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

.2 Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on aluminum louvers within the specified

warranty period and agreeing to repair finish or replace louvers that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, colour fade, chalking, cracking, peeling, and loss of film integrity for a period of ten (10) years from date of Substantial Performance.

PART 2 PRODUCTS

2.1 Manufacturer

.1 Basis of Design Manufacturer: Ten Plus Architectural Products Ltd. 5 - 2333 Millrace Court, Mississauga, Ontario, Canada, L5N 1W2 Phone: (888) 850-3878 Email: info@tenplus-online.com Website: www.tenplus-online.com

2.2 Materials

.1 Aluminum Extrusions: ASTM B211, Aluminum Alloy 6063-T52.

.2 Aluminum Sheet: ASTM B209, Aluminum Alloy 6063-T52.

.3 Fastenings: Provide zinc plated steel or AISI Type 304 stainless steel for screws and fasteners.

.4 Structural Support: Designed and furnished by louver manufacturer to support wind load of 955 Pa, unless otherwise specified.

2.3 Vision Screen Stationary Louvres

.1 102mm deep, inverted blade vision screen, with 6063-T52 aluminum alloy extrusion, and as described in the following performance criteria:

.1 Extrusion Thickness:

.1 Head, Sill, Jambs and Mullions: Minimum 2mm thick.

.2 Blades: Minimum 2mm thick.

.2 Louver Type: Mullion or continuous line construction

.3 Blade Angle: 52º

.4 Free Area - 1220mm x 1220mm unit: 0.639m²

.5 Percentage of Free Area: 43.3%

.2 Basis of Design Product: Model S4522 inverted blade Vision Screen by Ten Plus Architectural Products Ltd.

.3 Description:

.1 Vision Screen assembly shall consist of straight blades designed to cut off sight lines beyond the back of the screen.

.2 Heads, sills, (if required) jambs and mullions to be one piece extruded aluminum members with integral caulking slots.

.3 Blades to be mullion type or continuous line construction with vertical mullions or recessed, structural supports located at maximum 1524mm centers. ```

2.4 Finishes

.1 Clear Anodized Finish:

.1 Class I Finish: Architectural Class I, clear coating 0.018mm or thicker in accordance with AAMA 611.

.2 Exposed Steel Finishing:

.1 Shop Primer for Ferrous Metal: Organic zinc rich primer, ready for finish painting by Section 09 91 13.

2.5 Accessories

.1 General: Provide metal framing, furring, brackets, clips, hangers, and incidental components included as required for secure fastening; weather-tight installation with non-corrosive fasteners provided.

.2 Fasteners and Anchors:

.1 For Aluminum: Series 300 or 400 stainless steel.

.2 For Steel Exposed to Weather: Series 300 stainless steel.

.3 Flashings: Same material as louver frame, formed to required shape, single length in one piece per location.

.4 Sealant: As specified in Section 07 92 00.

2.6 Fabrication

.1 Fabricate for optimum performance with respect to water penetration, strength, durability and uniform appearance.

.2 Fabricate louvers to outside dimensions indicated, with allowance of 10mm (3/8”) on each side for sealant joints. Coordinate size, location and placement of units, with installer, prior to fabrication.

.3 Fabricate louvers to minimize field adjustments, splicing, mechanical joints and field assembly of units. Assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.

.4 Clearly mark units for assembly and coordinated installation. Include vertical structural supports, where required.

.5 Where, required provide vertical mullions of type and spacing indicated but not greater than 1524mm o/c. Mechanically assemble louvers using stainless steel or zinc plated steel fasteners recommended by manufacturer.

.6 Provide supports, anchors and accessories required for a complete assembly.

PART 3 EXECUTION

3.1 Examination

.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.

.2 Proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

3.2 Installation

.1 Comply with manufacturer's instructions and recommendations for installation of the work, as shown on reviewed shop drawings.

.2 Anchor louvers to the building substructure as indicated on shop drawings and architectural drawings.

.3 Erection Tolerances:

.1 Maximum variation from plane or location shown on the approved shop drawings 3mm in 3048mm.

.2 Erection tolerances shall prevail under both load and no load conditions.

.4 Cut and trim component parts during erection only with the approval of the manufacturer, and in accordance with the manufacturer’ recommendations. Restore finish completely.

.5 Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.

.6 Set units level, plumb and true to line, with uniform, tight joints to adjacent work.

.7 Provide necessary fastenings, anchors, clip angles, sills and sill flashings required to complete the installation.

3.3 Protection

.1 Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 At completion of installation, clean all surfaces so they are free of foreign matter using cleaners recommended by material manufacturer.

.3 Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Consultant, remove and replace damaged systems with new at no additional cost to the Owner.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 07 84 00 Firestopping

.2 Section 07 92 00 Joint Sealants

.3 Section 09 22 16 Non-Structural Metal Framing

.4 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C475/C475M-17(2022) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

.2 ASTM C514-04(2020) Standard Specification for Nails for the Application of Gypsum Board

.3 ASTM C840-20 Standard Specification for Application and Finishing of Gypsum Board

.4 ASTM C954-22 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

.5 ASTM C1002-22 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

.6 ASTM C1047-19 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

.7 ASTM C1396/C1396M-24 Standard Specification for Gypsum Board

.8 ASTM C1629/C1629M-19 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

.9 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.10 ASTM E814-13a(2017) Standard Test Method for Fire Tests of Penetration Firestop Systems

.11 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems

.12 ASTM G21-15(2021)e1 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

.2 American National Standards Institute (ANSI)

.1 ANSI A118.9-1992 Test Methods and Specifications for Cementitious Backer Units

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 19-GP-21M Sealing and Bedding Compound for Acoustical Purposes

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102:2019 (R2024) Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC 114:2018 Standard Method of Test for Determination of Non-Combustibility in Building Materials

.3 CAN/ULC S129- 2015 Standard Method of Test for Smoulder Resistance of Insulation (Basket Method)

.4 ULC List of Equipment and Material, Volume III, Fire Resistance Ratings.

.5 Gypsum Association (GA)

.1 GA-214-2022 Recommended Levels of Gypsum Board Finish.

.2 GA-216-2021 Application and Finishing of Gypsum Board.

.6 Wall and Ceiling Bureau (WCB)

.1 Technical Bulletin Control Joint Placement in Gypsum Board Assemblies

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 Quality Assurance

.1 Dry wall installers: minimum 5 years proven experience.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 Design Requirements

.1 Where indicated provide minimum sound transmission rating of installed partitions of STC 50 tested to ASTM E90.

.2 Provide fire resistance rating of installed partitions as indicated and according to referenced ULC design.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Protect gypsum board materials before, during and after installation and to protect the installed work and materials of other trades affected by this work. Store materials in a dry area inside the building. Do not remove wrapping until ready for use. Prevent damage to all edges and surfaces.

1.8 Project Conditions

.1 Maintain temperature minimum 10 ° C, maximum 21 ° C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Gypsum Board

.1 To ASTM C1396/C1396M. Standard for non-rated applications, Type X for rated applications, 1220 mm wide x maximum practical length, ends square cut, edges tapered with round edge, 12.7 mm thick or to thickness indicated on drawings. All fire rated board shall be minimum 16 mm thickness.

.2 Abuse Resistant Gypsum Board:

.1 Basis of Design: CGC Sheetrock Brand AR Firecode C Panels. To ASTM C1658

.2 Thickness: 15.9 mm.

.3 Core: Type X.

.4 Edges: Tapered.

.5 CAN/ULC-S114 Noncombustible

.6 Surface-burning characteristics:

.1 Flames spread: CAN/ULC-S102 Flame Spread Index: 15

.2 Smoke developed: CAN/ULC-S102 N/A

.7 Surface Abrasion: ASTM C1629/C1629M; Level 3.

.8 Indentation: ASTM C1629/C1629M; Level 1.

.9 Soft-Body Impact: ASTM C1629/C1629M; Level 2.

.10 Hard-Body Impact: ASTM C1629/C1629M; Level 1.

.3 Moisture and Mould Resistant Gypsum Board

.1 Basis of Design: CGC Sheetrock Brand Mold Tough Panels Firecode X. To ASTM C1396

.2 Thickness: 15.9 mm.

.3 Core: Type X.

.4 Edges: Tapered.

.5 CAN/ULC-S114 Noncombustible

.6 Surface-burning characteristics:

.1 Flames spread: CAN/ULC-S102 Flame Spread Index: 15

.2 Smoke developed: CAN/ULC-S102 N/A

.3 ASTM C473, Standard Test Methods for Physical Testing of Gypsum Panel Products

.1 Core Hardness: Not less than (49 N)

.2 Flexural Strength

.1 Parallel Not less than 205 N

.2 Perpendicular Not less than 1654 N)

.4 Humidified Deflection: Not greater than 15.9 mm

.5 Average Water Absorption: Not greater than 5% by weight after two-hour immersion.

.6 ASTM D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber: Meets ASTM C1396 specifications.

2.2 Fastening and Adhesives

.1 Drywall Screws: To ASTM C954 or ASTM C1002 self-drilling, self-tapping, case hardened, length to suit board thickness and provide minimum 12 mm penetration into support.

.2 Joint Tape: To ASTM C475, 50 mm perforated with preformed seam, mould and mildew resistant.

.1 Joint tape for abuse resistant gypsum board: CGC Mould Resistant Fiberglass Drywall Tape.

.3 Joint Filler and Topping: To ASTM C475 vinyl or latex base, slow setting.

.4 Laminating Compound: as recommended by manufacturer, asbestos-free.

2.3 Acoustic Insulation

.1 Acoustic Insulation: Mineral or Glass Fibre Acoustic Insulation:

.1 Mineral Fibre Acoustic Insulation: To ASTM C665, Mineral fibre blanket insulation, minimum density of 40 kg/m^3:

.1 AFB Acoustical Fire Batts manufactured by Roxul Inc.

.2 Creased SAFB manufactured by Owens Corning Canada.

.2 Glass Fibre Acoustic Blanket Insulation: To CAN/ULC-S702, type 1, pre-formed unfaced glass fibre batt acoustic insulation.

.1 QUIETZONE Acoustic Blanket insulation manufactured by Owens Corning Canada.

.2 Surface burning characteristics to ULC 102:

.1 Flame spread: 15

.2 Smoke developed: 5

.3 Smoulder resistance: to ULC 129.

.4 Non-combustible: to ULC 114

.3 Thickness to suit depth of wall framing and as indicated.

.4 Acoustic sealant: as specified in Section 07 92 00 - Joint Sealants.

2.4 Accessories

.1 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process 0.5 mm base thickness, perforated flanges, one piece length per location.

.2 Insulating Strip: Rubberized, moisture resistant, 3.0 mm thick, 12 mm wide closed cell neoprene strip, with self-sticking permanent adhesive on one face; lengths as required.

.3 Sealants: as specified in Section 07 92 00 - Joint Sealants.

PART 3 EXECUTION

3.1 General

.1 Prior to installation of gypsum wallboard, ensure that all required vapour barriers, air seals, gaskets and the like installed under another Section have been inspected and accepted by Municipal authorities and the Consultant. Failure to do so will result in removal of all gypsum board installed prior to approval and replacement, at no additional cost to the Owner.

.2 Unless otherwise indicated on the drawings, all gypsum board partitions shall extend from floor level to the underside of floor or roof structures above.

3.2 Acoustic Insulation

.1 Install acoustic blankets full width and length, with tight joints, between wall framing and around penetrating electrical service boxes, piping, air ducts and frames.

.2 Place acoustic blankets where indicated on the Drawings and to thickness required to obtain acoustic performance indicated for the assembly.

.3 Place acoustic blankets between studs ensuring friction fit, free of sags, folds or open

joints that may let sound pass through.

.4 Install blankets from the bottom up, tightly adjusted and trim accurately with a utility knife.

3.3 Gypsum Board Application

.1 Do application and finishing of gypsum board in accordance with ASTM C840 and/or GA-216 except where specified otherwise.

.2 Do not apply gypsum board until bucks, anchors, blocking, electrical, and mechanical work are approved.

.3 Apply gypsum board at right angles to framing members or furring using screw fasteners. Maximum spacing of screws 300 mm o.c.

.4 Install fibre gypsum abuse resistant panels at all ceilings and bulkheads except as noted below. Treat joints with fibreglass reinforced joint tape in accordance with manufacturer's instructions.

.5 Apply water or moisture resistant gypsum wallboard where indicated. Apply water resistant sealant to edges, ends and cut outs which expose gypsum core.

.4 Install Moisture and Mould Resistant gypsum board where indicated.

.6 Apply single layer abuse resistant gypsum board to concrete and masonry surfaces, where indicated, using laminating adhesive.

.1 Comply with gypsum board manufacturer's recommendations.

.2 Brace or fasten gypsum board until fastening adhesive has set.

.3 Mechanically fasten gypsum board at top and bottom of each sheet.

.7 Carry gypsum board from floor to underside of floor or roof structure above. Furr out and carry gypsum board around any structural members as may be required. Neatly cope gypsum board to fill deck flutes where gypsum board abuts floor or roof deck.

3.4 Accessories

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

.2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.

.3 Install insulating strips continuously at edges of gypsum board or casing beads abutting exterior door or window frames, to provide thermal break.

.4 Install continuous bead of acoustic sealant at all penetrations through sound control partitions.

.5 Provide control joints in gypsum board facing. Construct control joints in accordance with ASTM C840 and as described in Wall and Ceiling Bureau Technical Bulletin “Control Joint Placement in Gypsum Board Assemblies”. Place control joints consistent with lines of building spaces as indicated. Where not indicated install as directed at maximum 6.0 m spacing. Control joints shall be supported with metal studs or furring channels on both sides of the joint Construct joints using back-to-back casing beads filled with a low modulus sealant capable of flexible joint movement. Maintain fire-resistance rating of wall assemblies. Control joints shall be provided:

.1 At abutting structural elements, steel columns.

.2 At expansion or control joints in the substrate.

.3 At each door jamb.

3.5 Access Doors

.1 Install access doors to electrical and mechanical fixtures specified in respective Sections.

.2 Rigidly secure frames to furring or framing systems, to satisfy fire rating requirements.

3.6 Taping and Filling

.1 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces. Finish to GA-214 Level 5.

.2 Finish corner beads, control joints and trims as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.3 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after painting is completed.

.4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.

3.7 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM C645-18 Standard Specification for Nonstructural Steel Framing Members

.3 ASTM C754-20 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

.4 ASTM C841-03(2018) Standard Specification for Installation of Interior Lathing and Furring.

.5 ASTM C1002-22 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

.6 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.7 ASTM E814-13a(2017) Standard Test Method for Fire Tests of Penetration Firestop Systems

.8 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems

.2 Canadian General Services Board (CGSB)

.1 CAN/CGSB-1.40-97 Primer, Structural Steel, Oil Alkyd Type

.3 Underwriters Laboratories of Canada (ULC)

.1 ULC List of Equipment and Material, Volume III, Fire Resistance Ratings

.4 CSSBI Lightweight Steel Framing Manual

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 Quality Assurance

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Metal Stud Framing Systems

.1 Non-load bearing channel stud framing: to ASTM C645, stud size as indicated, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.

.1 Thickness of materials to conform to referenced standards unless noted otherwise.

.2 Thickness of materials shall be selected from manufacturer’s standard span tables to suit total height requirements.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.

.3 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.4 Tie Wire: 0.90 mm, galvanized, soft annealed, steel wire or clip as recommended by the manufacturer of furring channels.

2.2 Metal Furring and Suspension Systems

.1 Channel framing: to ASTM C645, stud size as indicated, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board.

.1 Thickness of materials to conform to referenced standards unless noted otherwise.

.1 Metal Furring Runners, Hangers, Tie Wires, Inserts, Anchors: to ASTM C645 , electro-zinc coated steel.

Runner Channels: 38 x 19 x 0.59 mm and 38 x 9.5 x 0.45 mm, hot dip or electro-galvanized sheet steel. Use of various sizes governed by applied loads and applicable spans.

.2 Drywall Furring Channel: Channel shaped furring member for screw attachment of drywall with knurled face. For interior use. Furring masonry or concrete surfaces. Cross furring under steel joist or suspended metal channels in suspended ceiling systems: 70 x 22 x 0.9 mm with knurled face, hot dip or electro-galvanized sheet steel. Bailey D-1001.

.3 Deflection Track: Bailey Multi-Slot Track MST 250, size to suit studs, and top deflection clips TDC 350 and TDC 587.

.4 Horizontal Flange attachment: Bailey Horizontal Flange Attachment Clip (HFA Clip).

.5 Hangers: minimum 4.1 mm diameter (or as required by ULC fire rating design requirements) mild steel rods.

2.2 Fasteners

.1 Powder activated fasteners: to suit structural conditions and fastening requirements and in accordance with manufacturer’s recommendations: Ramset; Hilti; or approved equivalent.

.2 Sheet Metal Screws: To ASTM C1002, self-drilling, self-tapping, case hardened, length to suit board thickness and provide minimum 12 mm penetration into support.

2.3 Accessories

.1 Acoustic sealant: As specified in Section 07 92 00.

.2 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self-sticking adhesive on one face, lengths as required.

.3 Zinc Rich Paint: to CGSB 1-GP-181M. Low VOC type.

PART 3 EXECUTION

3.1 Examination

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant.

3.2 Erection

.1 Comply with ASTM C754.

.2 All gypsum board shall be supported with steel framing whether indicated or not.

.3 Unless otherwise indicated on the drawings, all gypsum board partitions shall extend from floor level to the underside of floor or roof structures above.

.4 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum. Provide top deflection tracks where indicated or as required to permit structural deflection. Install top deflection clips as necessary to increase load capacity.

.5 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.6 Place studs vertically at 400 mm on centre unless noted otherwise and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.7 Erect metal studding to tolerance of 1:1000.

.8 Attach studs to bottom and ceiling track using screws.

.9 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.10 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.11 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.12 Install heavy thickness single jamb studs at openings.

.13 Erect track at head of door/window openings and sills of window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.14 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.15 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.16 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.17 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks.

.18 Install continuous insulating strips to isolate studs from un-insulated surfaces.

.19 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.

.20 Install supplementary framing, and blocking or backing to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

3.3 Wall Furring

.1 Install wall furring for gypsum board wall finishes in accordance ASTM C754 and ASTM C841 except where specified otherwise and indicated on drawings.

.2 Frame openings and around built-in equipment, cabinets, access panels, etc., on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.3 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.4 Suspended and Furred Ceilings and Bulkheads

.1 Erect hanger and runner channels for suspended gypsum board ceilings and bulkheads in accordance with ASTM C754 and ASTM C841 except where specified otherwise and indicated on drawings.

.2 Securely anchor hanger to structural supports 1220 mm o.c. maximum along runner channels and not more than 150 mm from ends. Under no circumstances shall hanger wires be secured to or supported from mechanical or electrical materials or equipment or penetrate mechanical ductwork.

.3 Space runner or furring channels as shown on drawings and not more than 610 mm o.c. maximum nor 150 mm from walls. Run channels in long direction of board. Bend

hanger sharply under bottom flange of runner and securely wire in place with a saddle tie. Provide channels below mechanical or electrical equipment and mechanical ductwork to maintain maximum spacing.

.4 Install furring channels transversely across runner channels in short direction of wallboard at 610 mm o.c. maximum or 150 mm from walls and interruptions in ceiling continuity. Secure channels to support with furring clips or wire. Where splicing is necessary lap minimum 200 mm and wire tie each end with double loops of 0.90 mm galvanized tie wire, 25 mm from each end of overlap.

.5 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 610 mm around perimeter of fixture. Coordinate with Electrical.

.6 Install work level to tolerance of 1:1200.

.7 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, etc.

.8 Install furring channels parallel to, and at exact locations of steel stud partition header track.

.9 Furr for gypsum board faced vertical bulkheads within or at termination of ceilings.

3.5 Gypsum Board

.1 Installation of gypsum board is specified in Section 09 21 16

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

.2 Section 04 20 00 Concrete Unit Masonry

.3 Section 07 92 00 Joint Sealants

.4 Section 07 95 13 Expansion Joint Covers

.5 Section 09 21 16 Gypsum Board

1.3 References

.1 ASTM International (ASTM)

.1 ACTM C144-18 Standard Specification for Aggregate for Masonry Mortar

.2 ASTM C150/C150M-22 Standard Specification for Portland Cement

.3 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes

.4 ASTM C627-18e1 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems using the Robinson-Type Floor Tester

.2 American National Standards Institute (ANSI)

.1 ANSI A108/A118/A136.1:2017 American National Specifications for the Installation of Ceramic Tile.

.2 ANSI A118.10 Waterproof Membrane

.3 ANSI A137.1: 2017 American National Standard Specifications for Ceramic Tile

.3 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP 22M 1978 Adhesive, Organic, for Installation of Ceramic Wall Tile

.4 International Standards Organization (ISO)

.1 ISO 10545 Series Ceramic Tiles, Standards for Testing

.2 ISO 13006-2012 Ceramic Tiles, Definitions, Classifications, Characteristics and Marking.

.3 ISO 13007-2010 Ceramic Tiles, Grouts and Adhesives.

.5 Terrazzo, Tile and Marble Association of Canada (TTMAC)

.1 TTMAC 2019-2021 Specifications Guide 09 30 00, Tile Installation Manual.

.2 TTMAC Hard Surface Maintenance Guide.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Provide product data. Include manufacturer's information on:

.1 Ceramic tile, marked to show each type, size, and shape required.

.2 Mortar and grout.

.3 Divider strip.

.4 Levelling compound.

.3 Submit duplicate samples of tile. Samples to be submitted on 300 x 600 mm sample board for each colour, texture, size and pattern of tile. Grout sample joints for representative sample of final installation.

.4 Trim and Accessories: submit duplicate samples of each trim.

.5 Maintenance Data: Provide maintenance data for tile work, for incorporation into Maintenance Manuals specified under Section 01 78 00.

1.5 Quality Assurance

.1 Do tile work in accordance with Installation Manual 200, Ceramic Tile, by Terrazzo, Tile and Marble Association of Canada (TTMAC), except where this specification is more stringent.

.2 Installer of ceramic tiles shall have a minimum of 10 years of experience including at least five projects of similar scope and scale. Submit documented proof of experience prior to commencing work of this Section.

.3 The setting material manufacturer's representative shall review the details with the Contractor prior to the start of work. Instruct the Contractor on the proper installation procedures to ensure compliance with the guarantee requirements.

1.6 Performance Requirements

.1 Floor Traffic Load Bearing performance: Provide installations rated for the following load bearing performance in accordance with ASTM C627 for ceramic tile installed on walkway surfaces:

.1 Moderate: passes cycles 1 through 10.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver packaged materials in original unopened containers.

.3 Keep delivered material dry and free from stains. Store cementitious material off damp surfaces.

.4 Use all means necessary to protect materials, before, during and after installation and to protect the installed work and materials of all other trades.

.5 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Consultant and at no additional cost to the Owner.

.6 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.8 Project Conditions

.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 °C for 48 hours before, during and after installation.

.2 Do not install tiles at temperatures less than 12 °C or above 38 °C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 °C or above 25 °C.

.4 Provide and maintain temporary lighting. Lighting levels shall be sufficient to complete work including inspections. Provide minimum lighting levels of 400 lux at work areas.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.10 Maintenance

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 – Closeout Submittals.

.2 Upon completion of the installation and as a condition of acceptance, deliver to the Owner 2% of tile and accessory tiles in each colour and pattern of ceramic tiles installed under this Section for the Owners maintenance program. Identify each carton for location and installation date. Submission must be made all at one time and prior to

Substantial Performance.

1.11 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of five years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Materials

.1 Materials shall be graded and containers grade sealed, delivered to the job site in their original packages or containers with the manufacturer's labels and seals intact.

.2 Tile and grout colours shall be selected by the Consultant from the manufacturer's standard range of colours.

.3 Tile shall conform to ANSI A137.1.

.4 Floor tile shall have coefficient of slip resistance conforming to ANSI A137.1.

.5 Provide coves, corners, reveals, surf caps, inners and outers as required to complete the work.

2.2 Ceramic Tile

.1 Porcelain Floor Tile: Daltile, Volume 1.0 305 x 305 mm. One field tile, 3 accent colours.

.2 Porcelain tactile indicators: Olympia, Tactile Dome, 305 x 305 mm.

.3 Porcelain Wall Tile: Centura, Costa Nova, 51 x 204 mm, stacked, matte finish

2.3 Mortar, Adhesives and Grout Material

.1 Primer: Low VOC, low viscosity primer as recommended by manufacturer to suit substrate and site conditions; provide proof of bonding ability of setting systems where manufacturer recommends that a primer is not necessary to installation.

.2 Surface Preparation Materials:

.1 Portland Cement Mortar: Scratch and bond coat, levelling bed containing the following:

.1 Portland Cement: Meeting or exceeding requirements of CSA A3000, Type GU.

.2 Hydrated Lime: Meeting or exceeding requirements of ASTM C207, Type N.

.3 Sand: Meeting or exceeding requirements of ASTM C144, passing 16 mesh.

.4 Water: Potable.

.3 Wall Tile Systems:

.1 Thin Set Interior Installation: Dry set mortar meeting or exceeding requirements of ANSI A118.1 formulated for thin set applications, factory sanded mortar consisting of Portland cement, sand and additives requiring only addition of potable water for installation complete with bond enhancing latex additive.

.4 Floor Tile Systems:

.1 Thin Set Interior Installation: Latex-Portland cement mortar meeting or exceeding requirements of ANSI A118.1, rated for floor traffic load bearing performance indicated above.

.5 Adhesive Systems:

.1 Epoxy Adhesive: Thin set adhesive system using 100% solids epoxy resin and epoxy hardener meeting or exceeding requirements of ANSI A108.1; stain proof, chemical resistant and having high temperature resistance and water cleanable.

.2 Organic Adhesive: Thin set wall tile adhesive system using non-flammable, water resistant, latex adhesives for interior use meeting or exceeding requirements of ANSI A108.1, Type 1.

.6 Tile Grout Systems:

.1 Unsanded Portland Cement Grout: factory blended dry-set stain resistant, latex modified Portland cement meeting or exceeding requirements of ANSI A118.6, specifically formulated for joints less than or equal to 3 mm in width.

.2 Epoxy Grout: 100%-solids, chemical-resistant, stain-free, nonsagging epoxy grout meeting ANSI A118.3 and ISO 13007 Class RG requirements. Mapei Kerapoxy.

2.4 Patching and Levelling Compound

.1 Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and levelling concrete floors, capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish and having not less than the following physical properties:

.1 Compressive strength: 25 MPa.

.2 Tensile strength: 7 MPa.

.3 Flexural strength: 7 MPa.

.4 Density: 1.9

.5 Products containing gypsum are not acceptable.

.2 Levelling Compound: Laticrete 3701 latex or 226 Mapecem mortar mixed with Planicrete 50.

2.5 Floor Sealer and Protective Coating

.1 To tile and grout manufacturer's recommendations.

2.6 Accessories

.1 Reducers, edge trim, and transition strips: Schluter Systems purpose made aluminum.

.2 CT Edge Protection: Schluter RONDEC, size to suit tile thickness. Satin anodized aluminum. Trim to come with all connectors or end caps required for a complete and finished installation. As a minimum, provide edge protection at the following locations:

.1 Top of PC Base;

.2 Top of CT wall tile;

.3 All outside corners of wall tile or porcelain ceramic tile base.

.3 Sealant: as specified in Section 07 92 00.

2.7 Mixes

.1 Mix premanufactured mortars and grouts in accordance with referenced standards, and mortar and grout manufacturer's written instructions; mix site mixed materials as follows:

.1 Scratch Coat (by volume): Mix 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC detail.

PART 3 EXECUTION

3.1 Surface Conditions

.1 Surfaces on which tile is to be applied, shall be thoroughly cleaned down.

.2 Verify that concrete substrates have been allowed to cure for a minimum of 28 days in accordance with TTMAC requirements.

.3 Verify that substrates for bonding tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and are within starting flatness tolerances as specified in Section 03 30 00 and are ready for application of levelling materials specified in this Section.

.4 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of Work, and similar items located in or behind tile have been completed before installing tile.

.5 Drywall surfaces on which wall and floor tile is to be applied, shall be free from dust, excess plaster and shall be plain and true without any irregularities.

.6 In the event of discrepancies, immediately notify the Consultant and do not proceed with installation in such areas until all such discrepancies have been fully resolved.

.7 Check that conditions of temperature, humidity, traffic and usage are suitable as required by Installation Manual specifications. Minimum temperature to be not less than 10°C.

.8 Check that surfaces ready to receive tiling are cured, level and/or graded, plumb, smooth, firm, free from loose particles, droppings, projection, grease, solvent, paint and other foreign matter and from other unsuitable conditions.

.9 Install transition strips, reducers and edge trim at exposed edges of all tiled walls and floors in accordance with manufacturer's instructions.

3.2 Installation

.1 Install tiling in accordance with requirements of TTMAC Tile Installation Manual and parts of ANSI A108 Series of tile installation standards that apply to types of bonding and grouting materials, and to methods required for complete tile installation.

.2 Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions:

.1 Terminate Work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

.2 Make cut edges smooth, even and free from chipping.

.3 Do not split tile.

.3 Accurately form intersections and returns; perform cutting and drilling of tile without marring visible surfaces:

.1 Cut, drill, and fit tile to accommodate work of other subcontractors penetrating or abutting work of this Section.

.2 Carefully grind cut edges of tile abutting trim, finish, or built in items for straight aligned joints.

.3 Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile and to provide a uniform joint appearance.

.4 Lay tile in pattern indicated on Drawings and as follows:

.1 Align joints when adjoining tiles on floor, base, walls, and trim are the same size.

.2 Centre tile patterns between control and movement joints; notify Consultant for further instructions where tile patterns do not align with control or movement joints.

.3 Cut tile accurately and without damage.

.4 Smooth exposed cut edges with abrasive stone, where exposed.

.5 Chipped or split edges are not acceptable.

.5 Bonding Bed: Set tile in place while bond coat is wet and tacky and as follows:

.1 Adjust amount of bonding materials placed on substrates based on temperature and humidity to prevent skinning over of bonding materials.

.2 Use sufficient bond coat to provide a minimum 80% contact for tiles smaller than 300 mm x 300 mm with bonding material evenly dispersed and pressed into back of tile; refer to back buttering requirements for larger materials and installations having Moderate or higher Load Bearing Performance requirements.

.3 Notch bond coat in horizontal straight lines and set on freshly placed bonding material while moving (sliding) tile back and forth at 90° to notches.

.4 Verify that corner and edges are fully supported by bonding material.

.5 Set tiles to prevent lippage greater than 1 mm over a 3 mm grout joint.

.6 Keep two-thirds of grout joint depth free of bonding materials.

.7 Clean excess bonding materials from tile surface prior to final set.

.8 Sound tiles after bonding materials have cured and replace hollow sounding tile before grouting.

.6 Back Buttering: Obtain 100% mortar coverage in accordance with applicable requirements for back buttering of tile in referenced TTMAC and ANSI A108 series of tile installation standards for the following applications:

.1 Tile installed with chemical resistant mortars and grouts

.2 Tile 300 mm or larger in any direction

.3 Tile with raised or textured backs

.4 Tile installation rated for Heavy or Extra Heavy Duty.

.5 All 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.

.7 Install prefabricated edge strips and control at locations indicated or where exposed edge of floor tile meets different flooring materials and exposed substrates.

.8 Protect exposed edges of floor tile with properly sized transition strips, use sloped reducer strips where uneven transitions between 6 mm and 13 mm occur.

.9 Control and Movement Joints: Install control joints and expansion joints in tile work in accordance with TTMAC Detail 301MJ; keep control and expansion joints free of bonding materials and as follows:

.1 Cut tiles to establish line of joints; sawn joints after installation of tiles will not be acceptable.

.2 Locate joints in tile surfaces directly above joints in concrete substrates.

.3 Provide floor control joints over structural control joints.

.4 Install prefabricated joint profiles in accordance with manufacturer's written instructions, set with top surface of joint profile slightly below top surface of tile.

.5 Prepare joints and apply sealants in accordance with requirements of Section 07 92 00.

.6 Keep control and movement joints free from setting materials.

.7 Form an open joint for sealant in tile wherever a change in backing material occurs, at all vertical interior corners, around penetrating pipes and fixtures, and where tile abuts other materials or fixtures.

.8 Install control joints where indicated or at not less than the flowing spacings:

Environment	**Minimum**	**Maximum**	**Joint Width (minimum)**
Interior/Shaded	4800 mm	6100 mm	6 mm

3.3 Grouting

.1 Grouting: Install grout in accordance with manufacturer's written instructions, the requirements of TTMAC, and as follows:

.1 Allow proper setting time before application of grout.

.2 Pre-seal or wax tiles requiring protection from grout staining.

.3 Force grout into joints to a smooth, dense finish.

.4 Remove excess grout in accordance with manufacturer's written instructions and polish tile with clean cloths.

.2 Grout all tile using specified grout in strict accordance with manufacturers written instructions all to give a flush, hard joint.

.3 Joints in tile shall be filled solid and flush with grout.

.4 Prepare joints and mix grout in accordance with manufacturer's printed instructions. Force maximum amount of grout into joints, avoiding air traps or voids.

.5 Remove all excess grout by washing diagonally across the joints. Check for voids, air pockets and gaps and fill same. Remove all discoloured grout and replace with new.

.6 Cure all joints.

3.4 Floor Sealer and Protective Coatings

.1 Apply in accordance with manufacturer's instructions.

3.5 Cleaning and Protection

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Cleaning: Clean tile surfaces so they are free of foreign matter using manufacturer recommended cleaning products and methods after completion of placement and grouting and as follows:

.1 Remove grout residue from tile as soon as possible.

.2 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation; protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.

.3 Flush surface with clean water before and after cleaning.

.3 Protection: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies as follows:

.1 Protect finished areas from traffic until setting materials have sufficiently cured in accordance with TTMAC requirements.

.2 Protect floor areas from traffic after grouting is completed in accordance with manufacturer's written instructions.

.3 Prevent foot and wheel traffic from floors for a minimum of 24 hours after completion of grouting.

.4 Provide protective covering until Substantial Performance of the Work.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 09 21 16 Gypsum Board

.2 Section 09 53 00 Acoustical Suspension

1.3 References

.1 ASTM International (ASTM)

.1 ASTM C423-23 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

.2 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.3 ASTM E1264-22 Standard Classification for Acoustical Ceiling Products

.4 ASTM E1414/E1414M-21a Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

.5 ASTM E1477-98a(2022) Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102:2019 (R2024) Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

.1 Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

.3 Submit duplicate 300 x 300 mm samples of each type of acoustical units.

.4 Provide maintenance data for acoustic panel ceilings for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

1.5 Quality Assurance

.1 Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

.2 Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

.3 Mock-up:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up 10 m² minimum of acoustical panel tile ceiling including one inside corner and one outside corner.

.3 Construct mock-up where directed.

.4 Allow 48 hours for inspection of mock-up by Consultant before proceeding with ceiling work.

.5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

1.6 Project Conditions

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15° C and humidity of 20-40% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

.4 Building areas to receive ceilings shall be free of construction dust and debris.

1.7 Performance Requirements

.1 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

.1 Surface Burning Characteristics: As follows, tested per ASTM E84 and complying with ASTM E1264 Classification.

.2 Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

.2 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.

1.8 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Protect on site stored or installed absorptive material from moisture damage.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.10 Extra Materials

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide acoustical units amounting to 5% of gross ceiling area for each pattern and type required for project.

.3 Ensure extra materials are from same production run as installed materials.

PART 2 PRODUCTS

2.1 Materials

.1 Acoustic units for suspended ceiling system: to ASTM E1264

.2 Panel Type 1:

.1 Surface Texture: Medium

.2 Composition: Mineral Fiber

.3 Colour: White

.4 Size: 610 x 1219 mm

.5 Edge Profile: Square Lay-in

.6 Noise Reduction Coefficient NRC ASTM C423 Classified w/ UL label on product carton 0.70

.7 Ceiling Attenuation Class CAC ASTM C1414 Classified w/ UL label on product carton 40 minimum

.8 Flame Spread: ASTM E 1264; Class A (UL)

.9 Light Reflectance (LR) White Panel: ASTM E1477; 0.85

.10 Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)

.11 Basis of Design Product:

.1 Armstrong School Zone Fine Fissured.

.3 Alternate manufacturer: Products as manufactured by the following are acceptable, subject to Consultants approval of style, finish, performance characteristics and texture:

.1 Armstrong Industries

.2 Certainteed

.3 Owa Acoustic Ceiling Systems

.4 Ceiling Suspension System: as specified in Section 09 53 00.

PART 3 EXECUTION

3.1 Examination

.1 Do not install acoustical panels until work above ceiling has been inspected by Consultant.

3.2 Installation

.1 Co-ordinate with Section 09 53 00 - Acoustical Suspension.

.2 Coordinate layout and installation of ceilings with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and fire-suppression system.

.3 Install acoustical panels and tiles in ceiling suspension system.

.4 Install acoustical units parallel to building lines with edge unit not less than 50% of unit width, with directional pattern running in same direction. Refer to reflected ceiling plan.

.5 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 05 12 23 Structural Steel

.2 Section 09 21 16 Gypsum Board

.3 Section 09 51 13 Acoustic Panel Ceilings

.4 Division 23 Mechanical

.5 Division 26 Electrical

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A307-21 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

.2 ASTM A641/A641M-19 Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire.

.3 ASTM A653 / A653M – 23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.4 ASTM A1011/A1011M-23 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

.5 ASTM C635/C635M-22 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings.

.6 ASTM C636/C636M-19 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.7 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.8 ASTM E119-22 Standard Test Methods for Fire Tests of Building Construction and Materials

.9 ASTM E1264-22 Standard Classification for Acoustical Ceiling Products

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

.3 Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

.4 Submit one representative model of each type of ceiling suspension system.

.1 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

1.5 Design Requirements

.1 Determine the superimposed loads that will be applied to suspension systems by components of the building other than the ceiling and ensure that adequate hangers are installed to support the additional loads in conjunction with the normal loads of the system.

.2 Design supplemental suspension members and hangers where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers at required spacing to support standard suspension system members:

.1 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

.3 Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of L/360 to ASTM C635 deflection test.

1.6 Performance Requirements

.1 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

.1 Surface Burning Characteristics: Tested per ASTM E84 and complying with ASTM E1264 Classification.

.2 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.

1.7 Quality Assurance

.1 Single-Source Responsibility: Provide acoustical panel units and grid components by a

single manufacturer.

.2 Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

.3 Where required, provide fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.4 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and as described in Section 09 51 13.

1.8 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.9 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Components: All main beams and cross tees, base metal and end detail shall be commercial quality hot-dipped galvanized steel as per ASTM C635. Main beams and cross tees shall be double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

.2 Face width: 22 mm

.3 Edge Moldings and Trim: Hemmed angle moulding to match main beams and cross tees.

.4 Structural Classification: Intermediate Duty System, ASTM C635.

.5 Colour: White and match the actual colour of the specified ceiling tile.

.6 Standard of Acceptance:

.1 Armstrong Prelude XL

.2 Donn DXT

.3 Certainteed Classic Environmental Stab.

.7 Attachment Devices: Size for five times design load indicated in ASTM C635, Table 1, Direct Hung unless otherwise indicated or required.

.8 Threaded Rod: to ASTM A397. Galvanized or zinc plated.

.9 Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 2.06 mm thick.

.10 Channel Framing and Fittings: Strut type metal framing and components to ASTM A1011 or ASTM A653. Unistrut P1000SL or equivalent. Galvanized.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 Examination

.1 Do not proceed with installation until all wet work such as concrete, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.3 Preparation

.1 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

.2 Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

.1 Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.4 Installation

.1 Install suspension system and panels in compliance with ASTM C636; CISCA Seismic Guidelines and in accordance with the manufacturer's installation instructions.

.2 Install wall moldings at intersection of suspended ceiling and vertical surfaces.

.3 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.

.4 Secure hangers to overhead structure using attachment methods as indicated by manufacturer. Do not suspend ceiling systems from building services including plumbing lines, conduit, cable trays or duct work.

.5 Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to: piping, ductwork, conduit and equipment. Provide trapeze or other supplementary support members at obstructions to allow typical hanger spacing. Brace assemblies must be configured and/or located in order to avoid obstructions in addition to maintaining the required brace assembly spacing.

.6 Install hangers spaced at maximum 1219 mm centres and within 152 mm from ends of main tees. Install hanger wires plumb and straight.

.7 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width.

.8 Ensure suspension system is coordinated with location of related components.

.9 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles, and speakers.

.10 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 610 mm around perimeter of fixture.

.11 Interlock cross member to main runner to provide rigid assembly.

.12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.13 Install access splines to provide ceiling access.

.14 Finished ceiling system to be square with adjoining walls and level within 1:1000

3.5 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Touch up scratches, abrasions, voids and other defects in painted surfaces.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-in-Place Concrete

1.3 References

.1 ASTM International (ASTM)

.1 ASTM E84-26a Standard Test Method for Surface Burning Characteristics of Building Materials

.2 ASTM F710-26 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

.3 ASTM F1066-04(2018) Standard Specification for Vinyl Composition Floor Tile

.4 ASTM F1344-21a Standard Specification for Rubber Floor Tile

.5 ASTM F1861-21(2025) Standard Specification for Resilient Wall Base

.6 ASTM F2169-15(2025) Standard Specification for Resilient Stair Treads

.2 Underwriters Laboratories of Canada (ULC)

.1 ULC 102.2-2018 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

.3 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-03, Adhesives and Sealants Applications.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit duplicate samples of manufacturer’s full range of colours for specified products for selection of colours by the Consultant.

.3 Submit a complete list of all materials proposed to be furnished and installed under this portion of the Work, stating manufacturer's name and catalogue number for each item, and product samples in colours specified.

.1 Submit two copies of the manufacturer's current recommended method of installation for each item.

.4 Provide maintenance data for resilient flooring for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

1.5 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Use all means necessary to protect resilient flooring materials before, during and after installation and to protect the installed work and materials of all other trades.

1.6 Maintenance Materials

.1 Provide extra stock materials of resilient flooring, base and adhesives in accordance with Section 01 78 00 – Closeout Submittals.

.1 Provide one carton of each colour, pattern and type flooring material required for this project for maintenance use.

.2 Provide one container of adhesive.

.3 Clearly identify each container of floor tile and each container of adhesive.

.2 Extra materials to be from same production run as installed materials.

1.7 Environmental Requirements

.1 Maintain air temperature and structural base temperature at floor installation area above 20° C for 48 hours before, during and after installation.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.9 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of ten years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Materials

.1 Vinyl Composition Tile: to CSA A126.1 or ASTM F1066, 305 x 305 x 3.2 mm thick, non-asbestos, Class 2 through pattern tile with static load of not less than 517 kPa and U.L.C. flame spread rating of 75 or less.

.1 Basis of Design Product: Armstrong Standard Excelon Imperial Texture.

.2 Colours: to be selected by the Consultant from full range of manufacturer's standards. Allow for 2 colours for each classroom.

.2 Resilient Base: To ASTM F1861, 100 mm high thermoplastic rubber, not less than 3.0 mm thickness with preformed internal and external corners. Base at resilient tile shall have standard toe.

.1 Basis of Design: Johnsonite DuraCove DC Rubber Wall Base.

.3 Rubber Stair Treads: one piece tread/riser combination with raised square pattern, full width and depth of stair with speckled pattern and 50 mm wide colour contrasting abrasive carborundum grit tape on stair nosing to meet ADA standards. Treads shall have a tapering thickness of 5.3 mm to 3.9 mm across a depth of 330 mm with a 180 mm integral riser.

.1 Basis of Design Product: Tarkett Color Splash treads with grit tape contrast strips.

.4 Rubber Floor Tile (Landings):

.1 Manufactured from a homogeneous composition of 100% synthetic rubber, high quality additives, and colorants to meet the performance requirements of ASTM F 1344, Class 1 – B Standard Specification for Rubber Floor Tile.

.2 Thickness: 3.17 mm

.3 Tile Size: 61 cm x 61 cm

.4 Product Performance and Technical Data

.1 Hardness (ASTM D 2240): Not less than 85 Shore

.2 Abrasion Resistance (ASTM D 3389): <1.0 gm weight loss

.3 Slip Resistance (ASTM D 2047): ≥ 0.5 SCOF

.4 Color Heat Stability (ASTM F 1514): < 8.0 □E

.5 Static Load Limit (ASTM F 970): Passes (250 psi load)

.6 Fire Resistance: • ASTM E 648/NFPA 253 (Critical Radiant Flux), Class 1 • ASTM E 662/NFPA 258 (Smoke Density), less than 450

.7 Chemical Resistance: ASTM F 925, Passed

.8 CAN/ULC S102.2: FSR 45 / SDR 265

.5 Basis of Design Product: Tarkett Color Splash Hammered Surface Rubber Floor Tile.

.5 Rubber Tactile Warning Surface:

.1 Manufactured from a homogeneous composition of 100% synthetic rubber, high quality additives, and colourants to meet the performance requirements of ASTM F1344, Class 1-A and 1-B Standard Specification for Rubber Floor Tile.

.2 Tactile Warning Tile (Attention Tile) Rubber Tiles (TW1): 4.0 mm dome height with 3.2 mm base thickness; 7.2 mm overall thickness.

.3 Tile Size: 61 cm x 61 cm,

.4 Meets CSA B651, current ISO/FDIS 23599 Assistive Products for The Blind and Vision-Impaired Persons – Tactile Walking Surface Indicators, Division A of Ontario Regulation 332/12, and Accessibility for Ontarians with Disabilities Act (AODA)

.5 Solid rubber floor tile to ASTM F1344.

.6 Abrasion Resistance (ASTM D 3389): < 1.0 gm weight loss

.7 Hardness ASTM D2240: Not Less than 85 Shore A

.8 Slip resistance ASTM D2047 SCOF ≥ 0.5

.9 Fire Resistance (ASTM E 648 - Critical Radiant Flux): Class 1

.10 Color Heat Stability (ASTM F 1514): < 8.0 □E

.11 Static Load Limit (ASTM F 970): Passes at 250 psi

.12 Smoke Generation ASTM E662 < 450

.13 CAN/ULC S102.2: FSR 45 / SDR 265

.14 Chemical Resistance (ASTM F 925): Passes

.15 Johnsonite Tactile Warning Tile – Rubber

.16 Basis of Design Product: Tarkett Solid Color Rubber Tactile Walking Surface Indicators

.6 Primers, Adhesives and Caulking: non-flammable, solvent free, waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.

.7 Sub-floor filler and leveler shall be white premixed latex compatible with flooring products and adhesive as recommended by flooring manufacturer for specific flooring types.

.8 Metal edge strips: aluminum extruded, smooth, mill finish with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.9 Transition strips, mouldings and adaptors shall be rubber or vinyl, manufactured by Johnsonite with lip to extend under floor tile with tapered edge, colour matched to flooring.

.10 Sealer: water based, type recommended by flooring manufacturer.

.11 Wax: type recommended by flooring manufacturer.

.12 All colours and patterns shall be as selected by the Consultant from the complete range of manufacturer's colours and patterns.

PART 3 EXECUTION

3.1 Surface Conditions

.1 Conform to requirements of ASTM F710.

.2 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

.3 Confirm that resilient flooring and base may be installed in accordance with the original design and the manufacturer's recommendations.

.4 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer. New concrete must be cured a minimum of 35 days prior to commencement of resilient flooring application.

.5 In the event of discrepancy, immediately notify the Consultant. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

.6 Perform subfloor moisture testing in accordance with ASTM F1869 and Bond Tests as described in manufacturer's installation guidelines to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not exceed 80%. MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

3.2 Sub Floor Treatment

.1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.2 Install sub floor and levelling compound to manufacturer's recommended standard limits and deviations. Levelling compound shall be applied to all subfloors and shall meet flatness requirements of flooring manufacturer and in accordance with ASTM F710.

.3 Remove all substance and materials affecting adhesive bond.

.4 Vacuum clean floors.

.5 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler is cured and dry.

.6 Prime or seal substrates to flooring and adhesive manufacturer's instructions.

.7 Allow for excessive leveling of existing slabs.

3.3 Application

.1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 hours after installation. Whenever possible, ventilate directly to outside. Do not allow contaminated air to re-circulate through the building ventilation system.

.2 Install all resilient flooring in strict accordance with the manufacturer's printed instructions and recommendations.

.3 Do not lay floor coverings and base until all trades, except painter, have completed their work and just prior to completion of the building.

.4 Apply adhesive uniformly with recommended trowels, at coverage as recommended by the manufacturer. Do not spread more adhesive than can be covered before initial set takes place.

.5 Lay flooring with joints parallel to building lines unless otherwise indicated, to produce symmetrical tile pattern. Patterns shall be as directed by the consultant. Allow for one field tile and one accent tile in each room or space. Border tiles shall be minimum ½ tile width.

.6 Install flooring to square grid pattern with all joints aligned unless otherwise indicated.

.7 As installation progresses, and after installation, roll flooring in 2 directions with a 45 kg roller to ensure full adhesion.

.8 Cut and fit tile neatly around fixed objects.

.9 Continue flooring throughout areas to receive movable type partitions or fitments without interrupting floor pattern.

.10 Install flooring full depth of closets, toe spaces, and recesses.

.11 Terminate flooring at centre line of door in openings where adjacent floor finish or colour is dissimilar.

.12 Install transition strips at unprotected or exposed edges where flooring terminates. Locate transition strip at centre line of door where a door occurs.

3.4 Tactile Warning Tile Installation

.1 Install in accordance with manufacturer's instructions.

3.5 Stair Tread Application

.1 Install stair treads and risers in one piece, full width and height of stairs and risers in accordance with manufacturer's printed instructions. Adhere over entire surface and fit accurately.

.2 Caulk edges of nosings with epoxy caulking.

3.6 Base Application

.1 Lay out base to keep number of joints to a minimum. Locate joints at maximum available spacing or at internal or pre moulded corners.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using a 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use pre-moulded end pieces at flush door frames.

.7 Cope internal corners. Use pre moulded corner units for right angle external corners. Use formed straight base materials for external corners of other angles, minimum 300 mm each leg.

.8 Provide rubber base at all locations specified, regardless of floor finish.

3.7 Protection

.1 Protect new floors until time of final inspection.

.2 Prohibit traffic on floors for 48 hours after installation.

.3 Immediately prior to final inspection, remove protection, clean, dry or damp mop resilient flooring and apply one additional coat of wax.

3.8 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Remove excess adhesive from resilient floor coverings, base and adjacent finished surfaces as the work progresses.

.3 Clean, seal and wax floor and base surfaces to manufacturer's instructions. In carpeted areas, clean base before installation of carpet.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 07 92 00 Joint Sealants

1.3 References

.1 ASTM International (ASTM)

.1 ASTM F1869-23 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

.2 ASTM F2170-19aStandard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

.2 International Concrete Repair Institute (ICRI)

.1 ICRI No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: For each type of product indicated.

.3 Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.

.4 Material Certificates: For each resinous flooring component, from manufacturer.

.5 Samples: Submit two 150 x 150 mm samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample colour and texture for approval fprior to installation.

.6 Submit maintenance instructions for resinous flooring for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00-Closeout Submittals.

1.5 Quality Assurance

.1 Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

.2 Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

.3 Pre-installation Conference: Conduct conference at Project site before work begins.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.7 Project Conditions

.1 Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

.2 Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

.3 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Manufacturer

.1 Basis of Design Manufacturer: The Sherwin Williams Company, 418 North Service Road E #200, Oakville, ON L6H 5R2

2.2 High-Performance Resinous Flooring

.1 Basis of Design Product:

.1 Sherwin Williams Resuflor Flex waterproofing and crack filler 2 coats. Resuflor MPE epoxy gloss topcoat 1 coat.

.2 VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

.1 Resinous Flooring: 100 g/L.

.3 System Characteristics:

.1 Resinous Flooring: Abrasion, impact and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.

.2 Colours: As selected by the Consultant from manufacturers complete range of colours.

PART 3 EXECUTION

3.1 Examination

.1 Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. Commencement of Work constitutes acceptance of surfaces.

.2 Verify that concrete substrates are dry and moisture-vapour emissions are within acceptable levels according to manufacturer's written instructions.

.1 Moisture Testing: Perform tests indicated below.

.1 Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours. Perform tests so that each test area does not exceed 1000 sq. ft. and perform 3 tests for the first 1000 sq. ft. and one additional test for every additional 1000 sq ft.

.2 In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

.3 Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

3.2 Preparation

.1 All manufacturers’ installation shall be implicitly followed.

.2 Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). Create a minimum

surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile as follows:

.1 Thin and medium films, 10 to 40 mils CSP-3 to CSP-5

3.3 Preparation

.1 Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

.2 Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

.3 Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

.4 Maintain a slab temperature of 15° C to 26° C for 24 hours minimum before applying floor topping, or as instructed by manufacturer.

3.4 Application

.1 Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

.2 Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

.3 Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

.4 Install resinous floor over properly prepared concrete surfaces in strict accordance with the manufacturer's directions.

.5 Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

.6 At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

.7 Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer’s written recommendations.

3.5 Protection

.1 Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

.2 Ensure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 09 91 23 Interior Painting

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A780/A780M-20 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

.2 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings)

.3 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specification Manual (ASM)

.2 MPI Standard GPS-1-12 and GPS-2-12 MPI Green Performance Standard for Painting and Coatings

.4 Society for Protective Coatings (SSPC)

.1 Systems and Specifications, SSPC Painting Manual 2024

.5 South Coast Air Quality Management District, California State (SCAQMD)

.1 SCAQMD Rule 1113-96 Architectural Coatings

.6 Green Seal GS-11 Green Seal Environmental Standard for Paints and Coatings, January 1997

.7 National Fire Code of Canada

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties and SCAQMD Rule 1113-96.

.5 Provide maintenance data for paint products for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00- Closeout Submittals. Include following:

.1 Product name, number, type and use.

.2 Colour numbers.

.3 MPI Environmentally Friendly classification system rating.

1.5 Quality Assurance

.1 Qualifications:

.1 Contractor: to have a minimum of five years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work.

.3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.2 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.3 Paint materials to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.4 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Consultant.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver and store materials in original containers, sealed, with labels intact. Labels to indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Provide and maintain dry, temperature controlled, secure storage. Store materials and equipment in well-ventilated area with temperature range 7 °C to 30 °C. Store materials and supplies away from heat generating devices.

.4 Observe manufacturer's recommendations for storage and handling.

.5 Keep areas used for storage, cleaning and preparation, clean and orderly. After completion of operations, return areas to clean condition.

.6 Remove paint materials from storage only in quantities required for same day use.

.7 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.8 Remove damaged, opened and rejected materials from site.

1.7 Fire Safety Requirements

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic in designated containers. Handle and dispose of hazardous materials in accordance with Municipal regulations.

.3 Unused materials must be disposed of at official hazardous material collections site.

.4 Paint and related materials are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from the Ministry of the Environment.

.5 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.6 Place materials defined as hazardous or toxic waste in containers or areas designated for hazardous waste.

1.9 Maintenance

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Owner and store where directed.

1.10 Ambient Conditions

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 51 00 – Temporary Utilities.

.2 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 °C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint

.4 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by Consultant and product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 °C.

.2 Substrate temperature is over 32 °C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 Relative humidity is above 85 % or when dew point is less than 3 °C variance between air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when maximum moisture content of substrate exceeds 12%.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 °C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

PART 2 PRODUCTS

2.1 Materials

.1 Paint materials listed in latest edition of MPI Approved Products List (APL) and from a single manufacturer for each system used are acceptable for use on this project.

.2 Paint materials for paint systems: to be products of single manufacturer.

.3 Only qualified products with E2 or E3 "Environmentally Friendly" ratings are acceptable for use on this project.

.4 Use only MPI listed ‘L’ rated materials.

.5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:

.1 Be water-based water soluble water clean-up.

.2 Be non-flammable biodegradable.

.3 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.

.4 Be manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.6 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including Fisheries Act and Canadian Environmental Protection Act (CEPA).

.7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.8 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61 °C or greater.

.9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 or E3 rating.

2.2 Colours

.1 Consultant will provide Colour Schedule.

.2 Exterior colour schedule will be based upon selection of three base colours and two deep tint accent colours.

.3 Selection of colours will be from manufacturer's full range of colours.

.4 Where specific products are available in restricted range of colours, selection will be based on limited range.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Mixing and Tinting

.1 Perform colour tinting operations prior to delivery of paint to site.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.

.4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 Gloss/Sheen Ratings

.1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees	Units @ 85 Degrees
G1 – matte finish	0 to 5	Max. 10
G2 – velvet finish	0 to 10	10 to 35
G3 – eggshell finish	10 to 25	10 to 35
G4 – satin finish	20 to 35	Min. 35

G5 – semi-gloss finish	35 to 70	
G6 – gloss finish	70 to 85	
G7 – high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces as specified.

2.5 Exterior Painting Systems

.1 Steel Doors, Frames and Metal Fabrications:

.1 EXT 5.1D – Alkyd G5 semi-gloss finish over alkyd primer.

PART 3 EXECUTION

3.1 General

.1 Perform preparation and operations for painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and application instructions, and data sheets.

3.2 Examination

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

3.3 Preparation

.1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

.2 Clean and prepare exterior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.

.5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.

.6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

.3 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements and SSPC-SP 6. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

3.4 Protection

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas.

3.5 Application

.1 Apply paint materials in accordance with paint manufacturer's written application instructions.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.7 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 Field Quality Control

.1 Standard of Acceptance:

.1 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.3 Remove protective coverings and warning signs as soon as practical after operations cease.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 05 50 00 Metal Fabrications

.2 Section 06 20 00 Finish Carpentry

.3 Section 08 11 00 Metal Doors and Frames

.4 Section 08 14 16 Flush Wood Doors

.5 Section 09 21 16 Gypsum Board

.6 Section 09 67 23 Resinous Flooring

.7 Section 09 91 13 Exterior Painting

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A780/A780M-20 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

.2 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings)

.3 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specification Manual (ASM)

.2 MPI Standard GPS-1-12 and GPS-2-12 MPI Green Performance Standard for Painting and Coatings

.4 Society for Protective Coatings (SSPC)

.1 Systems and Specifications, SSPC Painting Manual 2024

.5 Underwriters Laboratories of Canada (ULC)

.1 ULC 102-18 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.6 South Coast Air Quality Management District, California State (SCAQMD)

.1 SCAQMD Rule 1113-96, Architectural Coatings

.7 Green Seal GS-11 Green Seal Environmental Standard for Paints and Coatings, January 1997

.8 National Fire Code of Canada

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit full range colour sample chips.

.2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties and SCAQMD Rule 1113-96.

.5 Provide maintenance data for paint products for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00- Closeout Submittals. Include following:

.1 Product name, number, type and use.

.2 Colour numbers.

.3 MPI Environmentally Friendly classification system rating.

1.5 Quality Assurance

.1 Qualifications:

.1 Contractor: to have a minimum of five years proven satisfactory experience.

.2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work.

.3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

.3 Provide mock-up in accordance with Section 01 45 00 - Quality Control.

.1 Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen and textures. Locate where directed.

.2 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.

.3 Allow 24 hours for inspection of mock-up before proceeding with work.

.4 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver and store materials in original containers, sealed, with labels intact. Labels to indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Provide and maintain dry, temperature controlled, secure storage. Store materials and equipment in well-ventilated area with temperature range 7 ° C to 30 ° C. Store materials and supplies away from heat generating devices.

.4 Observe manufacturer's recommendations for storage and handling.

.5 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.6 Remove damaged, opened and rejected materials from site.

1.7 Fire Safety Requirements

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.8 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic in designated containers. Handle and dispose of hazardous materials in accordance with Municipal regulations.

.3 Unused materials must be disposed of at official hazardous material collections site.

.4 Paint and related materials are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from the Ministry of the Environment.

.5 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.6 Place materials defined as hazardous or toxic waste in containers or areas designated for hazardous waste.

1.9 Maintenance

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Owner and store where directed.

1.10 Ambient Conditions

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 51 00 – Temporary Utilities.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 ° C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.5 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved in writing by Consultant and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 ° C.

.2 Substrate temperature is above 32 ° C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3 ° C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 ° C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.2 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.3 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete to cure minimum of 28 days.

.2 15% for wood.

.3 12% for plaster and gypsum board.

.4 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.5 Test concrete and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

PART 2 PRODUCTS

2.1 Materials

.1 Provide paint materials for paint systems from single manufacturer.

.2 Products to meet requirements of GS-11 or SCAQMD Rule 1113-96

.3 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.4 Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use.

.5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Non-flammable, biodegradable.

.2 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.3 Manufactured without compounds which contribute to smog in the lower atmosphere.

.4 Do not contain methylene chloride, chlorinated hydrocarbons or toxic metal pigments.

.5 Recycled content of 15% post-consumer and ½ post-industrial waste.

.6 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.7 Flash point: 61 °C or greater for water-borne surface coatings and recycled water-borne surface coatings.

2.2 Colours

.1 Consultant will provide Colour Schedule.

.2 Colour schedule will be based upon selection of eight base colours and six deep tint accent colours.

.3 Selection of colours will be from manufacturer’s full range of colours.

.4 Where specific products are available in restricted range of colours, selection will be based on limited range.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Mixing and Tinting

.1 Perform colour tinting operations prior to delivery of paint to site.

.2 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.3 Thin paint for spraying in accordance with paint manufacturer's instructions.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 Gloss/Sheen Ratings

.1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees	Units @ 85 Degrees
G1 – matte finish	0 to 5	Max. 10
G2 – velvet finish	0 to 10	10 to 35
G3 – eggshell finish	10 to 25	10 to 35
G4 – satin finish	20 to 35	Min. 35
G5 – semi-gloss finish	35 to 70	
G6 – gloss finish	70 to 85	
G7 – high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces as specified and as noted on Finish Schedule.

2.5 Interior Painting Systems

.1 Metal Fabrications:

.1 INT 5.3A Latex G5 semi-gloss finish

.2 Galvanized Metal: interior doors, frames, railings, misc. steel, pipes, and ducts.

.1 INT 5.3A Latex G5 semi-gloss finish

.3 Concrete Masonry:

.1 INT 4.2D High performance architectural latex G5 semi-gloss finish.

.4 Concrete masonry units at wet areas and change rooms:

.1 INT 4.2G Epoxy (tile-like) finish.

.5 Interior Wood Doors

.1 INT 6.3K Polyurethane varnish G6 gloss finish.

.6 Electrical Equipment Backboards:

.1 INT 6.4P Fire retardant, pigmented coating. Low odour/low VOC. Semi-gloss (UL/ULC rated).

.7 Gypsum Board: Walls and Bulkheads.

.1 INT 9.2A Latex G3 eggshell finish over latex sealer.

.8 Gypsum Board: Ceilings and Bulkheads (wet areas and change rooms)

.1 INT 9.2E Epoxy (tile like) finish

.9 Gypsum Board: Ceilings and Bulkheads:

.1 INT 9.2A Latex G2 velvet finish over latex sealer.

.10 All other surfaces not noted above: high performance finish suitable for commercial and institutional environment and in accordance with MPI painting manual.

PART 3 EXECUTION

3.1 General

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and application instructions, and data sheets.

3.2 Examination

.1 Investigate existing substrates for problems related to proper and complete preparation of

surfaces to be painted. Report damages, defects, unsatisfactory or unfavourable conditions to Consultant before proceeding with work.

3.3 Preparation

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking and in accordance with paint manufacturers and MPI recommendations. If damaged, clean and restore surfaces as directed by Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.2 Surface Preparation:

.1 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.2 Place "WET PAINT" signs in occupied areas as painting operations progress.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths, or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements and SSPC-SP 6. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air or vacuum cleaning.

.7 Touch up of shop primers with primer as specified.

.8 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.4 Application

.1 Apply paint materials in accordance with paint manufacturer's written application instructions.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces.

.8 Finish alcoves as specified for adjoining rooms.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.5 Mechanical/Electrical Equipment

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces.

.2 Mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red.

.9 Paint natural gas piping yellow.

.10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.11 Do not paint interior transformers and substation equipment.

3.6 Field Quality Control

.1 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 Cleaning and Restoration

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 References

.1 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102:2019 (R2024) Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings.

.1 Show dimensions, layout and details for fabrication and installation of whiteboards, tackboards, aluminum trim and anchorage.

.3 Provide maintenance data for whiteboards and tackboards for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00- Closeout Submittals.

1.4 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Use all means necessary to protect whiteboards, tackboards, aluminum trim, during and after installation and to protect the installed work and materials of all other trades.

.4 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Consultant and at no additional cost to the Owner.

1.5 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.6 Requirements of Regulatory Agencies

.1 Surface burning characteristics of materials: to ULC S102.

PART 2 PRODUCTS

2.1 Manufacturer

.1 Basis of Design Manufacturer: Egan Visual Phone: 1-800-263-2387 Email customerservice@egan.com

.2 The following manufacturers have been approved for the work of this Section:

.1 Broome Porcelain Company

.2 Global School Products

.3 Martack Specialties

.4 Steelcase Inc.

.3 Whiteboards and tackboards shall be supplied by one manufacturer.

2.2 Whiteboards

.1 Basis of Design: Egan Visual Aluminum Frame Whiteboard , white porcelain enamel on steel, factory pre-framed in clear anodized aluminum trim with tray rail.

.2 Sizes as indicated.

2.3 Tackboards

.1 Basis of design: Egan Visual Classic Aluminum Bulletin Board, fine grain natural cork, light textured, brown with satin finished anodized aluminum frame and concealed fasteners.

.2 Sizes as indicated.

.3 All tackboards shall meet the minimum requirements of the applicable building code and shall have a flame spread rating of less than 150 when tested in accordance with ULC 102.

2.4 Trim

.1 Aluminum trim and trays shall be 6063 T5 aluminum alloy with satin finish clear etched and anodized .05 mm satin finish free from extruding draw marks and surface scratches.

.1 Perimeter: 19 mm exposed face and weight of approximately 0.372 kg/m.

PART 3 EXECUTION

3.1 Coordination

.1 Co-ordinate with all other trades as required to ensure proper and adequate provision in framing and wall finish for the installation of whiteboards and tackboards in the locations required.

.2 Prior to installation, inspect locations of all whiteboards and tackboards and verify that all necessary provisions have been made. In the event of discrepancy, immediately notify the Consultant.

.3 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 Installation

.1 Install all whiteboards and tackboards where indicated on the drawings and in full accordance with the manufacturer's recommendations, anchoring all components firmly in place for long life under hard use.

.2 Erection of materials shall be carried out to ensure a rigid, straight, square, plumb and horizontal installation.

.3 All aluminum trim to be attached in such a manner that all fastenings shall be concealed. All corners are to be mitred.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 09 21 16 Gypsum Board

.2 Section 26 08 50 Hand Dryers

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-25a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM A924/A924M-26 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.3 ASTM B456-17(2022) Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

.4 ASTM C1503-24 Standard Specification for Silvered Flat Glass Mirror

.5 ASTM D1187/D1187M-97(2024) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-M90 Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92 Gloss Alkyd Enamel, Air Drying and Baking.

.3 CSA Group (CSA)

.1 CSA/ASC B651:23 Accessible Design for the Built Environment

.2 CSA G164-18(R2023) Hot Dip Galvanizing of Irregularly Shaped Articles

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

.3 Samples:

.1 Submit samples when requested.

.2 Samples to be returned for inclusion into work.

.4 Closeout Submittals:

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.6 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.7 Extra Materials

.1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Owner.

PART 2 PRODUCTS

2.1 Materials

.1 Sheet steel: to ASTM A653 with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: Type 304, with Brushed finish.

.3 Stainless steel tubing: Type 304, commercial grade, seamless welded, minimum 1.2 mm wall thickness.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 Manufacturers

.1 Products and components listed are minimum standard of acceptance. Alternative products by recognized manufacturers of toilet and bath accessories may be accepted subject to review by the Consultant of manufacturer's product information and specifications.

.2 Acceptable manufacturers include:

.1 Bobrick

.2 Bradley

.3 Frost

.4 Watrous

2.3 Components

.1 TPD: Toilet Tissue Dispenser:

.1 Supplied by Owner, installed by Contractor.

.2 GB1: Grab Bar, 38 mm diameter x 1.6 mm wall tubing of stainless steel, 76 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN. 600 mm long.

.1 Bobrick B-6806.99 x 24

.3 GB2: Barrier Free Toilet Grab Bars 2 (L-shaped) 760 x 760 38 mm dia. Peened finish c/w mounting kits.

.1 Bobrick B-6898.99, 90° Angle Grab Bar.

.4 SND: Sanitary Napkin Disposal

.1 Bobrick B-270 Contura Series Sanitary Napkin Waste Receptacle

.5 SD: Soap Dispenser: Liquid wall mounted soap dispenser.

.1 Supplied by Owner, installed by Contractor.

.6 Framed Mirror: Bobrick B-165 1830.

.7 Hand Dryers: As specified in Section 26 08 50 – Hand Dryers.

.8 SNV: Sanitary Napkin Vendor: Satin-finish stainless steel surface mounted vending machine.

.1 Bobrick B-2706 25 Classic Series Surface Mounted napkin/Tampon Vendor.

.9 Stainless Steel Shelf: To CSA B651. 455 mm long x 125mm wide, 1.2mm type 304 stainless steel, satin finish. 19mm return edge; front edge hemmed for safety. 1.6mm brackets.

.1 Bobrick B295 x 18

.10 Collapsible Coat Hook: Bobrick B-983

.11 Horizontal Adult Changing Station: Future to be supplied and installed by Owner.

.12 Backrest: Bobrick B-5892

2.4 Fabrication

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes, to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.5 Finishes

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Baked enamel: condition metal by applying one coat of metal conditioner to ASTM D1187, apply one coat Type 2 primer to CAN/CGSB-1.81 and bake, apply two coats Type 2 enamel to CAN/CGSB-1.88 and bake to hard, durable finish. Sand between final coats. Colour selected from standard range by Consultant.

.3 Manufacturer's or brand names on face of units not acceptable.

PART 3 EXECUTION

3.1 Installation

.1 Install toilet and bath accessories in accordance with the Ontario Building Code, CSA B651 and manufacturer's instructions.

.2 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.

.3 Solid masonry or concrete: use bolt with lead expansion sleeve set into drilled hole.

.3 Install grab bars on built-in anchors provided by manufacturer.

.4 Use tamper proof screws/bolts for fasteners.

.5 Fill units with necessary supplies shortly before final acceptance of building.

.6 Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:

.1 Verify blocking has been installed properly.

.2 Verify location does not interfere with door swings or use of fixtures.

.3 Comply with manufacturer's recommendations for backing and proper support.

.4 Use fasteners and anchors suitable for substrate and project conditions.

.5 Install units rigid, straight, plumb, and level, in accordance with manufacturer's installation instructions and approved shop drawings.

.6 Conceal evidence of drilling, cutting, and fitting to room finish.

.7 Test for proper operation.

.7 Install electric hand dryers according to manufacturer's instructions. Installation shall be by an electrician and shall be completed in accordance with all relevant standards and Codes. Refer to Section 26 08 50 – Hand Dryers.

3.2 Schedule

.1 Locate accessories where indicated. Exact locations determined by Owner.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Clean exposed surfaces of compartments, hardware, and fittings using methods acceptable to the manufacturer.

.3 Touch-up, repair or replace damaged products until Substantial Performance.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 10 28 10 Toilet and Bath Accessories

1.3 Reference Standards

.1 ASTM International (ASTM)

.1 ASTM A36/A36M-19 Standard Specification for Carbon Structural Steel

.2 ASTM A449-14(2026) Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use

.2 Aluminum Association (AA)

.1 Aluminum Association Designation System for Aluminum Finishes

.3 Ontario Traffic Manual Book 5 Regulatory Signs.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit detailed shop drawings and where applicable complete colour charts or colour samples for each item specified herein.

.3 Submit manufacturer’s preprinted technical literature for pre-manufactured products.

.4 Submit samples of metal finishes when requested by the Consultant.

.5 Submit operating and maintenance instructions for all manufactured products and specialties, for inclusion in the Operations and Maintenance Manuals specified in Section 01 78 00-Closeout Submittals.

1.5 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

.3 Protect finished surfaces during shipment and installation.

1.6 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Items specified herein shall be standard manufactured items, modified if required and as specified to suit conditions of this project.

.2 Fabricate work true to dimensions, square and plumb, to suit site conditions.

.3 Thickness of metals shall be adequate for the various conditions with requirements specified as a minimum.

.4 Finished work shall be free from warping, open seams, weld marks, rattles and other defects. Drilling shall be reamed and exposed edges finished smooth.

.5 Provide all fastenings, anchorage and accessories as required to complete the work and as recommended by the manufacturer.

.6 Fastenings shall be concealed or theft-proof type where possible. Exposed fastenings shall be neatly executed and shall be of the same material and finish as the base metal on which they occur.

2.2 Products

.1 **Corridor Shelves and Hooks:** Architectural School Products Ltd. Model STL1001 with 2 hooks per 300mm. Dual shelves to consist of four 19mm square, 1.311 mm steel tubes closed and protected with plastic end caps. Mounting brackets to be two piece heavy duty die cast aluminum designed with an integral backplate to provide positive fastening. Shelf and brackets to be finished in manufacturer's standard Duracon finish. Hooks shall be double prong moulded ABS high impact plastic formed to be non-turning, positive gripping and laterally adjustable. Hooks to be arranged on 2nd and 4th shelf tubes at a spacing of 152mm on centre. Colours to be selected by Consultant from manufacturer's full range of colours. Refer to drawings for lengths of shelves.

.2 **Traffic Signs:** Heavy-duty, 2.0 mm thick aluminum signs and sign-posts to Ontario Traffic Manual Book 5- Regulatory Signs and Municipal standards. Reflective Aluminum (RA) engineer grade reflective sign face designed to provide increased visibility in low-light conditions with UV-resistant inks to prevent fading during long-term outdoor use. Supplied with top and bottom center holes for post or fence mounting and galvanized steel post. Symbols and markings as indicated.

.1 Fabricate posts from steel conforming to ASTM A36/A36M or ASTM A499 and having a minimum yield strength of 207 MPa 30 ksi and a minimum tensile strength of 345 MPa 50 ksi. Galvanize posts after punching in accordance with ASTM A123/A123M.

.2 Hardware: Bolts, nuts, post clips, lock and flat washers must be either aluminum alloy or commercial quality stainless steel, hot-dip galvanized or cadmium plated after fabrication. Bolts/nuts must be tamper resistant design. Provide fiber washers of commercial quality.

PART 3 EXECUTION

3.1 Installation - General

.1 Install manufactured items in accordance with manufacturer's printed instructions and recommendations.

.2 Mount standards to solid backing capable of supporting intended loads. Install standards using fasteners suitable for supporting intended loads.

.3 Install shelving and hooks as indicated on the Drawings.

3.2 Installation – Traffic Signage

.1 Signposts consist of a base post and signpost. Drive steel sign base posts with a suitable driving head. Attach signposts to base posts. Replace any base posts damaged during driving or otherwise at no additional cost to the Owner. Embed steel sign base posts in concrete.

.2 Locate and erect all signs in accordance with the drawings, municipal standards and codes. Vertically mount signs at right angles to the direction of, and facing, the traffic that they are intended to serve. Mounted signs must present a smooth flat surface varying no more than 10 mm from a 1.2 m straightedge placed in any position on the face of the sign after erection. Mount signs on traffic signal posts with strap or clamp type sign supports.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 06 10 00 Rough Carpentry

.2 Section 08 51 `3 Aluminum Windows

1.3 References

.1 ASTM International (ASTM)

.1 ASTM D5116-25 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products

.2 ASTM D6670-25 Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products

.2 Underwriters Laboratories of Canada (ULC)

.1 ULC 109:2014 (R2024) Standard Method for Flame Tests of Flame Resistant Fabrics and Films

.3 National Fire Protection Association (NFPA)

.1 NFPA 701 (2019) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawings. Clearly indicate, by large scale details, anchorage, assembly, materials, components, finishes, and perimeter construction conditions.

.3 Submit duplicate 300 mm x 300 mm samples of fabrics in selected colours.

.4 Submit manufacturer’s maintenance data in the form of printed instructions for cleaning and maintaining roller shades, for inclusion in Operation and Maintenance Manuals specified in section 01 78 00 – Closeout Submittals

1.5 Quality Assurance

.1 Work of this Section shall be by forces in the direct employ or under control of the

system manufacturer, skilled, trained and experienced in work of similar scope and complexity.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section, with a minimum of ten years of experience.

.3 Mock-Ups: Erect one full size mock-up of each roller shade type for review. Completed and accepted mock-up shall act as the standard to which the balance of the work will be judged.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Test all operable components prior to shipping.

.3 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.7 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

1.8 Warranty

.1 Warrant the work of this Section against defects of workmanship and material, for a period of two years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

.2 Manufacturer's Warranty: Submit manufacturer's standard 10 year product warranty executed by an authorized company official.

PART 2 PRODUCTS

2.1 Manufacturers

.1 Roller Shade System shall be glazing frame mounted, manually operated Solar Shades as manufactured by Solarfective Products Limited or approved equivalent.

.2 Basis of Design: The Legrand Shading Systems Solarfective Teleshade (TS)

.3 Subject to compliance with the contract documents, acceptable equivalent products of the following manufacturers may be used upon approval:

.1 Elite Window Fashions

.2 Lighting Harvesting Shading Solutions

.3 Mechoshade Systems Inc.

.4 Nysan Solar Control

.5 Sun Glow Window Covering Products of Canada

.6 SunProject Inc.

2.2 Hardware – Manually Controlled Shades

.1 Chain Operated with infinite positioning. Left or right hand operation and banding as applicable to project conditions.

.1 Drive assembly:

.1 Must allow fingertip control and include a built-in shock absorber system to prevent chain breakage under normal operating conditions.

.2 Factory set for size and travel of 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 40kg load test. Chain may be positioned at either, or both ends of the shade without disassembly of the shade unit.

.1 Supply and install child safe chain retainers.

.5 Supply and install counter balancing mechanism designed to offset the weight of the shade and give fingertip control.

2.3 Assembly

.1 Supply and install fully factory assembled shade units consisting of 2 shade brackets, shade tube, extruded aluminum fascia, hembar and fabric as specified.

.2 Factory modify housings where necessary to bypass columns and other obstructions.

.3 End Brackets: 2 piece molded ABS construction with nylon drive sprocket. Bracket colour coordinated with fascia colour.

.4 Shade tube; Minimum 1.52 mm thick extruded aluminum with 3 equally spaced continuous stiffening fins, non-sag design, maximum deflection under full load of fabric L/700.

.5 Fascia: One piece extruded aluminum 1.7 mm thickness complete with three continuous screw flutes. Anodized. Colour as selected by the Consultant. Extruded aluminum snap lock fascia which continuously fits on the end and center brackets as a one-piece section.

.6 Hembar: extruded aluminum with matching plastic end finials.

2.4 Shade Mounting System

.1 Extruded aluminum bracket designed to accept preassembled shade system.

.1 Brackets shall 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: Baked enamel, colour to be selected by the Consultant.

.2 Unexposed aluminum: mill finish.

2.6 Shade Fabric

.1 Sun control fabric: dimensionally stable shade fabric.

.1 Acceptable Products: 3% open area:

.1 Phifer Sheerweave, Style 4600.

.2 Colour: to be selected by the Consultant.

.2 Performance: fabric shall hang flat, without buckling or distortion. Edge, where trimmed, shall hang true and straight. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than + 3 mm in either direction due to warp distortion, or weave design.

.3 Fabric shall be certified by an independent laboratory to pass the small scale vertical burn requirements test ULC S109 and NFPA 701.

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.

.2 Factory applied finish shall be uniform, smooth and without blemishes.

.3 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 shall be retained in the recessed spline of the shade roller and the bottom of the fabric shall be retained by the hem bar.

PART 3 EXECUTION

3.1 Installation

.1 Install shading devices in accordance with manufacturer's instructions.

.2 Take field measurements prior to fabrication to ensure fit.

.3 Fabric shall be premeasured and manufactured off-site.

.4 Install square, plumb, true to line, adequately anchored, maintaining uniform clearances, accurate alignment levels and parallel with the window plane. Fabric shall not travel more than 3 mm in either direction within channels after installation.

.5 Adjust operable parts for correct function.

.6 Secure with non-corrosive fasteners, concealed in final assembly.

.7 Adjust to provide for operation without binding.

.8 Refinish damaged or defective work so that no variation in surface appearance is discernable.

3.2 Demonstration

.1 Prior to 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.

3.3 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

MECHANICAL SPECIFICATIONS

St. Luke the Evangelist Catholic School Addition

DURHAM CATHLOIC DISTRICT SCHOOL BOARD

55 TWIN STREAMS RD, WHITBY, ON L1P 1N9

DCDSB Tender #: T27-01
RDZ Project #: 25041
Revision 03
November 11, 2026

RDZ ENGINEERS LIMITED
17A - 30 Pennsylvania Avenue
Vaughan, Ontario
L4K 4A5

Date	Revision	Description	Prep. By	Check By
November 11, 2026	3	Issued for Tender	MH	GR
November 3, 2026	2	Issued for Permit	MH	GR
October 28, 2026	1	Issued for 90% Review	MH	GR
August 28, 2026	0	Issued for 80% Costing	MH	GR

DIVISION 20 **MECHANICAL COMMON WORK RESULTS**

Section 20 05 01 Supplementary Mechanical Bid Form
Section 20 05 05 Mechanical Work General Instructions
Section 20 05 10 Basic Mechanical Materials and Methods
Section 20 05 15 Seismic Control and Restraint
Section 20 05 20 Mechanical Vibration Control
Section 20 05 25 Mechanical Insulation
Section 20 05 30 Variable Frequency Drives
Section 20 05 35 Demolition and Revision Work
Section 20 05 40 Mechanical Work Commissioning
Section 20 05 50 Testing, Adjusting and Balancing
Section 20 05 55 Firestopping and Smoke Seal Systems

DIVISION 21 **FIRE SUPPRESSION**

Section 21 13 00 Fire Protection Sprinkler System
Section 21 20 05 Fire Extinguishers

DIVISION 22 **PLUMBING**

Section 22 11 00 Domestic Water Piping and Specialties
Section 22 13 00 Drainage and Vent Piping and Specialties
Section 22 42 00 Plumbing Fixtures and Fittings

DIVISION 23 **HEATING, VENTILATING AND AIR CONDITIONING**

Section 23 20 00 HVAC Piping and Specialties
Section 23 21 00 HVAC Pumps
Section 23 23 00 Refrigerant Piping, Valves and Accessories
Section 23 30 00 HVAC Air Distribution
Section 23 33 05 Silencers
Section 23 34 00 HVAC Fans
Section 23 36 00 Variable Air Volume Terminal Units
Section 23 41 00 Air Filters and Accessories
Section 23 62 13 Air Cooled Condensing Units
Section 23 70 00 Semi-Custom Rooftop Units
Section 23 82 00 Fin-Tube Radiation Units
Section 23 82 39 Motorized Heaters

DIVISION 25 **INTEGRATED AUTOMATION**

Section 25 05 05 Automatic Controls and Instrumentation

Section 25 90 00 Integrated Automation Control Sequences

END OF SECTION

PROJECT NAME: Eight Classroom Addition – St. Luke the Evangelist Catholic School

RDZ PROJECT NUMBER: 25041

Following Supplementary Mechanical Bid Form is submitted by:

…..

(Bidding Company)

…..

(Street Address or P. O. Box No.)

…..

(City, Province and Postal Code)

Dated …… And which is an integral part of Bid Form.

In accordance with Instructions to Bidders, we provide the Supplementary Mechanical Bid Form. We understand that the information provided to be considered an integral part of Bid Form and is to be completed in full.

Unless otherwise noted, submit Supplementary Mechanical Bid Form **within Twenty-Four (24) hours of Bid closing**, via e-mail addressed to:

RDZ Engineers Ltd.
Attention : Michael Hughes
e-mail : mhughes@rdzeng.ca
cc'd: rsukumaran@bba-archeng.com

Supplementary Bid Form Signature:

…..

(Signature of Authorized Representative)

…..

(Print Name)

…..

(Title)

LIST OF MANUFACTURERS/SUPPLIERS

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based and which we will supply. If no name is indicated, or if name identified is not listed in issued documents, or if more than one name is indicated for a particular product, we will if requested, provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us. Acceptance of non-base specified manufacturers with respect to their equivalency shall be as sole discretion of Consultant.

We also acknowledge that failure to submit this list as specified or failure to submit within time defined may result in provision of base specified manufacturer's product, at discretion of Consultant.

SECTION	PRODUCT	MANUFACTURER/SUPPLIER & CATALOGUE NUMBER
23 21 00	Vertical Inline Pumps	
23 30 00	Silencers	
23 34 00	HVAC Fans	
23 62 13	Air Cooled Condensing Units	
23 70 00	Semi-Custom Rooftop Units	

END OF DOCUMENT

1. GENERAL

1.01 REFERENCES

.1 Division 00 and Division 01 apply to and are a part of this Section.

1.02 APPLICATION

.1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence.

.2 Be responsible for advising product vendors of requirements of this Section.

1.03 DEFINITIONS

.1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

.2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.

.3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.

.4 “provision” or "provide" (and tenses of "provide") – means supply and install complete.

.5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.

.6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer’s supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers’ assistance to Contractor.

.7 "delete" or "remove" (and tenses of "delete" or “remove”) – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with Consultant.

.8 "barrier-free" – means when applied to a building and its facilities, that building and its facilities can be approached, entered and used by persons with physical or sensory disabilities in accordance with requirements of local governing building code.

.9 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and “DDC” means direct digital controls; references to "BAS", "BMS", "FMS" and “DDC” generally mean same.

.10 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.

.11 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.

.12 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.

.13 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.

.14 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.

.15 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

.16 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.04 DOCUMENTS

.1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.

.2 Specification is arranged in accordance with CSI/CSC 50 Division Sections MasterFormat.

.3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.

.4 Review Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant’s report.

.5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

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

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

.8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

.9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.

.10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

.11 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.

.12 In the case of discrepancies between the drawings and specifications, documents will govern in order specified in “General Conditions”, however, when scale and date of drawings are same, or where discrepancy exists within specification, most costly arrangement will take precedence.

1.05 METRIC AND IMPERIAL MEASUREMENTS

.1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Confirm exact measurements based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.06 EXAMINATION OF DOCUMENTS AND SITE

.1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.

.2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.

.3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.07 WORK STANDARDS

.1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.

.2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Owner and reviewed with Consultant.

.3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:

.1 Air-Conditioning, Heating and Refrigeration Institute (AHRI);

.2 Air Movement and Control Association (AMCA);

.3 American Iron and Steel Institute (AISI);

.4 American National Standards Institute (ANSI);

.5 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);

.6 American Society of Mechanical Engineers (ASME);

.7 American Society of Testing and Materials (ASTM);

.8 American Water Works Association (AWWA);

.9 Associated Air Balance Council (AABC);

.10 Building Industry Consulting Services, International (BICSI);

.11 Canadian Gas Association (CGA);

.12 Canadian General Standards Board (CGSB);

.13 Canadian Standards Association (CSA);

.14 Electrical and Electronic Manufacturers Association of Canada (EEMAC);

.15 Electrical Safety Authority (ESA);

.16 Electronic Industries Association (EIA);

.17 Factory Mutual Systems (FM);

.18 Illuminating Engineering Society (IES);

.19 Institute of Electrical and Electronic Engineers (IEEE);

.20 International Standards Organization (ISO);

.21 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);

.22 National Building Code of Canada (NBC);

.23 National Electrical Manufacturers Association (NEMA);

.24 National Environmental Balancing Bureau (NEBB);

.25 National Fire Protection Association (NFPA);

.26 National Standards of Canada;

.27 NSF International;

.28 Occupational Health and Safety Act (OHSA);

.29 Ontario Building Code (OBC);

.30 Ontario Electrical Safety Code (OESC);

.31 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);

.32 Technical Standards and Safety Authority (TSSA);

.33 Thermal Insulation Association of Canada (TIAC);

.34 Underwriters' Laboratories of Canada (ULC);

.35 Workplace Hazardous Materials Information System (WHMIS);

.36 Material Safety Data Sheets by product manufacturers;

.37 local utility inspection permits;

.38 Codes, standards, and regulations of local governing authorities having jurisdiction;

.39 additional codes and standards listed in Trade Sections;

.40 Owner's standards.

.4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.

.5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.

.6 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions. Notify Consultant in writing of conflicts between Contract Documents and manufacturer's instructions.

.7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.

.8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review with Consultant at any time.

.9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

.10 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.

.11 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner’s schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with Consultant, so as not to inconvenience Owner’s occupation or in any way hinder Owner’s use of building. Include for required premium time work to meet these requirements.

.12 Coordinate work inspection reviews and approvals with governing inspection department to ensure construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.

.13 Properly protect equipment and materials on site from damage and defacement due to elements and work of trades, to satisfaction of Owner and reviewed with Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

.14 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products are to bear a CRN number.

.15 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

1.08 PERMITS, CERTIFICATES, APPROVALS AND FEES

.1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

.2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.

.3 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.

.4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.

1.09 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

.1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer’s professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.

.3 Unless otherwise specified in Division 00 or 01, liability insurance requirements are as follows:

.1 coverage is to be a minimum of $1,000,000.00 CDN inclusive of any one occurrence;

.2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;

.3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;

.4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;

.5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner’s Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant’s services.

1.10 WORKPLACE SAFETY

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.

.2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.

.3 If at any time during course of existing building work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and reviewed with Consultant.

1.11 PLANNING AND LAYOUT OF WORK

.1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

.2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:

.1 piping requiring uniform pitch;

.2 piping 100 mm (4") dia. and larger;

.3 large ducts (main runs);

.4 cable tray and bus duct;

.5 conduit 100 mm (4") dia. and larger;

.6 piping less than 100 mm (4") dia.;

.7 smaller branch ductwork;

.8 conduit less than 100 mm (4") dia..

.3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.

.4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

.5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.

.6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

.7 Shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.

1.12 PHASING

.1 USE FOLLOWING PARAGRAPH FOR GENERAL PHASING REQUIREMENTS ON NEW CONSTRUCTION WHERE IT HAS BEEN CONFIRMED THAT REQUIREMENTS ARE IN DIVISION 01 OR ON DRAWINGS.

.2 Include for scheduling, coordination, and construction phasing to suit project. Review exact phasing requirements with Consultant and Owner prior to start of Work.

.3 Phasing and scheduling of Work is required in order to maintain existing building operations. Include costs (including costs for "off hours" work) for scheduling, co-ordination, and construction phasing to suit this project. Review phasing requirements with Consultant prior to start of Work.

.4 Provide for each partial permit, required local governing authority certificate and any other testing/verification certificates for systems where required.

1.13 COORDINATION OF WORK

.1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:

.1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;

.2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;

.3 depth and routing of excavation required for work, and requirements for bedding and backfill;

.4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.

.2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.

.3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building, subject to available space as confirmed with Owner and reviewed with Owner, and protected from elements.

.4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.

.5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.14 PRODUCTS

.1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.

.2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer’s authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.

.3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.

.4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.

.5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.

.6 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

.7 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.

.8 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.

.9 Indicate in Supplementary Mechanical Bid Form, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.

.10 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.

.11 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.

.12 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.

.13 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if accepted by Owner and reviewed with Consultant, and costs for review, to be borne by Contractor.

.14 Whenever use of product other than based specified products or named as acceptable is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.

1.15 SHOP DRAWINGS

.1 At start-up meeting, review with Consultant products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.

.2 Submit electronic copies of shop drawings unless otherwise directed by Consultant. Coordinate exact requirements with Consultant.

.3 Submit for review, drawings showing detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:

.1 product literature cuts;

.2 equipment data sheets;

.3 equipment dimension drawings;

.4 system block diagrams;

.5 sequence of operation;

.6 connection wiring schematic diagrams;

.7 functionality with integrated systems.

.4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.

.5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.

.6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.

.7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:

.1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;

.2 "RETURNED FOR CORRECTION" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.

.8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:

"THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."

.9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system are to be submitted together.

.10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

.11 Do not order product until respective shop drawing review process has been properly reviewed with Consultant.

.12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.

.13 Applicable mechanical equipment has been selected to meet energy efficiency requirements of ANSI/ASHRAE/IES 90.1, Energy Standards for Buildings, and shop drawings/product data submittals for such equipment are to indicate compliance with this Standard or they will be returned for correction and re-submittal.

1.16 ENGINEERED SUBMITTALS

.1 Submittals for items required to be sealed by a professional engineer (engineered) are to be duly prepared, sealed, and signed under direct control and supervision of a qualified professional engineer licensed in jurisdiction of the work. Professional engineer is to conform to requirements specified in this Section in article entitled Requirements for Contractor Retained Engineers.

.2 Engineered submittals are to include, but not be limited to, following:

.1 complete CAD layout drawings indicating equipment, piping schematic, pipe routing and sizing, zones, devices, wiring schematics, and any other pertinent data;

.2 listing of design data used to determine system layout and sizing;

.3 complete copies of design calculations and listing of design data used in preparing calculations;

.4 list detailing standards, codes, regulations, etc. adhered to when designing system;

.5 items as noted in other Sections of the Specification.

.3 Professional engineer responsible for engineered submittals is to perform periodic field reviews, including review of associated mock-ups where applicable, at locations wherever work as described by engineered submittal is in progress, during fabrication and installation of such work, and submit a field review report after each visit. Submit field review reports to Consultant and authorities having jurisdiction as required.

.4 Field reviews are to be at intervals as necessary and appropriate to progress of work described by engineered submittal to allow engineer to be familiar with progress and quality of such work and to determine if work is proceeding in general conformity with Contract Documents including reviewed shop drawings and design calculations.

.5 Upon completion of work as described by engineered submittal, professional engineer responsible for preparation of engineered submittal and for performing periodic field reviews is to prepare and submit to Consultant and, if applicable, authorities having jurisdiction, a letter certifying that work has been supplied and installed in accordance with requirements of Contract Documents, authorities having jurisdiction and engineered submittal.

1.17 EQUIPMENT LOADS

.1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.

.2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.

.3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with Consultant prior to construction.

1.18 OPENINGS

.1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.

.2 No openings are permitted through completed structure without written approval from Owner and reviewed with Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.

.3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless otherwise directed by Owner and reviewed with Consultant, do not leave any openings unprotected and unfinished overnight.

1.19 SCAFFOLDING, HOISTING AND RIGGING

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Owner and reviewed with Consultant.

.2 Use scaffolds in such a manner as to interfere as little as possible with work of other trades.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and reviewed with Consultant. No supports, clips, brackets or similar devices are to be welded, bolted or otherwise affixed to any finished member or surface without approval from Owner and review with Consultant.

.4 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

1.20 CHANGES IN THE WORK

.1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Consultant for review, a quotation detailing proposed cost for executing change or revision.

.2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as reviewed with Consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

.4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to all quotations submitted:

.1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;

.2 material costs are not to exceed those published in local estimating price guides;

.3 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;

.4 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;

.5 costs for journeyperson and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;

.6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;

.7 costs for rental tools and/or equipment are not to exceed local rental costs;

.8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;

.9 quotations, including those for deleted work, to include a figure for any required change to Contract time.

.5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.6 Make requests for changes or revisions to work in writing to Consultant and, if accepted by Owner, Notice of Change to be issued.

.7 Do not execute any change or revision until written authorization for the change or revision has been obtained from Consultant.

1.21 PROGRESS PAYMENT BREAKDOWN

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Owner's approval and Consultant's review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.

.3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.22 NOTICE FOR REQUIRED FIELD REVIEWS

.1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Consultant.

.2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.

.3 Do not conceal work until Consultant advises that it may be concealed.

.4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.23 PRELIMINARY TESTING

.1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.

.2 When, in Consultant’s opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.

.3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.

.4 When, in Consultant’s opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.24 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION

.1 Permanent building mechanical systems are not to be used for temporary heating or cooling purposes during construction.

.2 Confirm with Consultant what equipment can be used during construction.

.3 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.

.4 During this period of construction, such systems/equipment to not become property of Owner or be Owner’s responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turn over to Owner.

.5 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, such systems/equipment to be cleaned, restored to "new" condition, paint finishes "touched-up", filters cleaned or replaced, etc.

1.25 TEMPORARY SERVICES

.1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary heating, cooling and water. Unless otherwise noted, provide required services in compliance with requirements of local governing building code and local governing inspection authorities.

.2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

1.26 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

.1 Maintain equipment in accordance with manufacturer's instructions prior to start-up, testing and commissioning.

.2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.

.3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.

.4 All filters are to be new upon Substantial Performance of the Work. This is in addition to any spare filters specified.

1.27 CLEANING

.1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Owner and Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.

.2 Clean equipment and devices installed as part of this project.

1.28 RECORD AS-BUILT DRAWINGS

.1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of $500.00 CDN plus HST, per drawing, up to first 5 drawings, and $100.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.

.2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:

.1 dimensioned location of inaccessible concealed work;

.2 locations of control devices with identification for each;

.3 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;

.4 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;

.5 location of piping system air vents;

.6 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.

.3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant’s comments, to satisfaction of Consultant.

.4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.

.5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.

.6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.

1.29 OPERATING AND MAINTENANCE MANUALS

.1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Review exact quantity of manuals with Consultant. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:

.1 front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;

.2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;

.3 equipment manufacturer's authorized contact person name, telephone number and company website;

.4 Table of Contents sheet, and corresponding index tab sheets;

.5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;

.6 operating data as follows:

.1 pressure test reports, and certificates issued by governing authorities;

.2 description of each system and its controls;

.3 control schematics for equipment/systems including building environmental controls;

.4 wiring and connection diagrams;

.5 if applicable, BAS architecture and all required operating data;

.6 description of operation of each system at various loads together with reset schedules and seasonal variances;

.7 operation instruction for each system and each component;

.8 description of actions to be taken in event of emergencies and/or equipment failure;

.9 valve tag schedule, and flow diagrams to indicate valve locations.

.7 maintenance data as follows:

.1 operation and trouble-shooting instructions for each item of equipment and each system;

.2 schedules of tasks, frequency, tools required, and estimated task time;

.3 recommended maintenance practices and precautions including warnings of any maintenance practice that will damage or disfigure equipment/systems;

.4 complete parts lists with numbers.

.8 performance data as follows:

.1 equipment and system start-up data sheets;

.2 equipment performance verification test results, and final commissioning report;

.3 final testing, adjusting and balancing reports.

.9 copies of warranties;

.10 items requested specifically in Section Articles.

.2 Generally, binders are not to exceed 75 mm (3") thick and not to be more than 2/3 full.

.3 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner’s building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

.4 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O & M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

.5 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as reviewed with Consultant and enhanced with bookmarks and internal document links.

1.30 WARRANTY

.1 Unless otherwise specified in Divisions 00 and 01, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of 2 years from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., 5 years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner. Submit signed and dated copies of extended warranties to Consultant.

.3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer’s authorized technician to provide factory authorized on-site service.

.4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner’s staff or agents is exempted.

.5 Do not include Owner deductible amounts in warranties.

.6 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:

.7 once during 1st month of building operation;

.8 once during 3rd month of building operation;

.9 once between 4th and 10th month in a season opposite to 1st and 3rd month visits.

1.31 PROJECT CLOSEOUT SUBMITTALS

.1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:

.1 Operating and Maintenance Manuals;

.2 as-built record drawings and associated data;

.3 extended warranties for equipment as specified;

.4 operating test certificates, i.e. Sprinkler Test Certificate;

.5 final commissioning report and TAB report;

.6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;

.7 other data or products specified.

1.32 INSTRUCTIONS TO OWNER

.1 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.

.2 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.

.3 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:

.1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;

.2 Troubleshooting – diagnostic instructions, test and inspection procedures;

.3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;

.4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;

.5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.

.4 Before instructing Owner's designated personnel, submit to Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.

.5 Obtain in writing from Consultant list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:

.1 date instructions were given to Owner's staff;

.2 duration of instruction;

.3 names of persons instructed;

.4 other parties present (manufacturer's representative, consultants, etc.).

.6 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

.7 Submit to Consultant, copy of electronic version of training materials loaded on USB flash drive. Include in operating and maintenance manuals submission.

1.33 FINAL INSPECTION

.1 Submit to Consultant, written request for final inspection of systems. Include written certification that:

.1 deficiencies noted during job inspections have been completed;

.2 field quality control procedures have been completed;

.3 systems have been tested and verified, balanced and adjusted, and are ready for operation;

.4 maintenance and operating data have been completed and submitted to, reviewed with Consultant and accepted by Owner;

.5 tags and nameplates are in place and equipment identifications have been completed;

.6 clean-up is complete;

.7 spare parts and replacement parts specified have been provided and acknowledged by Consultant;

.8 as-built and record drawings have been completed and submitted to and reviewed with Consultant and accepted by Owner;

.9 Owner's staff has been instructed in operation and maintenance of systems;

.10 commissioning procedures have been completed.

1.34 ALLOWANCES

.1 Where allowances are included, amount of allowance is to be net and is to include product and material costs (less applicable trade discounts), including delivery to site and applicable taxes.

.2 Other costs, including unloading and handling at site, installation, overhead and profit and other burdens are to be included in Bid amount, not in allowance.

.3 Whenever costs are more or less than amount of allowance, Contract amount will be adjusted accordingly by Change Order.

.4 Materials and products under allowance will be selected by Owner in sufficient time to avoid delays to work, and Owner reserves right to take entire or any part of allowance out of Contract amount at any time.

.5 Expenditure from above allowances may be made only upon receipt of order signed by Consultant. Relationship of Contractor and Subcontractors performing work to be paid out of allowances to be strictly between Contractor and Contractor's Subcontractors.

2. PRODUCTS

.1 NOT USED

3. EXECUTION

.1 NOT USED

END OF SECTION

1. GENERAL

1.01 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

1.02 SUBMITTALS

.1 Submit shop drawings/product data sheets for:

.1 pressure gauges and thermometers;

.2 electric motors (submit with equipment they are associated with).

.2 Submit weight loads for selected equipment (upon request).

.3 Submit copy of architectural reflected ceiling plan drawings and elevation drawings to indicate proposed access door locations.

.4 Submit samples of materials and any other items as specified in Sections of Mechanical Divisions.

.5 Submit a list of equipment identification nameplates indicating proposed wording and sizes.

.6 Submit a list of pipe and duct identification colour coding and wording.

.7 Submit a proposed valve tag chart and a list of proposed valve tag numbering and identification wording.

.8 Submit drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.

.9 As specified in Part 2 of this Section, submit a spare belt set, tagged and identified, for each belt driven piece of equipment.

.10 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.

2. PRODUCTS

2.01 PIPE SLEEVES

.1 Galvanized Sheet Steel – Minimum #16 gauge galvanized steel with an integral flange at one end to secure sleeve to formwork construction.

.2 Polyethylene – Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.

.3 Waterproof Galvanized Steel Pipe – Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at sleeve midpoint.

.4 Galvanized Steel or Cast Iron Pipe – Schedule 40 mild galvanized steel, or Class 4000 cast iron.

2.02 FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Section entitled Firestopping and Smoke Seal Systems and work is to be included as part of mechanical work.

2.03 WATERPROOFING SEAL MATERIALS

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

.2 Acceptable products are:

.1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S-316;

.2 The Metraflex Co. "MetraSeal" type ES.

2.04 PIPE ESCUTCHEON PLATES

.1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

2.05 PIPING HANGERS AND SUPPORTS

.1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:

.1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;

.2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.

.2 Hangers and supports for horizontal suspended piping as follows:

.1 adjustable steel clevis hanger – MSS Type 1;

.2 adjustable swivel ring band hanger – MSS Type 10;

.3 adjustable roller hanger – MSS Types 41, 43, and/or 45, with MSS Type 39 steel protection saddle.

.3 Supports for horizontal pipe on vertical surfaces as follows:

.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;

.2 heavy-duty steel pipe clip – MSS Type 26;

.3 single steel pipe hook – Myatt Fig. 156;

.4 epoxy coated steel pipe stays are not permitted.

.4 Floor supports for vertical risers as follows:

.1 copper tubing riser clamp – MSS Type 8;

.2 heavy-duty steel riser clamp – MSS Type 8.

.5 Supports for vertical piping on vertical surfaces as follows:

.1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;

.2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;

.3 extension split pipe clamp – MSS Type 12;

.4 epoxy coated steel pipe stays are not permitted.

.6 Base support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment is to consist of a base elbow support with flange.

.7 For horizontal pipe on racks, Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:

.1 standard galvanized steel U-bolts/clamps supplied by rack manufacturer;

.2 adjustable roller chair – MSS Type 44 with MSS Type 39 steel protection saddle.

.8 Special hangers and supports for various applications as follows:

.1 vibration isolated riser supports – black steel riser clamps as specified above, complete with neoprene–steel–neoprene sandwich type vibration isolation pads between clamp and floor;

.2 for groups of pipes having same slope – MSS Type 32 welded steel brackets, Anvil Fig. 46 universal trapeze assemblies, or Unistrut or equal support assemblies, all with U-bolts, clamps, etc., to secure pipes in place;

.3 for sections of piping connected to vibration isolated equipment – hangers and supports as specified above but complete with MSS Type 48 spring cushions;

.4 for glass drain and vent piping – special padded hangers supplied by pipe supplier;

.5 for plastic piping – generally as specified above but in accordance with pipe manufacturer’s recommendations;

.6 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;

.7 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;

.8 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;

.9 insulation protection shields to and including 40 mm (1-½") dia. – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.

.9 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading in accordance with Table 3 in MSS SP-58, but in any case minimum 9.5 mm (3/8") diameter.

.10 Acceptable manufacturers are:

.1 E. Myatt & Co. Inc.;

.2 Anvil International Inc.;

.3 Empire Industries Inc.;

.4 Hunt Manufacturing Ltd.;

.5 Unistrut Canada Ltd.;

.6 Nibco Inc. "Tolco";

.7 Taylor Pipe Supports.

2.06 ROOF MOUNTED PIPING SUPPORTS

.1 Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without causing damage to the roofing membrane.

.2 Design system using high density / high impact polypropylene bases with carbon black, anti-oxidants for UV protection, and steel framing for support is 1-5/8 inch (41 mm) B22TH or 1-7/8 inch (48 mm) BTS22TH.

.3 Bases:

.1 Injection molded high density / high impact polypropylene with UV-inhibitors and anti-oxidants, conforming to the following:

.2 Moisture Content: Negligible.

.3 Shrinkage/Swelling Due to Moisture: Negligible.

.4 Density: 55.8 lb/cu ft (894 kg/cu m).

.5 Insect Resistance: No known insect damage potential.

.6 Chemical Resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, and sulfuric acid: No visual or physical change apparent.

.7 Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D 1929.

.8 Sized as required by loading conditions and as indicated on the drawings.

.9 Shop fabricated with inserts for square tubing or threaded rods as required.

.10 Color: Integral black color as molded.

.11 Bases for Mechanical Attachment: Sealant chamber around penetration point, with injection port for sealing after fastening; beveled lip for sealant bead around entire diameter.

.12 Do not use bases containing carbonated plastics, press molded recycled rubber and plastics, steel, stainless steel, or any injection molded threaded receivers.

.4 Steel Framing:

.1 Channel Types: 1-5/8 inch (41.3 mm) B22TH or 1-7/8 inch (47.6 mm) BTS22H, as required for loading conditions.

.2 Thickness: 12 gage (2.7 mm).

.3 Form: Roll-formed 3-sided or tubular shape, perforated with 9/16 inch (14.3 mm) holes at 1-7/8 inch (47.6 mm) centers on three sides.

.4 Finish: Hot dip galvanize in accordance with ASTM A 123 after fabrication, free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.

.5 Do not use tubing or tube steel.

.5 Stainless Steel Framing:

.1 Channel Types: 1-5/8 inch (41.3 mm) or 1-7/8 inch (47.6 mm), as required for loading conditions.

.2 Thickness: 12 gage (2.7 mm).

.3 Form: Roll-formed 3-sided or tubular shape.

.4 Finish: Mill finish.

.5 Do not use tubing or tube steel.

.6 Pipe Supports and Hangers: Conform to MSS SP-58 and MSS SP-69 and as follows:

.1 Fabricate of carbon steel where framing is carbon steel; fabricate of stainless steel where framing is stainless steel; finished same as framing.

.2 Sizes 2-1/2 inch (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.

.3 Sizes 3 inch (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.

.7 Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system.

.1 Carbon Steel: Hot-dip galvanized in accordance with ASTM A 153/A 153M.

.2 Stainless Steel: Mill finish.

.3 For Mechanical Fastening to Deck: On wood and steel decks, use bolts with toggle wings; on concrete decks use threaded rods and adhesive anchors, with rod embedded at least 1-3/4 inches (44 mm) into concrete.

.8 Acceptable manufacturers are:

.1 Portable Pipe Hangers (Canada), Inc. (PHP Systems/Design);

.2 Taylor Pipe Supports (EcoFoot);

.3 Mifab, Inc.

2.07 ACCESS DOORS

.1 Coordinate consistency of look and finish of access doors on project with each Division of Work. Coordinate exact requirements with General Trades Contractor.

.2 Access doors to be rust resistant steel door panels, with concealed hinges and positive locking and self-opening screwdriver operated lock. Wall type frame to be suitable for wall installation and have integral keys for plaster walls. Doors in tile wall to be stainless steel and in ceilings to be suitable for plaster covering with only frame joint showing. Other doors to be prime painted steel.

.3 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.

.4 Lay-in type tiles, properly marked, may serve as access panels. Coordinate marking of ceiling tiles with Consultant. Panels in glazed tile walls to be 12 gauge, 304 alloy stainless steel, No. 4 finish, with recessed frame secured with stainless steel counter-sunk flush head screws.

.5 Panels in plaster surfaces to have dish-shaped door and welded metal lath, ready to take plaster. Provide a plastic grommet for door key access.

.6 Other access doors to be welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat. Submit to Consultant for review, details of non-standard door construction details.

.7 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.

.8 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting finish in which they are to be installed so as to maintain final building surface appearance throughout.

.9 Acceptable manufacturers include Le Hage, SMS, Pedlar and Acudor.

2.08 PRESSURE GAUGES AND THERMOMETERS

.1 Pressure gauges as follows:

.1 adjustable, glycerine filled, 100 mm or 115 mm (4" or 4-½") diameter and each accurate to within 1% of scale range;

.2 type 304 stainless steel case with relief valve and polished stainless steel bayonet;

.3 stainless steel rotary movement with stainless steel bushings and socket;

.4 clear acrylic window;

.5 dual scale white dial with a scale range such that working pressure of system is at approximate mid-point of scale;

.6 black pointer.

.2 Pressure gauge accessories and additional requirements as follows:

.1 a bronze ball type shut-off valve is to be provided in the piping to each pressure gauge;

.2 each pressure gauge for piping and equipment with normal everyday flow is to be equipped with a brass pressure snubber;

.3 pressure gauges in fire protection piping must be ULC listed and labelled;

.3 Thermometers as follows:

.1 round, 125 mm (5") diameter, adjustable (90°) angle bimetal dial type thermometers, each accurate to within 1% of full scale;

.2 hermetically sealed stainless steel case with stainless steel ring;

.3 dampened bimetal coil;

.4 calibration adjustment screw;

.5 white aluminum dual scale dial with black and blue markings and a range such that working temperature of system is approximate mid-point of the scale;

.6 black aluminum pointer;

.7 double strength glass window;

.8 12 mm (½") NPT connection with 6.4 mm (¼") diameter stainless steel stem;

.9 suitable thermowell.

.4 Acceptable manufacturers are:

.1 H.O. Trerice Co.;

.2 Weiss Instruments;

.3 Winters Instruments;

.4 Western Gauge & Instruments (WGI);

.5 Ashcroft.

2.09 EQUIPMENT BELT DRIVES

.1 ANSI/RMA Standard V-belt type rated at minimum 1.5 times motor nameplate rating, and in accordance with following requirements:

.1 belts are to be reinforced cord and rubber, and multiple belts are to be matched sets;

.2 sheaves are to be cast iron or steel, secured to shafts with removable keys unless otherwise specified, standard adjustable pitch (± 10% range) for motors under 10 HP, fixed pitch type with split tapered bushing and keyway for motors 10 HP and larger, and, if required, replaced as part of mechanical work to suit system air/water quantity testing and balancing work;

.3 motor slide rail adjustment plates are to allow for centre line adjustment.

.2 Supply a spare belt set (tagged and identified) for each belt drive and hand to Owner upon Substantial Performance of the Work.

2.10 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 For V-belt drives – removable, 4-sided, fully enclosed, galvanized sheet steel guards to OHSA standards, cleaned, factory primed and painted with yellow equipment enamel, complete with a 2-piece full length hinged front panel to permit belt maintenance or replacement without removing guard, and 40 mm (1-½") diameter tachometer openings at each shaft location.

.2 For flexible couplings – removable "U" shaped galvanized steel guards to OHSA Standards with a 2.3 mm (3/32") thick frame and expanded mesh face.

.3 For unprotected fan inlets and outlets – unless otherwise specified, removable 20 mm (¾") galvanized steel wire mesh with galvanized steel frames, all to OHSA Standards.

2.11 ELECTRIC MOTORS

.1 Unless otherwise specified, motors are to conform to NEMA Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.

.2 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.

.3 Efficiency of 1-phase motors to 1 HP is to be in accordance with CAN/CSA C747. Efficiency of 3-phase motors 1 HP and larger is to be in accordance with CAN/CSA C390 or IEEE 112B.

.4 Unless otherwise specified, 1-phase motors smaller than ½ HP are to be 115 volt, continuous duty capacitor start type with an NEMA 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature.

.5 Explosion-proof 1-phase motors are to be totally enclosed, fan cooled, 115 volt continuous duty capacitor start type in accordance with CSA C22.2 No. 145, as specified for standard 1-phase motors but suitable for use in Class 1 Group D hazardous locations and complete with a rolled steel shell and a 1.0 service factor at 40°C (105°F) ambient temperature.

.6 Unless otherwise specified, motors ½ HP and larger are to be totally enclosed, fan cooled, 3-phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated on Drawings, NEMA Design "B" for normal starting torque or Design "C" for high starting torque as required by the application, each complete with Class "B" insulation, a 1.15 service factor at 40°C ambient temperature, grease lubricated open ball bearings with grease fittings to permit re-lubrication without dismantling motor, a cast iron frame with cast iron feet where required, cast iron end bracket and precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminum rotor windings.

.7 Explosion-proof 3-phase motors are to be totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3-phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40°C (105°F) ambient temperature.

.8 Unless otherwise indicated, motors 30 HP and larger are to be complete with a heat sensing PTC thermistor in the end turn of stator winding for each phase and connected in series inside motor with 2 marked leads brought out to motor conduit box.

.9 Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG-1 Part 31, quantified by CSA for operation from a variable frequency drive of type specified, and complete with Class "H" insulation. Motors are to be equipped with AEGIS, or approved equal, shaft grounding ring system to protect bearings from damage by diverting harmful shaft voltages and bearing currents to ground.

.10 Motors for equipment which is scheduled or specified with a corrosion resistant coating or constructed from corrosion resistant materials are to be factory coated with a primer and epoxy paint finish.

.11 Acceptable manufacturers are:

.1 TECO-Westinghouse Motors (Canada) Inc.;

.2 Canadian General Electric;

.3 Baldor Electric Co.;

.4 U.S. Electrical Motors;

.5 Weg Electric Corp.;

.6 Marathon Electric;

.7 Toshiba Corp.;

.8 Leeson Canada.

2.12 MOTOR STARTERS AND ACCESSORIES

.1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.

.2 Unless otherwise specified, starters for 1-phase motors are to be 115 volt, thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.

.3 Unless otherwise specified, starters for 3-phase motors less than 50 HP are to be combination "quick-make" and "quick-break" fused disconnects and full voltage non-reversing across-the-line starters, each complete with and overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts..

.4 Unless otherwise specified, starters for 3-phase motors 50 HP to 150 HP are to be reduced voltage, non-reversing, auto-transformer type starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, and auxiliary contacts.

.5 Unless otherwise specified, starters for 3-phase motors 150 HP and larger are to be reduced voltage, non-reversing, closed transition "wye-delta" starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, and auxiliary contacts.

.6 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.7 Starters for 2-speed single winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.8 Starters for reversible motors for cooling towers are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to allow fan(s) to coast down to a stop before being operated in reverse rotation.

.9 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:

.1 enclosures located in sprinklered areas – Type 2;

.2 enclosures exposed to the elements – Type 3R, constructed of stainless steel;

.3 enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;

.4 enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;

.5 enclosures except as noted above – Type 1;

.6 enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.

.10 Motor control centres are to be multi-unit, 2.28 m (9') high, NEMA Class 1, type "B", factory assembled, dead front, floor mounted, free-standing motor control centre with tin plated copper bus and an NEMA Type 1 or Type 2 enclosure as for loose starters specified above. Each motor control centre is to be complete with starters as specified above, load and control wiring terminal boards, and required facilities for line and load side power wiring connections.

.11 Disconnect switches for motor control centres are to be heavy-duty, CSA certified, front operated switches as per motor starter schedule, each complete with a handle suitable for padlocking in "off" position and arranged so that door cannot be opened with handle in "on" position and an NEMA enclosure as specified for loose starters. Fusible units are to be complete with fuse clips to suit fuse types specified below.

.12 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off.

.13 Acceptable manufacturers are:

.1 Rockwell Automation Inc. - Allen-Bradley;

.2 Eaton Corp. – Cutler-Hammer;

.3 Eaton Corp. – Moeller Electric;

.4 Siemens Canada;

.5 Schneider Electric.

2.13 SPRINKLER PROOFING

.1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:

.1 factory constructed by respective equipment manufacturers;

.2 constructed from non-combustible materials (sheet steel);

.3 enamel painted to match equipment;

.4 surfaces and edges filled/sanded smooth prior to painting;

.5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;

.6 structural support finish painted to match shield.

.2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.

.3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.

.4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.

.5 Above requirements are additional minimum "sprinkler proof" standards for equipment specified as NEMA 1, 2 or 12.

.6 Obtain CSA approval where required by local governing authorities.

2.14 MECHANICAL WORK IDENTIFICATION MATERIALS

.1 Equipment nameplates are to be minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2-½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:

.1 unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved wording to completely identify equipment and its use with no abbreviations;

.2 wording is generally to be as per drawings, i.e. Fan EF-1, and is to include equipment service and building area/zone served, but must be reviewed prior to engraving;

.3 supply stainless steel screws for securing nameplates in place;

.4 nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.

.2 Valve tags are to be coloured, 40 mm (1-½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match piping identification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V12
200 mm (8")
CHILL. WATER
NORMALLY OPEN

.3 Standard pipe identification is to be equal to Smillie McAdams Summerlin Ltd., Brady or Primark Manufacturing Inc. vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:

.1 for pipe less than or equal to 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around pipe or pipe insulation;

.2 for pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.

.4 Identification wording and colours for pipe identification materials are to be as follows:

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
domestic cold water	green	DOM. COLD WATER
domestic hot water supply	green	DOM. HW SUPPLY
domestic hot water recirculation	green	DOM. HW RECIRC.
tempered domestic water	green	TEMP. DOM. WATER
storm drainage	green	STORM
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
fire protection standpipe	red	F.P. STANDPIPE
fire protection sprinklers	red	F.P. SPRINKLER
natural gas	to Code	to Code, c/w pressure
natural gas vent	to Code	to Code
heating water supply	yellow	HTG. WTR. SUPPLY
heating water return	yellow	HTG. WTR. RETURN
heating water drain	yellow	HTG. WTR. DRAIN
glycol heating supply	yellow	GLY. HTG. SUPPLY
glycol heating return	yellow	GLY. HTG. RETURN
glycol heating drain	yellow	GLY. HTG. DRAIN
pumped condensate	yellow	PUMPED CONDENSATE
refrigerant suction	yellow	REFRIG. SUCTION
refrigerant liquid	yellow	REFRIG. LIQUID
refrigerant hot gas	yellow	REFRIG. HOT GAS

.1 Colours for pipe identification legends and directional arrows are to be as follows:

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
yellow	black
green	white
red	white

.2 Duct identification is to be custom made Mylar stencils with 50 mm (2") high lettering to accurately describe duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with lettering background.

3. EXECUTION

3.01 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

.1 Unless otherwise specified, locate and arrange horizontal pipes and ducts above or at ceiling on floors, arranged so that under consideration of all other work in area, maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, with Consultant’s approval.

.2 Unless otherwise specified, install work concealed in finished spaces, and concealed to degree possible in partially finished and unfinished spaces. Refer to and examine Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Walls which are painted are considered finished.

.3 Install pipes and ducts parallel to building lines and to each other.

.4 Neatly group and arrange exposed work.

.5 Locate work to permit easy access for service or maintenance as required and/or applicable. Locate valves, dampers and any other equipment which will or may need maintenance or repairs and which are to be installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate accessories at floor level.

.6 Make connections between pipes of different materials using adapters suitable for application. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.

.7 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.

.8 Carefully clean ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.

.9 Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around pipe or duct, except for ductwork at fire barriers, in which case insulation will be terminated at each side of the duct fire damper.

.10 Inspect surfaces and structure prepared by other trades before performing work. Verify surfaces or structure to receive work has no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of work will constitute acceptance of such surfaces as being satisfactory.

.11 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.

.12 Provide continuous galvanized sheet metal drip pan under drain, water and water solution piping extending through rooms with electrical equipment such as electrical, elevator equipment and transformer rooms, and other spaces provided primarily for the installation of electrical equipment. Drip pans are to be complete with a drain pipe connection and drain piping is to be extended to closest drain.

.13 For factory applied finishes, repaint or refinish surfaces damaged during shipment and installation. Quality of repair work is to match original finish. This requirement also applies to galvanized finishes.

.14 Provide screwed unions or flanges in piping connections to equipment and in regular intervals in long (in excess of 12 m [40']) piping runs to permit removal of sections of piping.

.15 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

3.02 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.

.4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.

.5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder’s identification symbol, and welds are not to be concealed until they have been inspected and approved. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.

.6 Unless otherwise specified, make flanged joints with Garlock 5500 or equivalent gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than length necessary to screw nut up flush to the end of bolt. Bolts used for flanged connections in piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193 Grade B-7, with heavy hexagon nuts to ASTM A-194 CL-2H. Provide suitable washers between each bolt head and flange and between each nut and flange.

.7 A random check of bolted flanged connections will be made to verify flanged connections are properly mated with no shear force acting on bolts. Supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.

.8 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean the outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.

.9 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.

.10 Grooves are to be rolled. Make arrangements with coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding the grooved piping system.

.11 If pressure crimped couplings and fittings are used, ensure gaskets are fully compatible with piping fluid, and valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with manufacturer’s latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of the piping system.

.12 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer’s recommendations, ASTM D2855, and CSA requirements.

.13 Install PVC piping with gasketed joints in accordance with manufacturer’s current published specifications, instructions and recommendations, and CSA requirements.

3.03 INSTALLATION OF PIPE SLEEVES

.1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:

.1 in poured concrete slabs – unless otherwise specified, minimum 16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves;

.2 in concrete or masonry walls – Schedule 40 galvanized steel pipe or Class 4000 cast iron pipe.

.2 Sleeves in waterproofed slabs or walls are to be lengths of Schedule 40 mild galvanized steel pipe with a waterstop plate in accordance with drawing detail. Provide waterproof sleeves in following locations:

.1 in mechanical room floor slabs, except where on grade;

.2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;

.3 in floors equipped with waterproof membranes;

.4 in roof slab;

.5 in waterproof walls.

.3 Size sleeves, unless otherwise specified, to leave 12 mm (½") clearance around pipes, or where pipe is insulated, a 12 mm (½") clearance around pipe insulation.

.4 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:

.1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;

.2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified.

.5 Where sleeves are required in masonry work, accurately locate and mark sleeve location, and hand sleeves to mason for installation.

.6 Terminate piping for sleeves that will be exposed so sleeve is flush at both ends with building surface concerned so sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above finished floor.

.7 "Gang" type sleeving will not be permitted.

.8 Where sleeves are provided in non-fire rated construction for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of sleeved opening.

3.04 INSTALLATION OF WATERPROOF MECHANICAL SEALS

.1 Provide watertight link type mechanical seals in exterior wall openings.

.2 Assemble and install each mechanical seal in accordance with manufacturer's instructions.

.3 After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until seal is completely watertight.

3.05 DUCT OPENINGS

.1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in new poured concrete work, masonry, drywall and other building surfaces by trade responsible for particular construction in which opening is required.

.2 Size openings for fire dampers to 600 mm (24") high to suit damper arrangement with folding blade out of air stream.

.3 For duct openings except where fire dampers are required, pack and seal space between duct or duct insulation and duct opening as specified above for pipe openings in non-fire rated construction.

3.06 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

3.07 INSTALLATION OF PIPE ESCUTCHEON PLATES

.1 Provide escutcheon plates suitably secured over exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.

.2 Install plates so they are tight against building surface concerned, completely covering pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case fit plate tightly around sleeve.

3.08 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide fastening and securing hardware required for mechanical work to maintain installations attached to structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding dead loads, live loads, superimposed dead loads, and any vibration of installed products.

.2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where floor, wall or ceiling construction is not suitable to support loads, provide additional framing or special fasteners to ensure proper securement to structure that is to support the products. Provide reinforcing or connecting supports where required to distribute loading to structural components.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CAN/CSA Z166.1 and CAN/CSA Z166.2.

.5 Do not attach fasteners to steel deck without written consent from Consultant.

3.09 INSTALLATION OF PIPE HANGERS AND SUPPORTS

.1 Provide required pipe hangers and supports.

.2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from structure only.

.3 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.

.4 Support requirements for underground piping are as follows:

.1 support underground pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified;

.2 support underground service piping penetrating building exterior walls or foundations to prevent pipe damage if minor building settlement occurs, all as per drawing detail;

.3 ensure bedding and supports for underground pipes are flat and true and allowances are made for pipe hubs, couplings, or other protrusions so no voids are left between pipe and bedding.

.5 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.

.6 Space hangers and supports in accordance with following:

.1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;

.2 plastic pipe – conform to pipe manufacturer's recommended support spacing;

.3 glass pipe – conform to pipe manufacturer's recommended support spacing and support requirements;

.4 copper and steel pipe – hang or support at spacing in accordance with following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

.5 flexible grooved pipe/coupling joint piping – as above but with not less than one hanger or support between joints.

.7 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.

.8 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.

.9 Provide roller hangers or supports for heat transfer piping greater than or equal to 150 mm (6") diameter and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to pipe to protect piping insulation.

.10 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:

.1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;

.2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;

.3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;

.4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;

.5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.

.11 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.

.12 For insulated horizontal piping less than or equal to 40 mm (1-½") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.

.13 Do not support piping from steel deck without written consent from Consultant.

3.10 INSTALLATION OF ROOF MOUNTED PIPE SUPPORTS

.1 Supply manufactured roof supports as per Part 2 of this Section to accommodate piping.

.2 The use of wood for supporting piping is not permitted.

.3 Provide supports spaced so deflection of piping does not exceed 1/240 of span.

.4 Piping support spacing is to be as per manufacturer’s recommendations or as indicated in schedule below, but in no case greater than 3 m (10') on centre.

.5 Supports are to be provided upstream and downstream of all corners, valves, and branch tee-offs.

.6 Contractor is responsible for piping supports meeting the requirements of all local codes and standards (ex. TSSA, Natural Gas Utility requirements, etc.).

.7 Set framing posts into bases and assemble framing structure as indicated.

.8 Use galvanized fasteners for galvanized framing and stainless steel fasteners for stainless steel framing.

.9 Piping supports are to be provided as follows:

.1 For Gas Lines 2-1/2 inches (64 mm) in Diameter or Less, up to 10 inches (254 mm) above roof: Portable Pipe Hanger Model number: SS8.

.2 For Gas Lines 3-1/2 inches (89 mm) in Diameter or less, up to 16 inches (406 mm) above roof: Portable Pipe Hanger Model number PP10.

.3 For Gas Lines 4 to 6 inches (100-150 mm) in Diameter, up to 12 inches (305 mm) above roof: Portable Pipe Hanger Model number RB18.

.4 For single Gas Lines 3 to 8 inches (80-200 mm) in Diameter: Portable Pipe Hanger Model number PS 1-2.

.5 For insulated piping mounted on roof: Portable Pipe Hanger Model number PSE.

.6 Option for Multiple Lines: Portable Pipe Hanger Model number PSE custom.

.10 Spacing requirements for supports are to be confirmed by manufacturer. Unless otherwise noted, support roof mounted piping at spacing according to the following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
Less than 25 mm (1")	1.2 m (4')	Continuous Support
25 mm (1")	2.4 m (8')	2 m (6')
32 mm (1-1/4) and Greater	3.0 m (10')	2 m (6')

.11 For copper tubing less than 25mm (1"), provide heavy gauge galvanized metal pan (or equivalent) running between supports (pan shall be constructed to support pedestrian loads). The refrigerant piping shall be mounted on the pan for continuous support c/w galvanized pipe clamp fasteners.

3.11 SUPPLY OF ACCESS DOORS

.1 Supply access doors to give access to mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on drawings.

.2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant’s review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.

.3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.

.4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Consultant prior to ordering.

.5 Group piping and ductwork to ensure minimum number of access doors is required.

.6 Submit a sample of each proposed access door for review prior to ordering.

.7 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.12 INSTALLATION OF VALVES

.1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:

.1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;

.2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;

.3 unless otherwise specified, provide a check valve in discharge piping of each pump;

.4 valve sizes are to be same as connecting pipe size;

.5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;

.6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

3.13 INSTALLATION OF PRESSURE GAUGES AND THERMOMETERS

.1 Provide pressure gauges in following locations:

.1 in valved tubing across suction, suction strainer (if applicable), and discharge piping of each circulating pump;

.2 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.;

.3 in expansion tank(s);

.4 in separate domestic hot water storage tank(s);

.5 at top most outlet in each standpipe fire protection system riser;

.6 in piping at each side of a pressure reducing valve;

.7 in potable water service piping downstream of meter;

.8 wherever else shown and/or specified.

.2 Provide thermometers in following locations:

.1 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, cooling towers, heat exchangers, main coils, etc., unless temperature indication is supplied with equipment;

.2 wherever else shown and/or specified.

.3 Conform to following installation requirements:

.1 for installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in piping well;

.2 for pressure gauges in piping at equipment locations, install pressure gauge between equipment and first pipe fitting;

.3 locate, mount and adjust instruments so they are easily readable;

.4 where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.

3.14 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 Provide OHSA guards for exposed accessible rotating parts such as belt drives, couplings, fan wheels, and shaft ends on mechanical equipment.

.2 Install belt guards to allow movement of motors for adjusting belt tension.

.3 Provide a means to permit lubrication and use of test instruments with guards in place.

.4 Secure guards to equipment or equipment base but do not bridge sound or vibration isolation.

.5 Where equipment oil level gauges, oil reservoirs, grease cups, or grease gun fittings are integral with equipment but are not easily accessible for service, extend to an accessible location using aluminium or copper tubing.

3.15 MECHANICAL WORK IDENTIFICATION

.1 Identify new exposed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at every end of every piping or duct run;

.2 adjacent to each valve, strainer, damper and similar accessory;

.3 at each piece of connecting equipment;

.4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;

.5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;

.6 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.

.2 Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas;

.2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;

.3 at each access door location;

.4 at each piece of connected equipment, automatic valve, etc..

.3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.

.4 Paint new natural and/or propane gas piping with primer and 2 coats of yellow paint in accordance with Code requirements and requirements of Painting Section in Division 09. Identify piping at intervals as specified above.

.5 Provide an identification nameplate for each motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter provided as part of mechanical work, and on each disconnect switch provided as part of the electrical work for motorized equipment provided as part of mechanical work.

.6 For electrically traced mechanical work, identification wording is to include "ELECTRICALLY TRACED".

.7 Tag valves and prepare a valve tag chart in accordance with following requirements:

.1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;

.2 prepare a computer printed valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);

.3 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;

.4 frame and glaze one copy of chart and, unless otherwise directed, affix to a wall in each main Mechanical and/or Equipment Room;

.5 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals;

.6 hand an identified CD of valve tag chart to Owner at same time O & M Manuals are submitted.

.8 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers equal to Brady "Quick Dot" on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:

.1 HVAC piping valves and equipment: yellow

.2 fire protection valves and equipment: red

.3 plumbing valves and equipment: green

.4 HVAC ductwork dampers and equipment: blue

.5 control system hardware and equipment: orange

3.16 FINISH PAINTING OF MECHANICAL WORK

.1 Finish painting of exposed mechanical work is specified in Division 09 and is part of the work of Division 09.

3.17 PIPE LEAKAGE TESTING

.1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test piping for leakage.

.2 Tests are to be witnessed by Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.

.3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.

.4 Gravity Drainage and Vent Piping

.1 Test piping in accordance with local governing building code.

.2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform a smoke test if required by local governing authorities.

.5 Pumped Drainage Piping

.1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.

.6 Domestic Water Piping

.1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.

.7 Sprinkler System Piping

.1 Test system piping in accordance with requirements of NFPA No. 13, "Installation of Sprinkler Systems", and in accordance with any additional requirements of governing authorities.

.8 Heat Transfer (HVAC) System Piping

.1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.

.9 Refrigerant Piping

.1 Test refrigerant piping for leakage and dehydrate in accordance with requirements of Chapter 18 of ASHRAE Handbook - Fundamentals.

.10 Following requirements apply to all testing:

.1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;

.2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;

.3 when testing is carried out below highest level of the particular system, increase test pressure by the hygrostatic head of 7 kPa (1 psi) for every 600 mm (24") below the high point;

.4 include for temporary piping connections required to properly complete tests;

.5 piping under test pressure is to have zero pressure drop for length of test period;

.6 make tight leaks found during tests while piping is under pressure, and if this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;

.7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions;

.8 tests are be done in reasonably sized sections so as to minimize number of tests required;

.9 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

3.18 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

.1 Unless otherwise shown or specified, supply a starter for each item of motorized equipment.

.2 Where 3-phase starters are indicated in motor control centres, supply motor control centres with starters and bolt to a concrete housekeeping pad.

.3 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor control centre, provide a disconnect switch in motor control centre in lieu of a motor starter.

.4 Where 3-phase starters are indicated and/or scheduled to be mounted on a motor starter panel, starters will be mounted and connected, complete with panels and splitter trough, as part of electrical work. Hand starters to electrical trade at site when they are required.

.5 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor starter panel, a disconnect switch will be provided on motor starter panel as part of electrical work.

.6 Unless otherwise specified or shown on drawings, 1-phase motor starters will be mounted adjacent to equipment they serve and connected complete as part of electrical work. Hand starters to electrical trade at site at the proper time.

3.19 ELECTRICAL WIRING WORK FOR MECHANICAL WORK

.1 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment will be done as part of the electrical work:

.1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment;

.2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment;

.3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment;

.4 provision of receptacles for plug-in equipment;

.5 provision of disconnect switches for motors in excess of 10 m (30') from starter location, or cannot be seen from starter location, and associated power wiring;

.6 motor starter interlocking in excess of 24 volts;

.7 wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts;

.8 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers;

.9 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units;

.10 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.

.2 Mechanical wiring work not listed above or specified herein or on drawings to be done as part of electrical work is to be installed in conduit and is to be done as part of mechanical work in accordance with wiring requirements specified for electrical work.

3.20 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

.1 Coordinate shut-down and interruption to existing mechanical systems with Owner. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.

.2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform Owner and Consultant in writing 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.

.5 Pipe freezing may be used to connect new piping to existing piping without draining existing piping. Pipe freeze equipment is to be equal to "NORDIC FREEZE" equipment supplied by Mag Tool Inc. (1-800-661-9983) or Rigid Tool Co. RIGID "SuperFreeze".

3.21 EQUIPMENT BASES AND SUPPORTS

.1 Unless otherwise specified or required, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:

.1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;

.2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;

.3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.

.2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:

.1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;

.2 flange bolt steel stands to concrete housekeeping pads;

.3 seismically restrained stands and supports in accordance with applicable requirements.

3.22 CONCRETE WORK FOR MECHANICAL EQUIPMENT BASES/PADS

.1 Provide poured concrete work, including reinforcing and formwork, required for mechanical equipment bases/pads. Perform concrete work in accordance with requirements specified in Division 03.

.2 Concrete is to be minimum 20,700 kPa ready-mix concrete in accordance with CAN/CSA-A23.1 and the Building Code.

.3 Submit for review, dimensioned shop drawings, prepared and stamped by a professional structural engineer registered in the jurisdiction of the work, for concrete pads or bases for support of large, heavy equipment. Indicate on shop drawings total weight of pad or base as well as equipment it is provided for, and concrete reinforcing.

3.23 EXCAVATION AND BACKFILL WORK

.1 Excavation, backfill and related work such as dewatering required for mechanical work will be performed as part of excavation and backfill work, except for final hand grading work which is to be done as part of mechanical work. Mark out location and routing of excavation required for work as well as required depth. Ensure that bedding is graded to provide proper drainage for ducts as directed by Consultant.

.2 Inverts and locations of existing site services may have been site surveyed and approximate location may be shown on drawings. Confirm local utilities have performed locates and marking out. Ensure inverts and locations are correct, prior to commencement of work. Where discrepancies are found, immediately inform Consultant, and await a direction.

.3 Accurately mark-out location and routing of excavation required, as well as required depth.

.4 Ensure underground piping subject to freezing and located outside building has a minimum of 1.37 m (4-½') of cover.

.5 Ensure underground piping subject to freezing and located inside building in unheated areas has a minimum of 450 mm (18") of cover.

.6 Ensure pipe bedding is proper prior to laying pipes. Hand excavate under pipe hubs, couplings, flanges and similar items to ensure even bearing along the entire barrel of each length of pipe.

.7 Ensure piping is inspected, leakage tested and approved prior to backfilling. Supervise initial backfilling operation to ensure buried work is not disturbed.

.8 Ensure work is inspected by Consultant before covering and backfilling. Failure to do so prior to backfilling will require re-excavating of work and re backfill at no additional cost to Owner.

3.24 CUTTING, PATCHING AND CORE DRILLING

.1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of mechanical work. Perform cutting in a neat and true fashion, with proper tools and equipment to Consultant's approval. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by Consultant.

.2 Criteria for cutting holes for additional services:

.1 cut holes through slabs only; no holes to be cut through beams;

.2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;

.3 keep at least 100 mm (4") clear from beam faces;

.4 space at least 3 hole diameters on centre;

.5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;

.6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;

.7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.

.3 Do not cut or drill any existing work without approval from Owner and Consultant. Be responsible for damage done to building and services caused by cutting or drilling.

.4 Where pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around pipes or pipe insulation.

.5 Prior to drilling or cutting an opening, determine, in consultation with Consultant and Owner, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Coring is not permitted through concrete beams or girders.

.6 Where drilling is required in waterproof slabs, size opening to permit snug and tight installation of a pipe sleeve sized to leave 12 mm (½") clearance around pipe or pipe insulation. Provide a pipe sleeve, constructed of Schedule 40 galvanized steel pipe with a flange at one end and of a length to extend 100 mm (4") above slab, in opening. Secure flange to the underside of slab and caulk void between sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a water-tight installation.

.7 Firestop and seal openings in fire rated construction in accordance with requirements of article entitled Firestopping and Smoke Seal Materials in this Section. Do not leave openings open overnight unless approved by Owner and Consultant.

3.25 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

.1 Pack and seal void between pipe opening and pipe or pipe insulation for length of opening as follows:

.1 non-fire rated interior construction – pack with mineral wool and seal both ends of opening with non-hardening silicone base caulking compound to produce a water-tight seal;

.2 exterior walls above grade – pack with mineral wool and seal both ends of sleeves water-tight with non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 exterior walls below grade (and any other wall where water leakage may be a problem) – seal with link type mechanical seals as specified.

3.26 FLASHING FOR MECHANICAL WORK PENETRATING ROOF

.1 Unless otherwise noted, perform required flashing work, including counter-flashing, for mechanical work penetrating and/or set in roof.

.2 Perform flashing work in accordance with requirements of drawing details, and requirements specified in Division 07.

3.27 CLEANING MECHANICAL WORK

.1 Clean mechanical work prior to application for Substantial Performance of the Work.

.2 Include for vacuum cleaning interior of air handling units and ductwork systems.

3.28 CONNECTIONS TO OTHER EQUIPMENT

.1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.29 INSTALLATION OF FLEXIBLE CONNECTORS

.1 Provide flexible connectors in piping connections to vibration isolated equipment, and wherever else shown.

3.30 FAN NOISE LEVELS

.1 Submit sound power levels with fan shop drawings/product data, with levels measured to AMCA 300 and calculated to AMCA 301.

3.31 EQUIPMENT AND SYSTEM MANUFACTURER’S CERTIFICATION

.1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for equipment/system manufacturer’s authorized representative to visit site to examine installation, and after any required corrective measures have been made, to certify in writing to Consultant that equipment/system installation is complete and in accordance with equipment/system manufacturer’s instructions.

3.32 EQUIPMENT AND SYSTEM START-UP

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:

.1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments made by Consultant;

.2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor.

END OF SECTION

1. GENERAL

1.01 APPLICATION

.1 This Section specifies seismic control and restraint requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 SEISMIC CONSULTANT

.1 Retain and pay for services of an experienced Seismic Consultant who is a registered professional engineer licensed in the jurisdiction of the work and a member in good standing of a Professional Engineers Association in the jurisdiction of the work.

.2 Seismic Consultant is to:

.1 determine proper seismic hazard level, design, recommend, and review proposed mechanical work seismic restraint shop, placement and securing drawings, and sign and stamp drawings prior to submittal for review as specified below;

.2 supervise installation of mechanical work seismic restraint and, when work is complete, certify in writing that seismic restraint work has been installed in accordance with signed, stamped and reviewed drawings;

.3 prepare and submit to Municipality and authorities having jurisdiction, on a form approved by Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when work is complete, original signed and sealed Letters of Assurance for design, installation and field review of seismic restraint work.

1.03 SUBMITTALS

.1 Obtain required equipment information and submit manufacturer's shop drawings/product data sheets for restraining devices and steel bases. Include placement data, and details of attachment to both equipment and structure meeting requirements of forces involved. Product data sheets and drawings are to be signed and stamped by Seismic Consultant referred to above.

.2 Submit copies of Seismic Consultant's Letters of Assurance as specified above.

.3 Submit copies of Seismic Consultant and seismic control manufacturer's certification letters as specified in Part 3 of this Section.

.4 If requested, submit samples of seismic restraint materials for review.

1.04 QUALITY ASSURANCE

.1 Seismic restraints are to be designed by a registered professional engineer as specified above, and are to be installed by qualified tradesmen under supervision of and to the approval of the design engineer.

.2 Unless otherwise specified, seismic control and restraints are to be designed in accordance with Code requirements, ANSI/SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, SMACNA/ASHRAE Service Restraint Applications CD-ROM, and the P.P.I.C. Manual Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems, all of which are to form a part of this Section.

.3 Seismic control and restraints for fire protection piping and equipment are to be in accordance with NFPA requirements. When specified and/or required, design is also to include Factory Mutual requirements.

.4 Restraint products must be tested in an independent testing laboratory, or certified by Seismic Consultant, to confirm restraint products meet requirements of this Section, i.e. dynamic ultimate limit load state as required by Code, "Fail Safe" design, etc. If particular tests are carried out to represent a restraint type, test is to be valid for the full load range of the restraint. Submit such tests or certification when requested.

.5 Seismic control and restraint product manufacturers are to provide required assistance during installation, and, when installation is complete, submit written reports listing any deficiencies to the installation.

2. PRODUCTS

2.01 GENERAL

.1 Isolation, anchors, bolts, bases, restraints, etc., are to be designed to withstand without failure or yielding, the dynamic G load as specified in Code for the seismic zone in which building is located. Design loads are ultimate limit state loads (1.5 times working load) acting through the centre of gravity of the anchored or restrained equipment. "Fail Safe" designs are acceptable.

.2 For both isolated and non-isolated floor mounted equipment, i.e. tanks, heat exchangers, boilers, etc., design and provide anchors and bolts to withstand, without failure or yielding, a dynamic ultimate limit state load as defined in Code, of the greater of 0.3 g or as required by Code, applied horizontally through the centre of gravity.

.3 Where impact forces may be significant, use ductile materials.

.4 Seismic restraining devices factory supplied with equipment are to meet requirements of this Section.

.5 Acceptable manufacturers are:

.1 Mason Industries Inc.;

.2 Kinetics Noise Control;

.3 Vibro-Acoustics Ltd;

.4 Price Industries Inc.

2.02 SLACK CABLE RESTRAINTS

.1 Aircraft cable galvanized slack cable restraints meeting current requirements of Building Code, sized to suit the application and complete with required cable ties, anchor hardware (selected for a load equal to twice the weight of the equipment), and similar connection accessories.

2.03 ANCHOR BOLTS

.1 Equal to Mason Industries type SAB seismic anchor bolts.

2.04 FLEXIBLE PIPING CONNECTIONS

.1 Flexible piping connectors are to be supplied with seismic restraint materials. Where flexible connections are not specified with piping in other Sections they are to be equal to Mason Industries twin sphere, non-metallic connectors with hose lengths preset in strict accordance with manufacturer's instructions and to approval of Seismic Consultant, each rated for continuous operation at 1725 kPa at 87.7°C (250 psi at 190°F) or 1380 kPa at 121°C (200 psi at 250°F), and complete with:

.1 nylon tire cord reinforced EPDM body;

.2 ductile iron reinforcing ring and ductile iron screwed or flanged connections as required and to suit piping system operating pressure.

2.05 VIBRATION ISOLATION PRODUCTS

.1 Refer to Section entitled Mechanical Vibration Control.

3. EXECUTION

3.01 INSTALLATION OF SEISMIC RESTRAINT MATERIALS

.1 Provide seismic restraint for mechanical equipment, piping, and ductwork, including diffusers, grilles, etc., as per requirements of current edition of Building Code and this Section of the Specification.

.2 Following Mechanical Components Restraint Guide is to be used as a general guide only to establish appropriate restraint methods, hardware, and attachments, however, due to differences in construction, size, weight, and configuration of different manufacturer's equipment and variety of ways and means that equipment and components can be installed, specific restraint methods are to be confirmed in the field. Seismic restraint materials and methods are to be reviewed and approved by Seismic Consultant.

MECHANICAL COMPONENT RESTRAINT GUIDE			
ITEM	**TYPE OF RESTRAINT**	**MINIMUM NO. OF RESTRAINTS**	**NOTES**
In-line Pumps	SCR	2	Pipe mounted type pump
Force Flow Heaters	TSR-SCR	4	
Packaged Rooftop Air Units (all types) On roof curb	BTRC	4	Roof curb bolted to roof.
Fans – Suspended - Isolated - Non-Isolated	 SCR SCR	 4 4	
Grilles, Registers, Diffusers	SCR	4	Where not bolted to duct (i.e. in tee-bar ceilings)
Airflow Control Valves	SCR	4	Where suspended
Piping	SCR TSR	As required	As per Specification
Ductwork	SCR TSR	As required	As per Specification

LEGEND	
SCR	Slack cable restraint (bolted to structure)
SNBR	Seismic snubber (bolted to structure)
TSR	Threaded support rod (bolted or clamped to structure)
BTSLPR	Bolt to sleeper (sleeper bolted to structure)
BTHP	Bolt to concrete housekeeping pad (pad to be keyed to structure)
CSSB	Custom steel shoe base (bolted to structure)
BTRC	Bolt to roof curb (roof curb bolted to roof structure)

.3 Provide structural steel bases for equipment unless equipment manufacturer certifies direct attachment capabilities.

.4 Space restraints under equipment so minimum distance between adjacent corner restraints is at least equal to the height of the centre of gravity of the equipment. Include the height of the centre of gravity on shop drawings, otherwise, design for increased forces on supports and submit design calculations with shop drawings. In particular, chillers are to meet this requirement.

.5 Floor mounted isolated equipment is to be installed on 100 mm (4") high concrete housekeeping pads with at least 200 mm (8") clearance between drilled inserts and edges of pads. Ensure housekeeping pads are keyed to structure to resist seismic displacement.

.6 Requirements pertaining to seismic control work are as follows:

.1 execute seismic control and restraint work in accordance with drawing details, reviewed shop drawings, ANSI/SMACNA Seismic Restraint Manual, PIPC Manual: Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems, and National Uniform Seismic Installation Guidelines (NUSIG);

.2 seismic control systems are to work in all directions;

.3 fasteners and attachment points are to resist same maximum load as the seismic restraint;

.4 drilled or power driven anchors and fasteners are not permitted;

.5 no equipment, equipment supports or mounts are to fail before failure of structure;

.6 supports of cast iron or threaded pipe are not permitted;

.7 seismic control measures are not to interfere with integrity of firestopping;

.8 equipment is to be bolted to structure, and bolts are to be fitted with isolation washers;

.9 number, size, type, and installation of anchor bolts are to be as recommended by anchor bolt manufacturer and seismic design consultant;

.10 where more than a 3 mm (1/8") differential exists between an anchor or attachment bolt diameter, an anchor and attachment point hole, or an isolator gap attachment bolt and equipment anchor attachment hole, pack air gap with Mason type 0.5 FastSteel reinforced epoxy putty;

.11 hung equipment and pipe hangers are to be fitted with a means of preventing upward movement, and non-isolated equipment and pipe hanger rods are to be fitted with oversized steel washers and nuts above and below hanger or equipment attachment point, locked tight to prevent uplift of equipment or hanger;

.12 where suspended equipment hanger rod length exceeds 50 rod diameters between structure and equipment attachment point, reinforce rods with angle iron to prevent bending due to uplift forces;

.13 seismic control measures are not to jeopardize noise and vibration isolation systems, and 6 mm (¼") to 9 mm (3/8") clearance during normal operation of equipment and systems is to be provided between seismic restraint and equipment;

.14 where hold-down bolts for seismic restraint equipment penetrate roofing membranes coordinate with roofing trade for installation of pitch pockets/"gum cups" and sealing compound to maintain water-tight integrity of roof;

.15 where friction type clamps are used for support of equipment and connecting services, secure clamps to steel work by means of welding or other positive means to prevent slippage or loosening of clamps due to seismic forces.

.7 Provide slack cable restraint assemblies for:

.1 piping 32 mm (1-¼") dia. and larger located in boiler, fan, and similar equipment rooms;

.2 horizontal and vertical piping 65 mm (2-½") dia. and larger;

.3 ductwork and duct mounted equipment;

.4 isolated and non-isolated ceiling hung fans, tanks, equipment, etc.

.8 Installation requirements for slack cable restraints include following:

.1 connect slack cable restraints to ceiling hung equipment in such a way that axial projection of wires passes through the centre of gravity of the equipment;

.2 orient restraint wires on ceiling hung equipment at approximately 90º to each other (in plan), and tie back to the ceiling slab at an angle not exceeding 45º to slab;

.3 install cables using appropriate grommets, shackles, and other hardware to ensure alignment of restraints and to avoid bending cables at connection points, and, where feasible, wrap cables directly around pipes as opposed to using collars;

.4 for piping systems, provide transverse slack cable restraints at a maximum spacing of 12.5 m (40'), and longitudinal restraints at 25 m (80') maximum spacing, or as limited by anchor/slack cable performance;

.5 for piping less than 250 mm (10") dia., reduce transverse restraint spacing to 6 m (20'), and note that smaller piping may be rigidly tied to larger piping for restraint, but not the reverse;

.6 vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonance;

.7 transverse bracing for one pipe section may also act as longitudinal bracing for piping connected perpendicular to it if bracing is installed within 600 mm (24") of elbow or tee, and if connected piping is same or smaller dia., and note that branch lines are not to be used to restrain main lines;

.8 provide flexibility in piping joints or sleeves where piping penetrates building seismic or expansion joints;

.9 wherever possible, support weight of vertical piping risers at a point or points above the centre of gravity of riser, and provide lateral guides at top and bottom of riser, and at intermediate points not to exceed the transverse spacing specified above for horizontal pipes, with guide clearance not exceeding 3 m (10');

.10 install restraints at least 50 mm (2") clear of other equipment and services;

.11 adjust restraint cables such that they are not visibly slack, or such that flexibility is approximately 40 mm (1-½") under thumb pressure for a 1.5 m (5') cable length, with an equivalent ratio for other cable lengths, and adjust clearance of cable strap/spacer piece restraints so as not to exceed 6 mm (0.23");

.12 provide transverse and axial restraints within 4 m (12') of a vertical bend;

.13 at steel trusses, connect to top chords at panel points and follow truss manufacturer's instructions;

.14 diffusers and grilles mounted in t-bar ceilings or which are not positively secured to ductwork or structure are to be fitted with slack cable restraints to prevent them from falling in the event the ceiling t-bar grid is displaced;

.15 do not bridge vibration isolators with slack cable restraints;

.16 other approved restraint systems are conventional pipe guides, rigid restraint where piping passes through a block or concrete wall, or a cable strap and spacer piece attached to structure and used where piping is adjacent to a wall and conventional slack cable restraints cannot be used.

3.02 INSTALLATION OF FLEXIBLE PIPING CONNECTORS

.1 Supply flexible piping connectors for connections (including plumbing) to seismically restrained equipment. Hand connectors to appropriate piping trade at site for installation.

3.03 SITE INSPECTION AND LETTERS OF CERTIFICATION

.1 When seismic control products have been installed, arrange for seismic control product manufacturer and Seismic Consultant to examine installation of seismic control products and to certify in writing (separate letters) that products have been properly installed in accordance with governing Codes and Regulations, and recommendations and instructions. Seismic Consultant is to apply his professional stamp to the letter.

END OF SECTION

1.01 GENERAL

1.02 APPLICATION

.1 This Section specifies vibration isolation product requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.03 SUBMITTALS

.1 Submit copies of manufacturer's product data sheets for products specified in this Section. Product data sheets are to include product characteristics, limitations, dimensions, finishes, and installation recommendations.

.2 Submit a letter from vibration isolation manufacturer to certify correct installation of products, as specified in Part 3 of this Section.

2. PRODUCTS

2.01 GENERAL

.1 Vibration isolation products are to be in accordance with drawing schedule and details, and as specified below.

.2 Springs are to be stable, colour coded, selected to operate at no greater than ⅔ solid load, designed in accordance with Society of Automotive Engineers Handbook Supplement 9 entitled Manual on Design and Application of Helical and Spiral Springs, and with spring diameters in accordance with manufacturer's recommendations to suit static deflection and maximum equipment load.

.3 Steel components of isolation products not exposed to the weather or moisture are to be zinc plated. Steel components of isolation products exposed to the weather or in a damp, moist environment are to be factory painted with rust inhibiting primer and 2 coats of neoprene.

.4 Where weight of isolated equipment may change significantly due to draining or filling with a liquid, vibration isolators are to be equipped with limit stops to limit spring extensions.

.5 Flexible piping connections to vibration isolated equipment are specified in the appropriate piping sections of the Specification.

2.02 ACCEPTABLE MANUFACTURERS

.1 Below are the acceptable manufactures for mechanical vibration control products:

.1 Vibro-Acoustics Ltd.;

.2 The VMC Group Vibration Mounting & Controls Inc. (Korfund-Dynamics);

.3 Kinetics Noise Control Vibron Products Group;

.4 Mason Industries Inc.;

.5 Isotech Industries Inc.

2.03 ISOLATION PADS

.1 Sandwich type pads, 20 mm (¾") nominal thickness, selected for 3.2 mm (1/8") static deflection unless otherwise specified, consisting of 2 waffle type or ribbed 50 durometer neoprene pads permanently bonded to a minimum #10 gauge steel plate, and complete with rubber bushed bolt holes and equipment anchor bolts with neoprene isolation grommets.

2.04 RUBBER FLOOR ISOLATORS

.1 Captive, bridge bearing quality neoprene mount selected for a minimum 4 mm (0.15") static deflection unless otherwise specified, with an integral ductile iron housing and integral equipment anchor bolt.

2.05 SPRING FLOOR ISOLATORS

.1 Seismically rated captive spring mount isolator complete with levelling bolts, upper and lower neoprene spring cups, neoprene cushion, ductile iron housing, neoprene sound pads, and neoprene isolation grommets for securing bolts.

2.06 OPEN SPRING MOUNTS

.1 Base mount free-standing assemblies, each complete with a stable colour coded steel spring welded in place, drilled mild steel mounting plate bonded to a ribbed rubber or neoprene acoustical pad, and an external 16 mm (5/8") diameter level adjustment bolt.

2.07 CLOSED SPRING MOUNTS

.1 Base mount free-standing enclosed assemblies, each complete with stable colour coded spring(s), 2 piece cast housing, non-binding rubber horizontal stabilizers, a ribbed rubber or neoprene acoustical pad bonded to base of the closed housing, and an external level adjustment bolt.

2.08 TOTALLY RETAINED SPRING MOUNTS

.1 Base mount free-standing enclosed and retained assemblies to limit both vertical and lateral movement of mounted equipment, each complete with stable colour coded spring(s), drilled welded steel housing and top plate, ribbed rubber or neoprene acoustical pad bonded to bottom of housing, vertical limit adjusting hardware, and a level adjustment bolt.

2.09 SPRING HANGERS

.1 Welded steel plate housing with top and bottom rod mounting holes and spring retainer, neoprene double deflection isolation element, stable colour coded spring, and heavy-duty rubber washers.

2.10 NEOPRENE HANGER ISOLATORS

.1 Neoprene double deflection rod isolators with steel housing and hanger rod bushing, selected for a minimum 4 mm (0.15") static deflection unless otherwise specified.

3. EXECUTION

3.01 INSTALLATION OF VIBRATION ISOLATION MATERIALS

.1 Provide vibration isolation products for mechanical work in accordance with drawing schedule and details, and requirements specified herein and/or on drawings.

.2 Supply to vibration isolation product manufacturer or supplier a copy of a "reviewed" shop drawing or product data sheet for each piece of equipment to be isolated and dimensioned pipe layouts of associated piping to be isolated.

.3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.

.4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.

.5 Unless otherwise indicated, install isolation materials for base mounted equipment on concrete housekeeping pad bases which extend at least over the full base and isolated area of the isolated equipment. Additional requirements are as follows:

.1 block and shim bases level so ductwork and piping connections can be made to a rigid system at proper operating level, before isolated adjustment is made, and ensure there is no physical contact between isolated equipment and building structure;

.2 steel bases are to clear the sub-base by 25 mm (1");

.3 concrete bases are to clear the sub-base by 50 mm (2").

.6 Isolate piping larger than 25 mm (1") dia. directly connected to motorized and/or vibration isolated equipment with 25 mm (1") static deflection spring hangers at spacing intervals in accordance with following:

.1 for pipe less than or equal to 100 mm (4") dia. – first 3 points of support;

.2 for pipe 125 mm (5") to 200 mm (8") dia. – first 4 points of support;

.3 for pipe equal to or greater than 250 mm (10") dia. – first 6 points of support;

.7 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm (2").

.8 Secure top of spring hanger frame rigidly to structure, and do not install spring hangers in concealed locations.

.9 Where it is impossible to use at least 2 spring hangers, provide Senior Flexonics Ltd. Style 102 (or 102-U as required) or equal, twin sphere, moulded rubber flexible connection assemblies, selected by manufacturer and suitable in all respects for intended application, and complete with required nipples and connections to provide proper vibration isolation.

.10 Isolate designated piping risers at floor support points in accordance with drawing detail.

.11 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm (1") dia. and smaller, and for conduit larger than 25 mm (1") dia., use Crouse Hinds EC couplings. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm (12") laterally from its installed position, and flexible enough to transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to Consultant.

.12 Arrange and pay for vibration isolation product manufacturer to visit site to inspect installation of his equipment. Perform revision work required as a result of improper installation. When vibration isolation equipment manufacturer is satisfied with the installation, obtain and submit a letter stating manufacturer has inspected the installation and equipment is properly installed.

.13 Refer to Section entitled Seismic Control and Restraint for requirements pertaining to seismically restrained vibration isolation.

END OF SECTION

1. GENERAL

1.01 APPLICATION

.1 This Section specifies insulation requirements common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.02 DEFINITIONS

.1 "concealed" – means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.

.2 "exposed" – means exposed to normal view during normal conditions and operations.

.3 "mineral fibre" – includes glass fibre, rock wool, and slag wool.

.4 "domestic water" or "potable water" – means piping extended from building Municipal supply main.

1.03 SUBMITTALS

.1 Submit a product data sheet for each insulation system product.

.2 Submit a fabrication drawing for each custom made cover to indicate material and fabrication details, and a 300 mm (12") square sample of proposed cover material.

1.04 QUALITY ASSURANCE

.1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.

.2 Do not apply insulation unless leakage tests have been satisfactorily completed.

.3 Ensure surfaces to be insulated are clean and dry.

.4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.

.5 Insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from site.

2. PRODUCTS

2.01 FIRE HAZARD RATINGS

.1 Unless otherwise specified, insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.02 THERMAL PERFORMANCE

.1 Unless otherwise specified, thermal performance of insulation is to meet or exceed values given in Tables entitled Minimum Piping Insulation Thickness Heating and Hot Water Systems and Minimum Piping Insulation Thickness Cooling Systems, as stated in ANSI/ASHRAE/IES Standard 90.1 version referenced in Ontario Building Code.

2.03 PIPE INSULATION MATERIALS

.1 Pre-moulded mineral fibre is to be rigid, sectional, sleeve type insulation to ASTM C547, with a factory applied vapour barrier jacket. Acceptable products are:

.1 Johns Manville Inc. "Micro-Lok AP-T Plus";

.2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket;

.3 Manson Insulation Inc. "ALLEY K APT";

.4 Owens Corning “Fiberglas” Pipe Insulation.

.2 Blanket mineral fibre is to be blanket type roll insulation to CGSB 51-GP-11M, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.3 Blanket mineral fibre is to be blanket type roll insulation to CGSB 51-GP-11M, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.4 Horizontal pipe insulation at hangers and supports are to be equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.

.5 Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories. Acceptable products are:

.1 Armacell AP/Armaflex SS;

.2 IK Insulation Group K-Flex "LS" Self-Seal Pipe Insulation.

.6 Closed cell foamed glass is to be Pittsburgh Corning "FOAMGLASS", expanded, sectional, rigid sleeve type insulation with a liquid or vapour permeability rating (as per ASTM C240) of 0.00, and a factory applied "PITTWRAP SSII" self-sealing jacket.

.7 Fire rated pre-moulded mineral wool is to be non-combustible, fire-rated, rigid, sectional, longitudinally split mineral wool or basalt pipe insulation with a reinforced vapour barrier jacket and compatible with ULC S115 and ULC-S101 firestopping. Acceptable products are:

.1 Roxul "Techton 1200";

.2 IIG (Johns Manville Inc.) MinWool-1200;

.3 Paroc 1200.

2.04 BARRIER-FREE LAVATORY PIPING INSULATION KITS

.1 Removable, flexible, reusable, white moulded plastic insulation kits for barrier-free lavatory drain piping and potable water supplies exposed under lavatory.

.2 Acceptable products are:

.1 Truebo "Lav-Guard 2" E-Z Series;

.2 Zeston "SNAP-TRAP";

.3 McGuire Manufacturing Co. Inc. "ProWrap".

2.05 EQUIPMENT INSULATION MATERIALS

.1 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.2 Closed cell foamed glass is to be Pittsburgh Corning "FOAMGLAS" expanded, rigid board and block type insulation with a liquid or vapour permeability rating (as per ASTM C240) of 0.00.

2.06 REMOVABLE/REUSABLE INSULATION COVERS

.1 Valve, etc. covers are to be NO SWEAT reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to adjoining insulation.

.2 Custom manufactured equipment covers conforming to shape of item to be insulated, designed to be easily removable and replaceable to suit use and maintenance procedures of particular item, and to provide adequate personnel protection. Covers are to be complete with minimum 95 kg/m3 (6 lb/ft³) density ceramic fibre insulation sewn between minimum 542.5 g/m2 (1.8 oz/ft²) weight silicone impregnated fibreglass fabric in a quilted pattern using double stitches made with Kelvar or Teflon coated fibreglass thread. Overlap flaps are to be secured using laces, snaps, or Velcro double stitched in place. Acceptable manufacturers are:

.1 Crossby Dewar Inc.;

.2 Insufab Systems Inc.;

.3 ADL Insulflex Inc.;

.4 Firwin Corp.;

.5 GlassCell Isofab Inc.

2.07 DUCTWORK SYSTEM INSULATION MATERIALS

.1 Rigid mineral fibre board is to be pre-formed board type insulation to ASTM C612, 48 kg/m3 (3 lb/ft³) density, with a factory applied reinforced aluminum foil and kraft paper facing. Acceptable products are:

.1 Knauf Fiber Glass Insulation Board with FSK facing;

.2 Manson Insulation Inc. "AK BOARD FSK";

.3 Johns Manville Inc. Type 814 "Spin-Glas";

.4 Owens Corning 703.

.2 Semi-rigid mineral fibre board is to be roll form insulation to ASTM C1393, consisting of cut strips of rigid mineral board insulation glued to an aluminium foil and kraft paper facing. Acceptable products are:

.1 Multi-Glass Insulation Ltd. "Multi-Flex MKF";

.2 Glass-Cell Fabricators Ltd. "R-FLEX";

.3 Owens Corning Pipe and Tank Insulation;

.4 Johns Manville Inc. Pipe and Tank Insulation.

.3 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m3 (1½ lb/ft3) density, 40 mm (1-½") thick, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.4 Flexible foam elastomeric sheet is to be sheet form, CFC free, closed cell, self-adhering elastomeric nitrile rubber insulation with a water vapour permeability rating of 0.08 in accordance with ASTM E96 Procedure A. Acceptable products are:

.1 Armacell "AP/Armaflex SA";

.2 IK Insulation Group "K-Flex Duct Wrap", S2S.

2.08 FIRE RATED DUCT WRAP

.1 Flexible, non-combustible, blanket type mineral fibre duct wrap completely encapsulated in reinforced foil, suitable for installation with zero clearance to combustibles (for grease ducts), and ULC tested and listed (ULC Designs FRD-17 & 23 for ventilation ducts, ULC Design FRD-19 for kitchen exhaust/grease duct) to facilitate a 2 hour fire resistance rating (76 mm [3"] thick) to kitchen grease exhaust duct in accordance with requirements of NFPA-96, and/or a 1 or 2 hour fire resistance rating (38 mm [1-½"] thick) to ventilation or pressurization ductwork in accordance with requirements of ISO 6944.

.2 Acceptable manufacturers are:

.1 3M Fire Barrier Duct Wrap 615;

.2 CL4 Inc. "CL4Fire";

.3 Unifrax Corp. "FyreWrap Elite 1.5";

.4 Morgan Thermal Ceramics "FireMaster FastWrap XL".

2.09 INSULATING COATINGS

.1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:

.1 anti-condensation coating, "No Sweat-FX";

.2 thermal insulating coating, "ThermaLite".

2.10 INSULATION FASTENINGS

.1 Wire – minimum #15 gauge galvanized annealed wire.

.2 Wire with Mesh – minimum #15 gauge galvanized annealed wire factory woven into 25 mm (1") hexagonal mesh.

.3 Aluminium Banding – equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.

.4 Stainless Steel Banding – equal to ITW Insulation Systems Canada "FABSTAPS" 0.6 mm (1/16") thick, minimum 12 mm (½") wide type 304 stainless steel strapping.

.5 Duct Insulation Fasteners – weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-½") square plastic or zinc plated steel self-locking washers.

.6 Tape Sealant – equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.

.7 Mineral Fibre Insulation Adhesive – clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.

.8 Flexible Elastomeric Insulation Adhesive – Armacell "Armaflex" #520 air-drying contact adhesive.

.9 Closed Cell Foamed Glass Insulation Adhesive – Pittsburgh Corning PC88 multi-purpose 2-component adhesive.

.10 Lagging Adhesive – white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.

.11 Screws – No. 10 stainless steel sheet metal screws.

2.11 INSULATION JACKETS AND FINISHES

.1 Canvas Jacket Material – ULC listed and labelled, 25/50 fire/smoke rated, roll form, minimum 170 g (6 oz.).

.2 Roll Form Sheet and Fitting Covers – minimum 15 mm (1/2") thick white PVC, 25/50 fire/smoke rated tested in accordance with ULC S102, complete with installation and sealing accessories. Acceptable products are:

.1 Proto Corp. "LoSMOKE";

.2 The Sure-Fit System "SMOKE-LESS 25/50";

.3 Johns Manville Inc. "Zeston" 300.

.3 Rigid Aluminium Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.406 mm (0.016") thick embossed aluminum jacket material to ASTM B209, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to weatherproof the end to end joints, and 2-piece epoxy coated pressed aluminum fittings with weather locking edges.

.4 Stainless Steel Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.254 mm (0.010") thick type 304 embossed stainless steel jacket material to ASTM A240, factory cut to size and complete with moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to cover end to end joints, and 2-piece pressed stainless steel fittings with weather locking edges.

.5 Multi-layered adhesive backed jacketing system - A zero permeable, all weather, multi-layered laminate coated with a cold weather acrylic adhesive, resistance to weathering, fungi, UV and extreme environmental conditions. Silver colouring. Acceptable products are:

.1 3M Ventureclad 1577CWE-EMJ series;

.2 MFM Building Products Corp. "Flex-Clad 400".

.6 Heat resistant, trowel consistency thermal insulating and finishing cement to CAN/CGSB 51.12, and suitable for the application.

.7 Foamed glass insulation protective coating is to be Pittsburgh Corning "PITTCOTE 404" flexible acrylic latex weather barrier coating, white unless otherwise specified.

.8 Flexible foam elastomeric insulation protective coating equal to Armacell "WB Armaflex" weatherproof, water-based latex enamel finish.

3. EXECUTION

3.01 GENERAL INSULATION APPLICATION REQUIREMENTS

.1 Unless otherwise specified, do not insulate following:

.1 factory insulated equipment and piping;

.2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;

.3 heating piping in soffits and/or overhang spaces and connected to bare element radiation in spaces;

.4 branch potable water piping located under counters to serve counter mounted plumbing fixtures and fittings, except barrier-free lavatories;

.5 exposed chrome plated potable water angle supplies from concealed piping to plumbing fixtures and fittings, except barrier-free lavatories;

.6 heated liquid system pump casings, valves, strainers and similar accessories;

.7 heating system expansion tanks;

.8 manufactured expansion joints and flexible connections;

.9 acoustically lined ductwork and/or equipment;

.10 factory insulated flexible branch ductwork;

.11 piping unions, except for unions in "cold" category piping.

.2 Install insulation directly over pipes and ducts, not over hangers and supports.

.3 Install piping insulation and jacket continuous through pipe openings and sleeves.

.4 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.

.5 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect insulation jacketing from the action of condensation at its junction with metal.

.6 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.

.7 Where piping and/or equipment is traced with electric heating cable, ensure cable has been tested and accepted prior to application of insulation, and ensure cable is not damaged or displaced during the application of insulation.

.8 Where existing insulation work is damaged as a result of mechanical work, repair damaged insulation work to Project work standards.

.9 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover exposed end of insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping.

.10 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.

.11 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

3.02 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS

.1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.

.2 For 100 mm (4") diameter and larger heating system piping where roller type hangers and supports are provided, a steel saddle will be tack welded to pipe at each roller hanger or support location. Pack saddle voids with loose mineral wool insulation.

3.03 PIPE INSULATION REQUIREMENTS – MINERAL FIBRE

.1 Insulate following pipe inside building and above ground with mineral fibre insulation of thickness indicated:

.1 domestic cold water piping, less than 100 mm (4") dia. – 25 mm (1") thick;

.2 domestic cold water piping, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;

.3 domestic hot water piping, less than 40 mm (1-½") dia. – 25 mm (1") thick;

.4 domestic hot water piping, greater than or equal to 40 mm (1½") dia. – 40 mm (1-½") thick;

.5 tempered domestic water piping, supply and return, less than 40 mm (1-½") dia. – 25 mm (1") thick;

.6 tempered domestic water piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.7 storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal underground mains – 25 mm (1") thick;

.8 condensate drainage piping from fan coil unit or any other air conditioning system/unit drain pans to main vertical drain risers or to indirect drainage point – 25 mm (1") thick;

.9 drainage piping from refrigerated drinking fountains to nearest 75 mm (3") dia. or larger drain pipe – 25 mm (1") thick;

.10 hot water heating piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1 ½") thick;

.11 hot water heating piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.12 glycol solution heating or heat reclaim piping, supply and return, less than 40 mm (1 ½") dia. – 40 mm (1-½") thick;

.13 glycol solution heating or heat reclaim piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.14 piping indicated to be traced with electric heating cable – minimum 50 mm (2") thick;

.15 drum drip(s) in dry zone standpipe and/or sprinkler system piping – 50 mm (2") thick;

.16 refrigerant suction piping (between compressor and evaporator coil) inside building – 25 mm (1") thick;

.17 refrigerant hot gas piping (between compressor and condenser) inside building – 25 mm (1") thick;

.18 refrigerant hot gas by-pass piping (between compressor discharge and evaporator coil) inside building – 25 mm (1") thick;

.2 Secure overlap flap of the sectional insulation jacket tightly in place. Cover section to section butt joints with tape sealant.

.3 Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket mineral fibre insulation to a thickness and insulating value equal to the sectional insulation, secure in place with adhesive and/or wire, and cover with PVC fitting covers.

.4 Unless otherwise specified, insulate unions, valves, strainers, and similar piping system accessories in "cold" piping with cut and tightly fitted segments of sectional pipe insulation with joints covered with tape sealant, or, alternatively, wrap piping union, valve, strainer, etc., with blanket mineral fibre and cover with PVC covers as for paragraph above.

.5 Terminate sectional insulation approximately 50 mm (2") from flange or coupling on each side of flange or coupling. Cover flange or coupling with a minimum 50 mm (2") thickness of blanket mineral fibre insulation wide enough to butt tightly to ends of adjacent sectional insulation. Secure blanket insulation in place and cover with a purpose made PVC coupling cover.

.6 Drum drips in dry zone sprinkler and/or standpipe system piping will be traced with electric heating cable as part of electrical work, and are generally not shown on drawing(s). Confirm number and size of drum drips required with trade providing piping and include for insulation to suit. Wherever possible drum drips will be located in heated areas.

.7 Take special care at concealed water rough-in piping at plumbing fixtures to ensure piping is properly insulated. If necessary due to space limitations, use 12 mm (½") thick sectional pipe insulation in lieu of 25 mm (1") thick insulation.

3.04 PIPE INSULATION REQUIREMENTS – FLEXIBLE FOAM ELASTOMERIC

.1 Install flexible elastomeric pipe insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants and finish to produce a water-tight installation. Insulate following pipe with flexible elastomeric pipe insulation of thickness indicated:

.1 refrigerant suction and hot gas piping outside building – 25 mm (1") thick.

3.05 PIPE INSULATION REQUIREMENTS – CLOSED CELL FOAMED GLASS

.1 Install closed cell foamed glass insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants, and jacketing to produce a water-tight installation. Insulate following pipe with closed cell foamed glass of thickness indicated:

.1 piping located outside building and indicated to be heat traced – minimum 50 mm (2") thick.

3.06 PIPE INSULATION REQUIREMENTS – FIRE RATED INSULATION

.1 Where pipe (inside building and above ground) which is to be insulated as specified above penetrates fire rated construction, provide fire-rated, non-combustible sectional insulation on portion of pipe in fire barrier and for a distance of 50 mm (2") on either side of fire barrier. Insulation thickness is to be as specified, but in any case minimum 25 mm (1").

3.07 INSTALLATION OF BARRIER FREE LAVATORY INSULATION KITS

.1 Provide manufactured insulation kits to cover exposed drainage and water piping under barrier free lavatories.

3.08 EQUIPMENT INSULATION REQUIREMENTS – BLANKET TYPE MINERAL FIBRE

.1 Insulate following equipment with mineral fibre blanket type insulation of thickness indicated:

.1 roof drain sumps where inside the building – 25 mm (1") thick;

.2 water meter(s) – 40 mm (1-½") thick;

.3 top of radiant ceiling panels – 50 mm (2") thick.

.2 Unless otherwise noted, wrap equipment to a thickness and insulating value equal to an equivalent thickness of rigid sectional pipe insulation. Laminate insulation in place with a full coverage of adhesive and secure with wire. Apply a jacket of insulation vapour barrier material secured in place with adhesive or sealant tape.

.3 Cover roof drain sumps with purpose made PVC fitting covers.

.4 Lay fibreglass blanket on radiant ceiling panels after testing is complete.

3.09 EQUIPMENT INSULATION REQUIREMENTS – CLOSED CELL FOAMED GLASS

.1 Insulate following equipment with closed cell foam glass insulation of thickness indicated:

.1 Equipment which has to be heat traced with heating cable.

.2 Install insulation in strict accordance with manufacturer’s published instructions using adhesive, wrap, sealant, etc., to secure insulation in place, to secure and seal joints, and to produce a 100% water-tight installation.

3.10 EQUIPMENT INSULATION REQUIREMENTS – REMOVABLE/REUSABLE TYPE

.1 Provide custom designed and manufactured removable and reusable insulation covers for following:

.1 plate type heat exchanger(s);

.2 150 mm (6") dia. and larger piping strainers, backflow preventers, etc.

.2 Provide "wrap type" removable and reusable insulation covers for "cold" circuit balancing valves, backflow preventers, and similar items, and for steam traps and similar items requiring service in piping less than 150 mm (6") dia.

3.11 DUCTWORK INSULATION REQUIREMENTS – MINERAL FIBRE

.1 Insulate following ductwork systems inside building and above ground with mineral fibre insulation of thickness indicated:

.1 outside air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and fresh air is not tempered, then the fresh air ductwork system complete – minimum 40 mm (1-½") thick as required;

.2 combustion air intake ductwork - minimum 40 mm (1-½") thick as required;

.3 mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.4 supply air ductwork outward from fans, except for supply ductwork exposed in area it serves – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.5 exhaust discharge ductwork for a distance of 3 m (10') downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10') distance – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.6 exposed exterior ductwork outside the building, except fresh air intake and exhaust ductwork - minimum 40 mm (1-½") rigid board;

.7 any other ductwork, casings, plenums or sections specified or detailed on drawings to be insulated – thickness as specified.

.2 Provide rigid board type insulation for casings, plenums, and exposed rectangular ductwork. Provide blanket type insulation for round ductwork and concealed rectangular ductwork.

.3 Liberally apply adhesive to surfaces of exposed rectangular ducts and/or casings. Accurately and neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom and side surfaces. Secure and seal joints with 75 mm (3") wide tape sealant. Additional installation requirements as follows:

.1 at trapeze hanger locations, install insulation between duct and hanger;

.2 provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.

.4 Liberally apply adhesive to surfaces of concealed rectangular or oval ductwork, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom surfaces. Secure and seal joints with 75 mm (3") tape sealant. At each trapeze type duct hanger, provide a 100 mm (4") wide full length piece of rigid mineral fibre board insulation between duct and hanger.

.5 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket insulation is used, provide a 100 mm (4") wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.

.6 Insulation application requirements common to all types of rigid ductwork are as follows:

.1 at duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant;

.2 installation of fastener pins and washers is to be concurrent with duct insulation application;

.3 cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant;

.4 accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers;

.5 prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

3.12 DUCTWORK INSULATION REQUIREMENTS – FLEXIBLE ELASTOMERIC

.1 As an alternative to rigid mineral fibre board insulation, ductwork with irregular shapes that is exposed exterior ductwork (except fresh air intake ductwork) and associated plenums and/or casings outside building may be insulated with minimum 40 mm (1-½") thick flexible elastomeric sheet insulation as required, applied in 2 minimum 20 mm (¾") thick layers with staggered tightly butted joints.

.2 Install with adhesive in strict accordance with manufacturer's instructions to produce a weather-proof installation. Ensure sheet metal work joints are sealed watertight prior to applying insulation.

3.13 APPLICATION OF INSULATING COATINGS

.1 Apply, in accordance with manufacturer's instruction, insulating coatings to following bare metal surfaces:

.1 paint bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating;

.2 paint bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "ThermaLite" insulating coating.

.2 Apply coatings with a brush. Remove any splatter or excess coating from adjacent surfaces.

3.14 INSULATION FINISH REQUIREMENTS

.1 Unless otherwise shown and/or specified, jacket exposed mineral fibre insulation, and calcium silicate duct insulation work inside building with canvas secured in place with a full covering coat of lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent uninsulated surfaces.

.2 Jacket exposed pipe insulation work inside building with white sheet PVC and fitting covers. Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by manufacturer's instructions.

.3 Install rigid aluminum jacket material tightly in place with overlapped circumferential joints positioned to shed water and covered with butt straps supplied with the jacket. Provide aluminum jacket for following insulation:

.1 pipe insulation outside building.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings with product data sheets for variable frequency drives (VFDs). Include:

.1 construction and performance details;

.2 wiring and control schematics;

.3 dimensions of units;

.4 calculations specific to installation showing total harmonic voltage distortion is less than 5%;

.5 certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.

.2 Submit a start-up and installation certification letter from supplier of VFDs as specified in Part 3 of this Section;

.3 Prepare list of parameters for uploading for Owner's future use as specified in Part 3 of this Section. Load on USB type flash drive and submit to Consultant.

.4 Where extended warranty is specified to be included, include a copy of VFD extended warranty in each Operating and Maintenance Manual. Prior to Substantial Performance of Work, submit a copy of warranty to Owner.

.5 Additionally, coordinate with Prime Contractor and Electrical Contractor to ensure shop drawings clearly identify proposed VFDs and connected motors are 100% compatible and Mechanical Contractor to sign off on selected VFDs.

1.02 COORDINATION WITH ELECTRICAL DIVISIONS

.1 This Section specifies VFD requirements for motors. VFDs packaged with various system equipment are to comply with specifications of this Section.

.2 Each VFD to be approved by respective manufacturer of VFD and connected motors, as suitable for installation on scheduled motors. VFD output current rating to match or exceed connected motor nameplate full load current rating.

.3 Coordinate and review with Electrical Divisions, responsibility requirements for supply of VFDs, harmonic filters and requirements for control and power conductors and connections.

.4 Check motors are equipped with AEGIS or approved equal, shaft grounding ring system to protect bearings from damage in motors by diverting harmful shaft voltages and bearing currents to ground.

.5 Additionally, review and confirm responsibilities with Consultant and Prime Contractor.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable VFD manufacturers are:

.1 ABB;

.2 Danfoss;

.3 Rockwell Automation;

.4 Eaton;

.5 Siemens Electric.

2.02 VFD BASIC REQUIREMENTS

.1 VFDs supplied on project to be products of same manufacturer and be CSA approved, ULC listed and labelled. Base specified product is ABB ACH series units that include compliance with following standards:

.1 CSA C22.2 No.14 Industrial Control Equipment;

.2 UL 508 - Industrial Control Equipment;

.3 UL 508C – Power Conversion Equipment;

.4 NEMA ICS 7 - Adjustable-Speed Drives.

.2 Basis for limiting harmonics is to be provided generally to IEEE Standard 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, except intended for user’s electrical distribution system with point of common coupling (where harmonic limits are assessed) to be set at input terminals of harmonic mitigating equipment.

.3 VFDs to include following basic requirements:

.1 regardless of HP rating are to be of same VFD model; I/O and control circuit boards as well as keypads are to be identical and interchangeable regardless of HP rating;

.2 to be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without safety tripping or component damage (flying start);

.3 6-pulse width modulated (PWM) AC to AC converter utilizing latest isolated gate bipolar transistor (IGBT) technology; PWM switching pattern to include a motor flux optimization circuit that automatically reduces applied motor voltage to the motor to optimize energy consumption and audible motor noise;

.4 carrier frequency control circuit that reduces carrier frequency based on actual VFD temperature allowing higher carrier frequency without derating VFD or operating at high carrier frequency only at low speeds;

.5 provisions that determines motor torque and flux every 25 microseconds (40,000 times per second);

.6 completely assembled and tested by manufacturer in their facility;

.7 designed to provide at least 250,000 hours mean time before failure (MTBF) when specified preventative maintenance is performed.

.8 bypass system completely factory wired and tested;

.9 door interlocked padlockable disconnect switch to disconnect all input power from drive and all internally mounted options;

.10 control panel keyboard and display with password protection against parameter changes.

2.03 VFD RATINGS

.1 VFDs to be rated to operate from 3 phase input voltage of 208 or 600 volts ± 10%, as scheduled, and frequency range from 48 to 63 Hz. In addition, a tolerated voltage window to allow system to operate from a line of +30% to -35% nominal voltage. System to incorporate circuitry that allows drive or bypass contactor to remain “sealed in” over this voltage tolerance at a minimum.

.2 VFDs to employ a full wave rectifier to prevent input line notching and operate at a minimum fundamental input power factor of 0.97 at all speeds and loads.

.3 VFDs efficiency to be 97% or better at full speed and load.

.4 Output voltage and current ratings to match adjustable frequency operating requirements of standard 3 phase, 60 Hz, NEMA design B inverter-duty motors in compliance with NEMA-MG1, Part 31 Standard. Overload current capacity for variable torque overload capacity to be 110% of rated current for 1 minute out of 10 minutes and 130% for 2 seconds. Output frequency to be adjustable between 0 and 500 Hz.

.5 Open loop static speed regulation to be 0.1% to 0.3% (10% of motor slip). Dynamic speed accuracy to be 4%-sec. or better open loop.

.6 When a suitable motor is used, drive provides breakaway torque equal to 200% of rated motor torque. Torque response time to be 5 ms or less.

.7 Enclosures:

.1 in climate controlled areas – minimum NEMA 12 with drip shield;

.2 in non-climate controlled areas – NEMA 3R.

2.04 HARMONIC FILTERS AND REACTORS

.1 VFDs to include internal 5% impedance AC line reactor (or equivalent 5% impedance dual positive and negative DC bus reactors) provided as a standard to reduce input current harmonic content and provide isolation from power line transients and to reduce RFI emissions.

.2 VFDs serving motors sized 19 kw (25 HP) or more to be provided with harmonic filters to limit harmonics distortion produced by each drive to following maximum levels as measured on input side of drive:

.1 Total harmonic distortion (voltage) – 5%;

.2 Total harmonic distortion (current) – 10%.

.3 Harmonic filter to be equivalent to MIRUS International Inc. “LINEATOR AUHF” series, with features as follows:

.1 manufactured and tested in accordance with latest applicable standards of ULC, CSA and NEMA;

.2 treat characteristic low frequency harmonics generated by a 3-phase, diode bridge rectifier load (5th, 7th, 11th, 13th, etc.);

.3 passive inductor/capacitor network;

.4 low capacitive reactance (KVAR) of less than 20% of kVA rating, to ensure compatibility with engine generator sets;

.5 full load efficiency of harmonic mitigation equipment / VFD combination to be greater than 96%;

.6 copper wiring;

.7 220°C system insulation class and temperature rise of 130°C;

.8 anti-vibration pads between reactor or transformer core and enclosure;

.9 manufacturer’s standard ventilated, NEMA-3R enclosure.

.4 Acceptable harmonic mitigation product manufacturers are:

.1 MIRUS International Inc.;

.2 Synergy Energy Ltd. (Harmonizer);

.3 MTE Corporation.

2.05 CONTROLS AND ADJUSTMENT FUNCTIONS

.1 Include for following:

.1 programmable critical frequency lockout ranges to prevent VFD from operating load continuously at an unstable speed;

.2 proportional integral derivative (PID) speed loop regulators with an auto tune function as well as manual adjustments; PID set point controllers to allow pressure or flow signals to be connected to VFD, using microprocessor in VFD for closed loop control; includes 250 mA of 24 VDC auxiliary power and capability of loop powering a transmitter supplied by others; two parameter sets for first PID allowing sets to be switched via a digital input, serial communications or from keypad for night setback, summer/winter set points, etc; independent, second PID loop to utilize second analogue input and modulate analogue outputs to maintain set point of an independent process (ie. valves, dampers, etc.); set points, process variables, etc. to be accessible from serial communication network;

.3 programmable analogue inputs that accept current or voltage signals;

.4 programmable analogue outputs (0-20 mA or 4-20 mA), that may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data;

.5 programmable digital inputs;

.6 programmable digital Form-C relay contact outputs for programmable on and off delay times and adjustable hysteresis; rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS;

.7 run permissive circuit - for damper or valve control; dry contact closure to signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;

.8 two independently adjustable accel and decel ramps with 1 to 1800 seconds adjustable time ramps;

.9 fireman’s override input - upon receipt of a contact closure from fireman’s control station, VFD operates in one of two modes: operate at a programmed predetermined fixed speed or operate in a specific fireman’s override PID algorithm that automatically adjusts motor speed based on override set point and feedback; mode overrides all other inputs (analogue/digital, serial communication and keypad commands), except customer defined safety run interlock, and forces motor to run in one of the two modes; "Override Mode" to be displayed on control panel; upon removal of override signal, VFD resumes normal operation.

.2 Operator Control Panel:

.1 front mounted plug-in operator control panel consisting of keypad, multi-line backlit LCD display for programming and fault diagnostics;

.2 keys (switches) for H-O-A, and manual speed control INCREASE/DECREASE;

.3 menu navigation and parameter selection keys for custom programming;

.4 HELP key for assistance with programming and troubleshooting;

.5 date and time clock - clock to have a battery backup with 10 years minimum life span; clock to be used to date and time stamp faults and record operating parameters at time of fault; if battery fails VFD automatically reverts to hours of operation since initial power up; clock also to be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays; VFD to have digital input that allows an override to time clock (when in off mode) for a programmable time frame; four (4) separate, independent timer functions that have both weekday and weekend settings;

.6 parameter names, fault messages, warnings and other information to be displayed in complete words or standard abbreviations to allow user to understand what is being displayed without use of a manual or cross reference table, as follows:

.1 “HAND” position to start drive and modify reference frequency by use of INCREASE/DECREASE keys;

.2 “OFF” position stops drive;

.3 "AUTO" position allows drive to be started or stopped using whichever remote start/stop command configured; drive speed controlled by external speed reference input or by PID controller.

.4 applicable operating values to be capable of being displayed in engineering (user) units; operating displayed include:

.1 Output Frequency;

.2 Motor Speed (RPM, %, or Engineering units);

.3 Motor Current;

.4 Drive Temperature;

.5 DC Bus Voltage;

.6 Output Voltage.

2.06 PROTECTIVE FUNCTIONS

.1 For each programmed warning and fault protection function, keypad displays a message in complete words or standard abbreviations. Three most recent fault messages and times are stored in drive’s fault history.

.2 VFDs include metal oxide varistors (MOV’s) for phase to phase and phase to ground line voltage transient protection.

.3 Short circuit current rating of 100,000 amps to be provided per UL 508C without relying on line fuses.

.4 Ground fault protection, motor phase loss protection and phase unbalance protection to be provided. Single phase protection to be provided on input and output.

.5 VFDs to provide electronic motor overload protection qualified per UL 508C.

.6 Protection to be provided for AC line or DC bus overvoltage at 130% of maximum rated or undervoltage at 65% of minimum rated.

.7 Stall protection to be programmable to provide a warning or stop VFD after motor has operated above a programmable torque level for a programmed time limit.

.8 Underload protection to be programmable to provide a warning or stop VFD after motor has operated below a selected underload curve for a programmed time limit.

.9 Overtemperature protection to provide a warning if power module temperature is less than 5C° (9F°) below overtemperature trip level.

.10 Input terminal to be provided for connecting a motor thermistor (PTC type) to drive's protective monitoring circuitry. An input to also be programmable to monitor an external relay or switch contact.

.11 VFDs through 56 kW (75HP) to be protected from damage from input and output power miss-wiring. VFD to sense this condition and display an alarm on control panel.

.12 EMI / RFI filters to be provided as per standard EN 61800-3.

.13 dv/dt long lead filter (LRC) to protect power system network.

.14 Automatic reset feature to automatically reset selected faults and attempt to restart drive based on control parameters such as adjustable time delays, number of restart attempts and duration of restart attempts. Faults include following:

.1 Overcurrent;

.2 Overvoltage;

.3 Undervoltage;

.4 Analogue input signal reference loss;

.5 External fault.

.15 Additional built-in protection circuits include:

.1 Overcurrent trip limit;

.2 Undervoltage trip limit;

.3 Microprocessor fault;

.4 Keypad control panel loss;

.5 Serial communication loss;

.6 External fault interlock inputs;

.7 Adjustable output frequency and motor speed limits;

.8 Pass code parameter change protection;

.9 Keypad operator control lockout.

2.07 ELECTRONIC BYPASS

.1 Electronic bypass system to be a fully operational horsepower rated manual and automatic system for full speed operation without VFD, with following components and features:

.2 factory wired and tested microprocessor controlled bypass system consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses; (bypass designs, which have no VFD only fuses, or that incorporate fuses common to both VFD and bypass will not be accepted);

.3 bypass enclosure door and VFD enclosure to be interlocked such that input power is turned off before either enclosure can be opened;

.4 door interlocked padlockable disconnect switch that disconnects all input power from drive and all internally mounted devices;

.5 following operators:

.1 bypass H-O-A;

.2 drive mode selector and light;

.3 bypass mode selector and light;

.4 bypass fault reset;

.5 bypass LCD display, 2 lines for programming and status / fault / warning indications.

.6 motor protection from single phase power conditions; bypass system to detect a single phase input power condition while running in bypass, disengage motor in a controlled fashion, and give a single phase input power indication;

.7 bypass system does not depend on VFD for bypass operation; bypass to be completely functional in both Hand and Automatic modes even if VFD is removed from enclosure for repair / replacement;

.8 run permissive circuit - for damper or valve control; dry contact closure that will signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;

.9 bypass control to monitor status of VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil; this failed contactor operation to be indicated on Bypass LCD display as well as over serial communications protocol;

.10 bypass control to include a programmable time delay for bypass start and control panel indication that this time delay is in process; this allows VAV boxes to be driven open before motor operates at full speed in bypass mode; time delay to be field programmable from 0 to 120 seconds;

.11 bypass control to be programmable for manual or automatic transfer to bypass; user to be able to select via control panel programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass;

.12 adjustable motor current sensing circuit for bypass and VFD mode to provide proof of flow indication; condition is indicated on control panel display, transmitted over building automation protocol and on a relay output contact closure;

.13 programmable digital inputs, and programmable Form-C relay outputs;

.14 relay outputs from bypass to be programmable for any of following indications:

.1 system started;

.2 system running;

.3 bypass override enabled;

.4 drive fault;

.5 bypass fault;

.6 bypass H-O-A position;

.7 motor proof of flow (broken belt);

.8 overload;

.9 bypass selected;

.10 bypass run;

.11 system started (damper opening);

.12 bypass alarm;

.13 over temperature.

.15 digital inputs for system accept 24VAC or 24VDC; bypass incorporates internally sourced power supply and does not require an external control power source; bypass power board to supply 250 ma of 24 VDC for use by others to power external devices;

.16 interlock terminal strip: provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command; external safety interlocks to remain fully functional whether system is in VFD or bypass mode; remote start/stop contact to operate in VFD and bypass modes; terminal strip allows for independent connection of up to four (4) unique safety inputs;

.17 User is able to select text to be displayed on keypad when safety opens; example text display indications include "Firestat", "Freezestat", "Over pressure" and "Low pressure"; user is able to determine which of four (4) safety contacts is open over serial communications connection;

.18 Class 10, 20, or 30 (selectable) electronic motor overload protection is included as required for specific applications.

2.08 COMMUNICATIONS

.1 VFD to be complete with communications connections of integrated RS-485 port suitable to allow for VFD to be controlled, supervised, monitored and programmed from one remote control panel or PC with VFD system Windows based application software.

.2 Communications protocol to be industry standard compatible to BAS of building. Coordinate exact requirements with Mechanical Divisions controls contractor and BAS vendor to ensure appropriate interface module is supplied for drive system to communicate with BAS being used in building with interface capability to include serial communication standard protocols as follows:

.1 BACnet - MSTP.

.3 Serial communication and Windows based software to be used for drive setup, diagnostic analysis, monitoring and control. Software to provide real time graphical displays of drive performance. VFD software communication capabilities include, but not be limited to:

.1 system ON/OFF;

.2 system status;

.3 Suitable input for speed control;

.4 run-stop control;

.5 ability to force unit to bypass;

.6 ability to lock and unlock control panel keypad;

.7 allowing BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and logic board temperature;

.8 monitoring relays output status, and all digital input status;

.9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;

.10 remote fault reset;

.11 keypad "Hand" or "Auto" selected, and status indications and settings transmitted over serial communications bus;

.12 monitor if motor is running under load in both VFD and bypass (proof of flow) in VFD mode over serial communications or Form-C relay output;

.13 minimum of 40 field parameters to be capable of being monitored in bypass mode.

2.09 WARRANTY

.1 VFDs to be warranted free from defective labour and materials for period of 36 months from date of Substantial Performance of the Work. Include for initial one year Contract warranty and an additional 2 year extended warranty direct to Owner. Extended warranty terms and conditions are to be identical to one year Contract warranty, and extended warranty period is to commence day Contract warranty expires.

2.10 SITE SERVICES, TRAINING AND MAINTENANCE MANUALS

.1 Provide onsite inspection, testing, start up and verification work of VFDs and filters by manufacturer's authorized technician. Allow a minimum of 1/2 day per system. Also include for a second visit to site of one (1) day duration to train operating personnel in operation and maintenance of drives. Provide verification reports and supply soft copy of system programming parameters.

.2 Upon completion of installation, supplier of VFDs to supply minimum one hard copy of complete sets of service and maintenance manuals including wiring and connection diagrams. Include for digital copy loaded onto a USB type flash drive.

.3 Provide system training and instructions on operating and maintenance procedures. Refer to additional requirements in General Instructions section and Division 01.

.4 Where there is a third party Commissioning Agent, include for manufacturer's authorized technician to be in attendance to assist Commissioning Agent during commissioning process. Refer to Section 20 05 40 Mechanical Work Commissioning for more information.

2.11 EXECUTION

2.12 INSTALLATION OF VARIABLE FREQUENCY DRIVES

.1 Provide variable frequency drives for motorized equipment in accordance with drawing requirements. Coordinate requirements for conductors and connections with Electrical Divisions Contractor.

.2 VFDs supplied to be products of same manufacturer.

.3 Unless otherwise noted on drawings or in Part 2 of this Section, include an electronic bypass with each VFD.

.4 Wire length between VFD and motor to be less than 15 m (50') with properly sized conductors.

.5 Install VFDs in accordance with manufacturer's instructions. VFDs installation to include upstream protection, either fuses or circuit breakers in accordance with VFD manufacturer's recommendations and local electrical code requirements. Advise Electrical Divisions Contractor of these requirements in addition to required conductors and connections. Provide required control wiring and connections.

.6 Review VFD and related connected motor installation. Provide local disconnect to VFD in accordance with local governing code requirements.

.7 Mount VFDs operating controls/display at approximately 1.5 m (5') above finished floor level, unless otherwise directed by Consultant. Provide dual back to back C-channel support system from floor to ceiling, complete with cross bracing to form a solid backing for VFD mounting at required locations.

.8 Properly support VFDs. Coordinate exact locations on site with Consultant.

.9 Where VFDs are required for custom made air handling units VFDs to be supplied, factory mounted on fan cabinets, and "load" side connected to fan motors by air handling unit manufacturer. "Line" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.10 Where VFDs are required for commercial fans, mount each VFD generally where shown but with exact location to ensure VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFD's to be provided as part of Electrical Divisions work.

.11 Where VFDs are required for pumps, mount each VFD generally where shown but with exact location to ensure VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.12 Install harmonic mitigation filter equipment as follows:

.1 in accordance with manufacturer's recommended installation practices and to comply with applicable local governing codes;

.2 provide each VFD as specified in per Part 2, with a harmonic filter sized in accordance with manufacturer's rating table to match rating of connected VFD;

.3 mount harmonic filters sized up to 110 kW (150 HP) typically to wall/ceiling construction using suitable brackets, metal C-channel framework and vibration isolators assemblies, ensuring full support of units acceptable to local governing authorities;

.4 mount harmonic filters sized greater than 110 kW (150 HP) typically to floor mounted concrete pads with suitable vibration isolators and seismic restraints in accordance with local governing building codes;

.5 ensure adequate ventilation and space for access is provided;

.6 review exact locations with Consultant prior to installation;

.7 coordinate with Electrical Division Contractor to ensure units are connected complete to line side supply feed and to VFD in accordance with VFD manufacturer's instructions for standalone VFDs and VFD system with bypass; include required control wiring and connections.

.13 Ground and bond equipment as per local governing electrical code requirements and manufacturer's instructions.

.14 Provide engraved lamacoid nameplate identifying each piece of equipment. Review exact nomenclature with Consultant.

2.13 TESTING, START-UP AND VERIFICATION

.1 When installation of VFDs and filters are complete, arrange for respective equipment manufacturer/supplier to:

.1 supply factory authorized technician at site for minimum of 4 hours per system to examine installation and connection of equipment, and to perform start-up and set-up procedures in conjunction with equipment start-up and testing procedures;

.2 supply factory authorized technician at site for minimum of one 8 hour day to train Owner's personnel on equipment operating and maintenance procedures;

.3 prepare and submit letter certifying equipment have been properly installed, tested and adjusted, and are in proper operating condition;

.4 submit list of start-up and testing parameters for uploading for future use by Owner and start-up data entries to include motor nameplate power, speed, voltage, frequency and current.

.2 Perform following:

.1 Inspect equipment and accessories for verification of proper operation and installation.

.2 Inspect interface wiring to BAS for verification of proper operation and installation.

.3 Verify wire terminations to VFDs and bypass and to operational circuitry.

.4 Verify installation of VFD, bypass and motor being driven for proper operation and reliability.

.5 Verify connections and communications to BAS or other monitoring/remote control system are of proper operation and installation and of full communications compatibility.

.6 Measurement for verification of proper operation on each of following items:

.1 Motor voltage and frequency;

.2 Verification of proper motor operation;

.3 Control input for proper building automation system interface and control calibration.

.7 Calibration check for following set points (and adjustment as necessary):

.1 minimum speed;

.2 maximum speed;

.3 acceleration and deceleration rates.

.8 Verify harmonic compliance with onsite field measurements of both voltage and current harmonic distortion at point of common coupling-input terminals of harmonic mitigating equipment with and without equipment operating. Utilize recording type Fluke 41 or equivalent harmonics analyser displaying individual and total harmonic currents and voltages.

.3 Document testing and results in a report signed by a Professional Engineer licensed in the Place of Work and authorized by equipment manufacturer. Include for minimum 3 hard copies and electronic copy of report to be submitted to Consultant for review.

.4 Additionally, refer to applicable installation, testing, coordination and verification requirements in Electrical Divisions Sections.

.5 Coordinate procedures specified above to be performed by equipment manufacturer/supplier authorized technician with system commissioning work.

END OF SECTION

1. GENERAL

1.01 APPLICATION

.1 This Section specifies requirements, criteria, methods and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

1.02 SUBMITTALS

.1 Submit documentation to confirm reclaimed refrigerant has been properly removed and stored, recycled, or disposed of as applicable.

2. PRODUCTS

Not Used

3. EXECUTION

3.01 DISCONNECTION AND REMOVAL OF EXISTING MECHANICAL WORK

.1 Where indicated on drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, etc. Disconnect at point of supply, remove obsolete connecting services and make system safe. Cut back obsolete piping behind finishes and cap water-tight unless otherwise specified.

.2 Scope and extent of demolition or revision work is only generally indicated on drawings. Estimate scope, extent and cost of work at site during bidding period site visit(s). Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at site during bidding period site visits will not be allowed.

.3 If any re-design is required due to discrepancies between mechanical drawings and site conditions, notify Consultant who will issue a Site Instruction. If, in the opinion of Consultant, discrepancies between mechanical drawings and actual site conditions are of a minor nature, required modifications are to be done at no additional cost.

.4 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes.

.5 Unless otherwise specified, remove from site and dispose of existing materials which have been removed and are not to be relocated or reused.

3.02 DECOMMISSIONING OR ALTERATIONS TO REFRIGERATION EQUIPMENT

.1 Remove and reclaim refrigerant from applicable equipment to be decommissioned and/or altered. Refrigerant reclaim and recycling work is to be in accordance with Refrigerant Management Canada guidelines, and governing codes and regulations. Do not under any circumstances vent refrigerant from existing equipment to atmosphere.

.2 Use refrigerant recovery equipment designed specifically to reclaim and recycle refrigerant, and use only skilled refrigeration mechanics to perform reclaim and recycle work.

.3 Provide approved, properly sized and sealable refrigerant containers for reclaimed refrigerant.

.4 Dispose of reclaimed refrigerant by engaging services of a licensed firm specializing in recycling of reclaimed refrigerant. Submit documentation to confirm refrigerant has been properly removed from site and recycled or disposed.

3.03 ROOFING WORK

.1 Where roof revisions and/or replacements are part of project, include for disconnecting, lifting, or temporarily removing mechanical equipment on roof as required to permit completion of roofing work, and for re-installing equipment when roofing work is complete.

END OF SECTION

1. GENERAL

1.01 APPLICATION

.1 This Section specifies commissioning requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. When requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Divisions 00 or 01 to take precedence.

1.02 COMMISSIONING AGENT INVOLVEMENT VERSUS WARRANTY OBLIGATIONS

.1 Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.

1.03 SUBMITTALS

.1 Submit to Consultant, one copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.

.2 Submit for review, a Commissioning Plan with schedule and commissioning procedures for commissioning for equipment/systems to be commissioned.

.3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.

.4 Submit equipment and system manufacturer’s start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.

.5 After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter confirming pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.

1.04 DEFINITIONS

.1 Commissioning: process of demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, all as further described below.

.2 Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned mechanical work.

.3 Start-Up and Adjusting: process of equipment manufacturer’s/supplier’s technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer’s/supplier’s start-up reports to confirm equipment has been properly installed and is operational as intended.

.4 Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.

.5 Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate and verify equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.

.6 Commissioning Documentation Sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag in accordance with drawings, and, for each commissioning procedure listed, a column giving expected data in accordance with Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.

.7 Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.

.8 Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

1.05 QUALITY ASSURANCE

.1 Commissioning work is to be in accordance with requirements of following:

.2 CSA Z320, Building Commissioning Standard and Check Sheets;

.3 ASHRAE Guideline 0, The Commissioning Process;

.4 ASHRAE Guideline 1.1, The HVAC Commissioning Process;

.5 Owner designated Commissioning Agent.

1.06 COMMISSIONING OBJECTIVES

.1 Objectives of commissioning process:

.1 to support quality management by means of monitoring and checking installation;

.2 to verify equipment/system performance by means of commissioning of completed installation;

.3 to move completed equipment/systems from "static completion" state to "dynamic" operating state so as to transfer a complete and properly operating installation from Contractor to Owner.

1.07 TESTING EQUIPMENT

.1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

2. PRODUCTS

NOT USED

3. EXECUTION

3.01 COMMISSIONING

.1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent, if applicable.

.2 Prerequisites to successful completion of commissioning:

.1 submittal of signed start-up and test reports;

.2 completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;

.3 permanent electrical and control connections of equipment;

.4 successful completion and documentation of pre-functional performance testing;

.5 submittal of letters to Consultant certifying systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents.

3.02 DEFICIENCIES LISTED DURING COMMISSIONING

.1 Correct deficiencies listed by Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with Consultant, and when deficiencies have been corrected, notify Consultant and Commissioning Agent immediately.

3.03 SYSTEMS TO BE COMMISSIONED

.1 Mechanical systems to be commissioned include, but are not to be limited to, systems described below. Specific commissioning procedures are to be as directed by Commissioning Agent.

.2 Commissioning of drainage systems includes:

.1 commissioning of drainage pumps and controls by means of tests recommended by manufacturer to confirm proper operation and performance;

.2 commissioning of equipment such as interceptors and backflow preventers.

.3 Commissioning of fire protection systems will be considered complete upon preparation and submittal by Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to local Fire Chief and any other authorities, including Owner’s insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures, in particular smoke control systems and other such fan system control sequences.

.4 Commissioning of water systems (all piping extended from Municipal main) includes:

.1 commissioning of piping specialties such as backflow preventers, mixing valves, and similar components;

.2 commissioning of trap seal primer units, including adjustment of water flows and confirmation of water flow at each connected trap;

.3 commissioning of plumbing fixtures.

.5 Commissioning of noise and vibration control equipment includes noise and vibration measurements to confirm proper operation of equipment.

.6 Commissioning of heating systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.7 Commissioning of cooling systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.8 Commissioning of air handling systems includes equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows in accordance with TAB reports.

.9 Control work commissioning includes confirmation of proper operation of individual control components, and overall operation of controls in conjunction with operation of connected building systems, including heating season/cooling season testing requirements specified above.

.10 Commissioning of BAS includes confirmation of proper operation of components, input/output points, hardware and software, and demonstration of system performing required procedures.

3.04 COMMISSIONING PROCESS

.1 Perform commissioning process in stages and include, but not be limited to, following:

.1 Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual.

.2 Stage 2: Commissioning work performed 12 months after issue of a Certificate of Substantial Performance and which includes supervision of Contractor’s "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.

.3 Stage 3: Successful completion of satisfactory equipment/system operation during 1st month after issue of a Certificate of Total Performance of the Work.

.4 Stage 4: Successful completion of satisfactory equipment/system operation during 3rd month after issue of a Certificate of Total Performance of the Work.

.5 Stage 5: Successful seasonal commissioning of building.

3.05 RESPONSIBILITIES OF CONTRACTOR

.1 During construction phase, Contractor is to:

.1 prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;

.2 prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Consultant, and allowances for additional time for re-tests as may be required, and update schedule on a monthly basis as required;

.3 promptly correct reported deficient work, and report when corrective work is complete;

.4 where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;

.5 under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;

.6 complete Manufacturer’s commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Consultant, accompany Consultant for an on-site check of 30% of data sheet information for each type of equipment, and perform any corrective action required as a result of site checks;

.7 perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Consultant for review and a site check of results, and perform any corrective work required as a result of site checks by Consultant;

.8 in accordance with updated commissioning schedule and actual progress at site, certify in writing to Consultant that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving Consultant a minimum of 5 working days' notice;

.9 perform system and subsystem functional performance testing, and submit to Consultant, completed and signed functional performance testing and commissioning data sheets.

.2 During post construction phase, Contractor is to:

.1 optimize system operation in accordance with building occupant’s needs and comments;

.2 complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;

.3 complete system checks and "fine tuning" with signed documentation as follows:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th months in a season opposite to 1st and 3rd month visits.

.4 correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;

.5 3 months after Substantial Completion conduct a question and answer session(s) at building with Owner’s operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that have to be addressed.

END OF SECTION

1. GENERAL

1.01 APPLICATION

.1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 DEFINITIONS

.1 “Agency” – means agency to perform testing, adjusting and balancing work.

.2 “TAB” – means testing, adjusting and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.

.3 “hydronic systems” – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.

.4 “air systems” – includes outside air, supply air, return air, exhaust air, and relief air systems.

.5 “flow rate tolerance” – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.

.6 “report forms” – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting and balancing.

.7 “terminal” – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

.8 “main” – means duct or pipe containing system’s major or entire fluid flow.

.9 “submain” – means duct or pipe containing part of the systems’ capacity and serving 2 or more branch mains.

.10 “branch main” – means duct or pipe servicing 2 or more terminals.

.11 “branch” – means duct or pipe serving a single terminal.

1.03 SUBMITTALS

.1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.

.2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.

.3 Submit a report by Agency to indicate Agency's evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.

.4 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.

.5 Submit a draft report, as specified in Part 3 of this Section.

.6 Submit a final report, as specified in Part 3 of this Section.

.7 Submit a testing and balancing warranty as specified in Part 3 of this Section.

.8 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.04 QUALITY ASSURANCE

.1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives. Agency is to have successfully completed testing, adjusting and balancing of mechanical systems for a minimum of 5 projects similar to this Project within past 3 years, and is to be certified as an independent agency in required categories by one of following:

.1 AABC - Associated Air Balance Council;

.2 NEBB - National Environmental Balancing Bureau.

.2 Testing, adjusting and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with 1 of following publications:

.1 National Standards for a Total System Balance published by Associated Air Balance Council;

.2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;

.3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

2. PRODUCTS

NOT USED

3. EXECUTION

3.01 SCOPE OF WORK

.1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.

.2 Mechanical systems to be tested, adjusted and balanced include:

.1 TAB of domestic water systems (all piping extended from Municipal main) is to include:

.1 domestic hot water recirculation piping.

.2 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.3 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities and flows.

3.02 TESTING, ADJUSTING AND BALANCING

.1 Conform to following requirements:

.1 as soon as possible after award of Contract, Agency is to carefully examine a white print set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;

.2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices;

.3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing;

.4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;

.5 testing, adjusting and balancing is not to begin until:

.1 building construction work is substantially complete and doors have been installed;

.2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.

.6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;

.7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;

.8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;

.9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;

.10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;

.11 for belt-driven equipment, Agency is to inform Contractor and Consultant of any situation where sheaves have to be replaced to suit testing and balancing, and replacements are to be done by Contractor at no cost;

.12 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;

.13 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;

.14 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of ±5% of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;

.15 Agency is to perform testing, adjusting and balancing to within ±5% of design values, and make and record measurements which are within ±2% of actual values;

.16 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;

.17 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.

.2 Prepare reports as indicated below.

.1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

.2 Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports. Use units of measurement (SI or Imperial) as used on Project Documents.

.3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Divide contents of binder into divisions listed below, separated by divider tabs:

.4 General Information and Summary;

.1 Air Systems;

.2 Hydronic Systems;

.3 Temperature Control Systems;

.4 Special Systems.

.5 Agency is to provide following minimum information, forms and data in report:

.1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;

.2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;

.3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;

.4 Agency is to include report sheets indicating building comfort test readings for all rooms.

.3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.

.4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to Owner.

.5 After acceptance of final report, Agency is to perform post testing and balancing site visits in accordance with following requirements:

.1 post testing and balancing site visits are to be made:

.1 once during first month of building operation;

.2 once during third month of building operation;

.3 once between fourth and tenth months in a season opposite to first and third month visit.

.2 during each return visit and accompanied by Owner's representative, Agency is to spot rebalance terminal units as required to suit building occupants and eliminate complaints;

.3 Agency is to schedule each visit with Contractor and Owner, and inform Consultant;

.4 after each follow-up site visit, Agency is to issue to Contractor and Consultant a report indicating any corrective work performed during visit, abnormal conditions and complaints encountered, and recommended corrective action.

END OF SECTION

1. GENERAL

1.01 APPLICATION

.1 This Section specifies material requirements for firestopping and smoke seal systems that are common to mechanical work Sections and it is a supplement to each Section and is to be read accordingly.

1.02 SUBMITTALS

.1 Submit a product data sheet and WHIMIS sheet for each firestopping and smoke seal product.

.2 Submit for review, full company name and experience of proposed firestopping and smoke seal system applicator.

.3 Submit letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

1.03 QUALITY ASSURANCE

.1 Applicator is to have a minimum of 3 years of successful experience on projects of similar size and complexity, and applicator's qualifications are to be submitted to Consultant for review.

.2 Comply with firestopping and smoke seal product manufacturer’s recommendations regarding suitable environment conditions for product installation.

1.04 PRODUCTS

1.05 FIRESTOPPING AND SMOKE SEAL SYSTEM MATERIALS

.1 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN/ULC S115, and CAN/ULC S101 for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.

.2 Firestopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and system number for each specific installation.

.3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer’s recommendations and ULC tested assembly. Coordinate material requirements with trades supplying abutting areas of materials.

.4 Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.

.5 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.

.6 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.

.7 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.

.8 Supply products of a single manufacturer for use on work of this Division.

.9 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.

.10 Include for manufacturer’s authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer’s authorized representative and manufacturer’s representative.

.11 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".

.12 Acceptable manufacturers are:

.1 Specified Technologies Inc.;

.2 3M Canada Inc.;

.3 Tremco;

.4 A/D Fire Protection Systems;

.5 Nelson;

.6 Hilti Canada.

1.06 EXECUTION

1.07 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Where work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to seal openings and voids around and within raceway and to ensure that continuity and integrity of fire separation is maintained. Openings not in immediate vicinity of working areas are to be firestopped and sealed same day as being opened.

.2 Install firestopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and manufacturer's instructions. Comply with local governing building code requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations do not exceed maximum size wall opening, and maximum and minimum dimensions indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and firestopping materials.

.3 Ensure that continuity and integrity of fire separation is maintained and conform to requirements of latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".

.4 Comply with following requirements:

.5 Examine substrates, openings, voids, adjoining construction and conditions under which firestop and smoke seal system is to be installed. Confirm compatibility of surfaces.

.6 Verify penetrating items are securely fixed and properly located with proper space allowance between penetrations and surfaces of openings.

.7 Report any unsuitable or unsatisfactory conditions to Consultant in writing, prior to commencement of work. Commencement of work will mean acceptance of conditions and surfaces.

.8 Mask where necessary to avoid spillage and over coating onto adjoining surfaces. Remove stains on adjacent surfaces.

.9 Prime substrates in accordance with product manufacturer’s written instructions.

.10 Provide temporary forming as required and remove only after materials have gained sufficient strength and after initial curing.

.11 Tool or trowel exposed surfaces to a neat, smooth, and consistent finish.

.12 Remove excess compound promptly as work progresses and upon completion.

.13 At fusible link damper locations, seal perimeter of angle iron framing on both sides of wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.

.14 Notify Consultant when work is complete and ready for inspection, and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies. Arrange for final inspection of work by local governing authority inspector prior to concealing or enclosing work. Make any corrections required.

.15 On completion of firestopping and smoke sealing installation, submit a Letter of Assurance to Consultant certifying the firestopping and smoke sealing installation has been carried out throughout the building to service penetrations and that installation has been performed in strict accordance with requirements of local governing building code, any applicable local municipal codes, ULC requirements, and manufacturer’s instructions.

.16 Manufacturer's authorized representative to inspect and verify each installation and provide a test report signed by installing trade and manufacturer's representative. Test report to list each installation and respective ULC certification and number.

.17 Where work requires removal of existing firestopping materials and replacement of firestopping materials after cabling changes have been made, ensure that replacement material is same material and manufacturer of existing if any remains in place, or ensure that all existing material is removed before installation of replacement material.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets to regulatory authority for review and approval prior to submitting to Consultant. Conform to following requirements:

.1 submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings;

.2 submit complete CAD layout drawings indicating source of water supply with test flow and pressure, "head-end" equipment piping schematic, pipe routing and sizing, and zones, all signed and sealed by a qualified professional mechanical engineer registered in jurisdiction of the work as specified below;

.3 submit copies of all calculations, including hydraulic calculations, stamped and signed by same engineer who signs layout drawings, and a listing of all design data used in preparing the calculations, system layout and sizing, including occupancy-hazard design requirements;

.2 Submit a complete sprinkler system test certificate as specified in Part 3 of this Section.

.3 Sprinklers are to be identified on drawings and product submittals, and be specifically identified by manufacturer's listed model or series designation. Trade names and other abbreviated listings are unacceptable.

1.02 QUALITY ASSURANCE

.1 Fire protection sprinkler system work is to be in accordance with following Codes and Standards:

.1 NFPA 13, Standard for the Installation of Sprinkler Systems;

.2 CSA B137.2, Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications;

.3 CSA B137.3, Rigid Polyvinylchloride (PVC) Pipe for Pressure Applications;

.4 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless;

.5 ASTM A135, Standard Specification for Electric-Resistance-Welded Steel Pipe;

.6 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service;

.7 ASTM A536, Standard Specification for Ductile Castings;

.8 ASTM A795, Standard Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use;

.9 ANSI/ASME B16.4, Grey Iron Threaded Fittings (Classes 125 and 250);

.10 CAN/CSA B64.10, Backflow Preventers and Vacuum Breakers.

.2 Fire protection sprinkler work is to be performed by a sprinkler company who is a member in good standing of the Canadian Automatic Sprinkler Association. Site personnel are to be licensed in jurisdiction of the work and under the continuous supervision of a foreman who is an experienced fire protection system installer and a journeyman pipe fitter licensed in jurisdiction of the work.

.3 Check and verify dimensions and conditions at site and ensure work can be performed as indicated. Coordinate work with trades at site and accept responsibility for and cost of making adjustments to piping and/or spacing to avoid interference with other building components.

.4 Where there is an existing sprinkler system that is to remain, verify working condition of existing sprinkler system equipment which has direct interface with project work and is to remain. Replace with new equipment where necessary.

.5 System components must be ULC listed and labelled.

.6 Grooved couplings, and fittings, valves and specialties are to be products of a single manufacturer. Grooving tools are to be of same manufacturer as grooved components.

.7 Castings used for coupling housings, fittings, valve bodies, etc., are to be date stamped for quality assurance and traceability.

1.03 DESIGN REQUIREMENTS

.1 Fire protection sprinkler work is to be designed in accordance with NFPA 13 and Provincial Standards, and, where required, local building and fire department requirements and standards of Owner's Insurer. If water supply flow and pressure test data is not available, conduct Municipal main water flow and pressure tests at nearest fire hydrant to obtain criteria to be used in system design. Include hydrant location and flow and pressure test data with system design calculations.

.2 Include for a qualified mechanical professional engineer registered and licensed in the jurisdiction of the work to design the fire protection standpipe work. Refer to Section entitled Mechanical Work General Instructions for requirements regarding Contractor retained engineers.

.3 Sprinkler /System Occupancy – Hazard Design requirements: In accordance with NFPA 13 occupancy-hazard density requirements, unless otherwise specified.

1.04 PROJECT CLOSEOUT

.1 Provide all required closeout documents to engineer for review and record, including but not limited to, sprinkler test certificate, NFPA conformance letter stamped by a professional engineer, etc.

2. PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 Pipe, fittings and joints are to be as follows, with exceptions as specified in Part 3 of this Section:

.1 PVC

.1 Class 200, DR14, rigid, hub and spigot pattern PVC pipe and CSA certified fittings to CAN/CSA B137.2 and B137.3 and complete with gasketed joints.

.2 Schedule 40 Steel – Grooved Coupling Joints

.1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and mechanical fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints. Strap type outlet fittings such as Victaulic "Snap-Let" are not acceptable.

.3 Schedule 40 Steel – Screwed and Welded Joints

.1 Schedule 40 mild black carbon steel, ASTM A53, Grade B. Screwed piping complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4. Welded piping complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible.

.4 Schedule 10 Steel – Grooved Coupling Joints

.1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and fitings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints.

.5 Schedule 10 Steel – Screwed Joints

.1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with mill or site threaded ends, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.

.6 "Lightwall" Steel – Grooved Coupling Joints

.1 Commercial quality. "Lightwall" rolled mild carbon steel pipe to ASTM A135, Grade A, complete with a galvanized exterior, grooved ends, and fittings and couplings equal to Victaulic "Fire Lock" grooved fittings and Victaulic Style 009N QuickVic or 005 rigid coupling joints.

.7 " Lightwall" Steel – Screwed Joints

.1 Commercial quality, "Lightwall" rolled mild carbon steel pipe to ASTM A135, Grade A, ULC listed, mill or site threaded, complete with galvanized exterior, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.

.8 Flexible Pipe – Equal to Victaulic "VicFlex"

.1 Drop system is to consist of a braided type 304 stainless steel flexible tube, zinc plated steel 25 mm (1") NPT male threaded nipple for connection to branch-line piping, and a zinc plated steel reducer with a 12 mm (1/2") or 20 mm (3/4") NPT female thread for connection to sprinkler head.

.2 Drop is to include a cULus/FM approved Series AH2 braided hose with a bend radius to 50 mm (2") to allow for proper installation in confined spaces.

.3 Hose is to be listed for following number of 50 mm (2") radius 90° bends:

.1 4 bends at 0.79 m (31") length;

.2 5 bends at 0.91 m (36") length;

.3 8 bends at 1.2 m (48") length;

.4 10 bends at 1.5 m (60") length;

.5 12 bends at 1.8 m (72") length.

.4 Union joints are to be provided for ease of installation, prevention of hose torque stresses and on site changing of factory 146 mm (5.75") straight reducing nipple in reduced spaces under obstructions.

.5 On T-bar ceiling grid with drop in tile application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB1 bracket. Bracket is to allow installation before ceiling tile is in place.

.6 On T-bar ceiling grid designed for hard lid drywall application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB2 bracket. Bracket is to allow for vertical adjustment of reducer/head from below drywall, post-drywall installation.

.7 On hat furring channel grid with hard lid drywall application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB4 bracket. Bracket is to allow for vertical adjustment of reducer/head from below drywall, post-drywall installation.

.8 Braided drop system is to be cULus listed for sprinkler services to 1206 kPa (175 psi).

.9 Standard Mechanical Couplings: Equal to Victaulic

.1 Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets are to be pressure-responsive synthetic rubber, grade to suit intended service, conforming to ASTM D-2000. Mechanical coupling bolts are to be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183. Couplings are to comply with ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

.2 Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads are to be used to provide system rigidity and support and hanging in accordance NFPA-13. Couplings are to be fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping of bolt pads at specific torque ratings are not permitted.

.3 Flexible Type: Use in locations where vibration attenuation and stress relief are required; Victaulic Style 177 (Quick-Vic™) flexible coupling.

2.02 SERVICE MAIN DOUBLE CHECK VALVE ASSEMBLY

.1 Minimum 1205 kPa (175 psi) rated dual check valve backflow preventer assembly to CAN/CSA B64, complete with tight-closing resilient seated shut-off valves, test cocks, and strainer.

.2 Assembly is to incorporate a metered by-pass to detect leaks and unauthorized water use. Where the municipality requires, coordinate water meter supply with the City water service otherwise include water meter as part of the assembly.

.3 Acceptable manufacturers are:

.1 Watts Industries Canada;

.2 Zurn/Wilkins;

.3 Apollo Valves (Conbraco Industries).

2.03 SHUT-OFF VALVES

.1 Minimum 2070 kPa (300 psi) rated full port brass or bronze body screwed ball valves and lug body or grooved end type butterfly valves.

.1 Butterfly valves are to include a pressure responsive seat, and stem is to be offset from disc centerline to provide complete 360° circumferential seating.

.2 Standard of Acceptance: Victaulic Style 705, NCI BFVAX-GD3551-TM2, and NIBCO GD-4865-8N

.3 Supervised closed applications standard of acceptance Victaulic Series 707C, NCI BFVAX-GD3551-CTM2, and NIBCO GD-4865-C-8N supervised closed butterfly valves.

.2 OS&Y Gate Valves: 1725 kPa (250 psi), grooved ends with ductile iron body, yoke, and handwheel conforming to ASTM A-536, EPDM coated ASTM A-126-B cast iron disc, ASTM B16 brass rising stem, flanged and epoxy coated ductile iron bonnet, EPDM O-ring stem seals and body gasket. Equal to Victaulic Series 771H (Grooved ends) and Series 771F (Grooved x Flanged), NCI GTVAG-GDI3151-HW (grooved), GTVAG-FDI3151-HW (flanged), NIBCO G-697-RW (grooved), F-607-RWS (flanged), and FG-697-RW (flanged x grooved).

2.04 CHECK VALVES

.1 Minimum 1725 kPa (250 psi) resilient seat check valves, suitable for vertical or horizontal installations. Standard of Acceptance: Victaulic Series 717, NCI CKVA-GD8351, and NIBCO G-997.

.2 Check valves associated with Fire Department connections and fire pump test connection are to be tapped for site installation of a 20 mm (¾") diameter ball drip.

2.05 BALL DRIPS

.1 Equal to National Fire Equipment Ltd. Model #A58, 20 mm (¾") diameter automatic ball drip.

2.06 SHUT-OFF VALVE SUPERVISORY SWITCHES

.1 Tamper-proof supervisory switches, each arranged to activate a fire alarm system trouble alarm condition if the valve is closed or tampered with, each suitable in all respects for the application, and each complete with all required mounting and connection hardware.

.2 Actuator housings are to be weatherproof.

2.07 SPRINKLER MAIN "LOSS OF PRESSURE" ALARM SENSOR

.1 Piping mounted adjustable pressure sensor designed to actuate an alarm upon sensing a loss of pressure in the fire protection main. Switch is to be low voltage or line voltage as required.

2.08 WATER FLOW ALARM SWITCH

.1 Pipe mounting water flow alarm switch, minimum 1725 kPa (250 psi) rated, designed to actuate 2, 7 ampere rated (at 125/250 VAC) SPDT snap action switches when water flow exceeds 0.758 L/sec. (10 Imperial gpm), complete with a tamper-proof cover with conduit connection opening, a piping saddle and U-bolt, and an automatic rest pneumatic retard device with field adjustable (0 to 70 second) switch actuation delay to reduce false alarms caused by a single or series of transient water flow surges.

2.09 ALARM CHECK VALVE

.1 Enamelled cast iron check valve assembly designed for either vertical or horizontal mounting and to actuate alarms when wet type sprinkler system is activated. Assembly is to be minimum 1205 kPa (175 psi) cold water rated with all moving parts constructed of brass, bronze, stainless steel or EPDM, and is to be complete with:

.1 pipe, fittings and accessories for site connection of an excess pressure pump;

.2 basic trim including piping materials and check valve for an external by-pass, potable water supply and system water supply pressure gauges with gauge test ports and shut-off valves, an angle type main drain valve, and fittings for mounting an alarm test by-pass;

.3 alarm test by-pass piping with ball valve to permit alarm testing without operation of alarm valve;

.4 alarm trim with pipe and fittings for connection to a water motor alarm, and an adjustable pressure switch for electrical connection to an alarm system upon flow through valve.

2.10 WATER MOTOR ALARM

.1 Surface wall mounting water motor driven alarm device consisting of a water motor assembly with 20 mm (¾") diameter inlet and 25 mm (1") or 32 mm (1-¼") diameter drain connections, inlet strainer, a red enamelled steel exterior wall mounting strike and gong assembly, a drive shaft sleeve with drive shaft to connect water motor and gong assembly and, at the exterior gong, identification to read "SPRINKLER FIRE ALARM - WHEN BELL RINGS CALL FIRE DEPARTMENT OR POLICE".

2.11 DRY PIPE VALVE

.1 Equal to a Victaulic Series 768-NXT:

.1 Series 746-LPA accelerator quick opening device;

.2 Series 757 regulated air maintenance trim assembly;

.3 required air pressure: 90 kPa (13 psig);

.4 externally resettable valve;

.5 Series 757 regulated air maintenance trim assembly.

.2 Valve to be complete with internal components that are replaceable without removing valve from installed position.

.3 Systems requiring a quick opening device are to use a regulated, tank mounted air supply.

2.12 PREACTION VALVE AND ACCESSORIES

.1 Victaulic Series 745 FirePac, pre-assembled [Dry] [Preaction] [Deluge] fire protection valve mounted completely within a steel cabinet for sizes 40 mm (1-½") through 203 mm (8"). Unit is to be ULC listed with all materials and wiring conforming to NFPA requirements.

.2 Cabinet is to be coated with red ASA-61 electrostatically applied polyester powder coating. Cabinet is to have field removable access panels on three sides to allow for ease of valve maintenance, servicing, and installation. Unit is to be provided with Series 728 ball valve or Series 705 butterfly shutoff valve with pre-wired supervisory switches, sprinkler system fire protection valve, alarm line pressure switches, air supervisory pressure switches, alarm pressure switch and pressure gauges for proper operation and is to be pre-wired to Model RP-2001 control panel. External electrical connections are to be able to be connected through a factory provided conduit connection to an enclosure inside of cabinet. Water inlet, system supply, and drain connections are to be grooved for ease of installation.

.3 Victaulic FireLock NXT Series valve is to be low differential, latched clapper design with a black enamel coated ductile iron body conforming to ASTM A536, aluminum bronze clapper, stainless steel spring and shaft, EPDM diaphragm and seal, brass seat with nitrile seat o-rings. Valve internal parts are to be replaceable without removing valve from installed position and are to be externally resettable. 2070 kPa (300 psi) pressure rating in sizes 40 mm (1-½") through 203 mm (8") and are to be grooved ends for vertical installation only.

.4 Trim configurations:

.1 Dry Valve: Pneumatic operation.

.2 Preaction Valve:

.1 Non-interlock; [Pneumatic] [and] [or] [Electric].

.2 Single interlock; [Pneumatic] [or] [Electric].

.3 Double interlock; [Pneumatic] [and] [Electric].

.3 Deluge Valve:

.1 Electric release.

.2 Wet pilot.

.3 Dry pilot.

.5 Electric Release Panel: Notifier Model RP-2001 is a compact single enclosure unit containing power supply, two 12Amp-hr batteries and availability to have factory installed all accessory options.

.6 Acceptable manufacturers are:

.1 Victaulic Co.;

.2 FireFlex System Inc.;

.3 Reliable Automatic Sprinkler Co. Inc.

.7 Photoelectric type smoke detectors, each complete with a red LED that pulses during normal standby conditions and illuminates steadily during an alarm condition.

.8 Surface wall mounting (to a recessed box) non-break glass pull station with test/reset key.

2.13 ZONE CONTROL RISER MODULES

.1 Equal to Victaulic Co. "FireLock" Series 747M factory assembled zone control riser modules, each complete with a painted cast ductile iron grooved end body, a ball type shut-off valve, a test and drain combination with properly sized orifice, a flow alarm switch, a pressure gauge with cock, and a pressure relief valve kit.

.2 Zone flow test and drain assembly cabinets are to be equal to National Fire Equipment Ltd. Model CV-200 recessed cold rolled steel cabinets, sized to suit assemblies, with a baked enamel finish, #18 gauge with universal knockouts for tubs, #14 gauge for doors and trim, with all metal edges ground and rounded. Doors are to be complete with:

.1 hollow channel reinforcement;

.2 full length semi-concealed piano hinge with paint stop feature and designed to permit 180° door opening;

.3 flush stainless steel door latch.

2.14 SPRINKLER HEADS

.1 Sprinkler heads, unless otherwise specified, are to be as scheduled in Part 3 of this Section.

.2 Sprinkler body is to be die-cast, with a hex-shaped wrench boss integrally cast into sprinkler body to reduce risk of damage during installation. Wrenches are to be provided by sprinkler manufacturer that directly engages wrench boss.

.3 For locations where corrosive resistant coatings are required, body is to be coated with ULC listed and FM approved anti-corrosion VC-250 coating (silver colouring).

.4 Recessed sprinkler heads in finished areas are to be chrome plated unless otherwise specified. Concealed sprinkler head ceiling plates are to match ceiling colour.

.5 Where exposed pendent heads occurs in areas with suspended ceilings, they are to be complete with chrome plated escutcheon plates. Similarly, sidewall heads with concealed piping are to be complete with chrome plated escutcheon plates.

.6 Sprinkler heads which are exposed in areas where they may be subject to damage are to be complete with wire guards, chrome plated where in finished areas.

.7 Escutcheons and guards are to be listed, supplied, and approved for use with sprinkler by sprinkler manufacturer.

.8 Sprinkler heads located in areas or over equipment where high ambient temperature is present are to be, unless otherwise specified, 74°C (165°F) heads. All other heads, unless otherwise specified or required, are to be 57°C (135°F) rated.

.9 Acceptable manufacturers are:

.1 Victaulic Co.;

.2 Tyco Fire Suppression & Building Products;

.3 The Viking Corporation;

.4 The Reliable Automatic Sprinkler Co.

2.15 SPARE SPRINKLER HEAD CABINET

.1 Surface wall mounting, red enamelled steel, identified cabinet with hinged door, shelves with holes for mounting sprinkler heads, a wrench or wrenches suitable for each type of sprinkler head, and a full complement of spare sprinkler heads.

.2 Cabinet is to be sized to accommodate a minimum of 4 spare heads for each type of head used on the project, however, each cabinet is to be full of spare heads.

3. EXECUTION

3.01 MONITORING OF SYSTEMS

.1 Daily monitor and supervise existing sprinkler system serving renovated areas to ensure that each respective system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:

.2 Under presence of Owner’s representative, check each morning and evening (start and end of work) of each day, sprinkler system to ensure that it is in proper working condition;

.3 If portions of sprinkler system is not in proper working order, provide temporary provisions subject to approval of local fire authority or local governing authority, to ensure that proper sprinkler coverage is provided and/or provide supervisory personnel to monitor areas where sprinkler system is not operational;

.4 Document and sign off with Owner’s representative signing off also, each respective daily check condition;

.5 Ensure that work to sprinkler system does not affect portion of system serving areas outside of renovation areas.

3.02 DEMOLITION

.1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.03 PIPING INSTALLATION REQUIREMENTS

.1 Provide required sprinkler system piping.

.2 Perform piping work in accordance with requirements of NFPA 13, governing regulations, and "Reviewed" shop drawings.

.3 Piping, unless otherwise specified, is as follows:

.1 for underground piping inside or outside building – Class 200, DR14 rigid PVC, braced and secured at bends and tees with concrete blocks in accordance with Municipal standards and details;

.2 for piping inside building and above ground except as noted below – Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints, or, for piping to and including 50 mm (2") diameter, screwed fittings and joints, or, for piping 65 mm (2-½") diameter and larger, welding fittings and welded joints;

.3 for wet system piping inside building and above ground – at your option, CPVC sprinkler pipe and fittings;

.4 for piping downstream of "head end" alarm valve(s) and equipment – Schedule 10 or "Lightwall" black steel pipe with Victaulic or equal fittings and coupling joints or screwed fittings and joints;

.5 for branch piping to heads in suspended ceilings, etc. – at your option, flexible piping installed in accordance with manufacturer’s instructions;

.6 for branch piping to heads in MRI suites – copper pipe, fittings, and sprinkler head adapters with stainless steel hangers and support hardware.

.4 Exceptions to piping requirements specified above are as follows:

.1 dry pipe zone steel piping, fittings, unions, couplings and flanges are to be galvanized;

.2 wet zone steel piping, fittings, unions, couplings and flanges for sprinkler work exposed to weather either inside or outside building (including parking garages), are to be galvanized;

.3 PVC piping is not to be used above grade;

.4 ferrous pipe hangers, supports, and similar hardware used for galvanized steel piping are to be electro-galvanized.

.5 Pipe sizes, pipe routing, sprinkler head quantities and locations, and layout of work shown on drawings are to assist during tendering period. Ensure adequate head coverage, head quantities and pipe sizing as specified in Part 1 of this Section. Do not reduce size of sprinkler main or re-route main unless reviewed with and approved by Consultant.

.6 Install grooved joints in accordance with manufacturer's latest installation instructions. Grooved ends are to be clean and free from indentations, projections and roll marks. Gaskets are to be moulded and produced by coupling manufacturer, and verified as suitable for intended service. Have factory-trained representative from mechanical joint manufacturer provide on-site training in proper use of grooving tools and installation of grooved piping products. Have factory-trained representative periodically review product installation and ensure best practices are being followed. Remove and replace any improperly installed products.

.7 Clean pipe, fittings, couplings, flanges and similar components after erection is complete. Wire brush clean any ferrous pipe, fitting, coupling, flange, hanger, support and similar component which exhibit rust and carefully coat with suitably coloured primer.

.8 Provide non-freeze, glycol-water solution filled sprinkler piping. Install piping complete with a CSA certified reduced pressure backflow preventer, valves and glycol solution fill facilities in accordance with requirements of Chapter 3 of NFPA 13. Fill piping with a solution of 50% Union Carbide Canada Ltd. "UCAR THERMO-FLUID 17" or Dow Chemical Co. "Dowtherm SR1" propylene glycol with corrosion inhibitors, and 50% clean water. Prior to filling piping, check the specific gravity of the solution using a hydrometer with proper scale. Specific gravity is to be approximately 1.069 at 15.6°C.

.9 When sprinkler work is complete, test system components and overall system(s) and submit completed test certificate and other documentation in accordance with Chapter 8 of NFPA 13.

3.04 INSTALLATION OF SHUT-OFF VALVES AND CHECK VALVES

.1 Provide shut-off valves and check valves in piping where shown and wherever else required.

.2 Locate valves for easy operation and maintenance.

.3 Confirm exact locations prior to roughing-in.

3.05 INSTALLATION OF SHUT-OFF VALVE SUPERVISORY SWITCHES

.1 Equip each shut-off valve with a supervisory switch.

.2 Identify each supervised valve with a 150 mm (6") square, engraved, laminated red-white plastic tag to correspond with supervised valve numbering specified and/or shown as part of the electrical work fire alarm system.

.3 At low point near each fire department connection, install a 90° elbow with drain connection to allow for system drainage to prevent freezing.

3.06 INSTALLATION OF LOSS OF PRESSURE SENSOR

.1 Supply and mount a pressure sensor in the fire protection piping main to activate a "LOSS OF PRESSURE" trouble alarm should Municipal water service pressure fall below the acceptable level.

.2 Locate sensor for easy access and maintenance, and set alarm pressure to suit site conditions. Confirm setting on site.

.3 Identify pressure sensor and its normal setting with a 150 mm (6") square red-white laminated plastic tag engraved to read "LOSS OF WATER PRESSURE SENSOR - NORMAL SETTING 210 kPa". Confirm wording prior to engraving.

3.07 INSTALLATION OF FLOW ALARM SWITCHES

.1 Provide water flow alarm switches in accessible locations in zone piping.

.2 Adjust to suit site water pressure conditions. Check and test operation.

.3 Identify each switch with a 150 mm (6") square red-white laminated engraved plastic tag. Confirm wording prior to engraving.

3.08 INSTALLATION OF ALARM CHECK VALVES

.1 Provide alarm check valves, complete with trim, for wet zone fire protection sprinkler piping.

.2 Check and test operation of each valve and adjust as required to suit site water pressure conditions.

.3 Identify each valve with a 150 mm (6") square red-white laminated engraved plastic tag. Confirm wording prior to engraving.

3.09 INSTALLATION OF EXCESS PRESSURE PUMP AND CONTROL

.1 Provide an excess pressure pump in wet fire protection sprinkler system piping, arranged to prevent activation of alarm check valve water flow alarms during normal water pressure fluctuations in the main. Locate pump on a steel mounting plate assembly at alarm check valve(s) and install accessories supplied with pump. Provide a pressure gauge in valved tubing across pump suction and discharge connections.

.2 Supply a starter and control panel for pump and surface wall mount adjacent to pump. Connect panel pressure switch with copper tubing in accordance with pump manufacturer’s instructions. Adjust pressure switch to suit site conditions.

.3 Start-up the pump, test operation and adjust as required.

3.10 INSTALLATION OF WATER MOTOR ALARM

.1 Provide a water motor alarm. Secure gong on the exterior wall, impeller and motor assembly on the interior wall, and connect with drive assembly in accordance with manufacturer’s instructions. Install inlet strainer supplied loose with assembly.

.2 Provide a galvanized steel drain pipe from impeller-motor assembly down the interior wall and terminate piping back out through the wall with a 45° piping elbow and wall plate located 600 mm (24") above finished grade.

.3 Confirm exact location of alarm gong prior to roughing-in.

.4 When installation is complete, check and test alarm operation and adjust as required.

3.11 INSTALLATION OF DRY PIPE VALVES

.1 Provide dry pipe valves for zones.

.2 Connect compressed air piping to each valve, as well as all compressed air piping trim.

.3 When installation is complete, check and test valve operation and adjust as required.

.4 Provide drum drips in dry type fire protection sprinkler zone piping where shown or required. Wherever possible locate drum drips in heated areas. Where drum drips are located in unheated areas ensure trades performing thermal insulation work and electric heating cable pipe tracing work are aware of the number of drum drips required, and the size and location. Identify each drum drip. Locate drum drips in heated areas wherever possible.

3.12 INSTALLATION OF PREACTION SPRINKLER SYSTEM

.1 Provide a preaction sprinkler system.

.2 Install preaction deluge valve cabinet assembly with control panel and air compressor as indicated but confirm exact location prior to roughing-in.

.3 Provide required water supply, compressed air, sprinkler, and drain piping. Terminate drain piping over a funnel floor drain.

.4 Provide detection devices and install in accordance with manufacturer’s instructions. Connect to control panel with wiring in conduit.

.5 Supply detection devices and hand to electrical trade on site for installation.

.6 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.13 INSTALLATION OF ZONE CONTROL RISER MODULES

.1 Provide zone control riser modules with drain piping where required. Terminate drainage piping over a funnel floor drain unless otherwise shown or specified. Identify each assembly.

3.14 INSTALLATION OF ZONE CONTROL RISER MODULE CABINETS

.1 Provide flush wall mounting cabinets for zone control and inspector’s test connection assemblies where required in finished areas. Confirm exact locations prior to roughing-in.

.2 Identify each cabinet with a nameplate in accordance with requirements of Section entitled Basic Mechanical Materials and Methods.

3.15 INSTALLATION OF SPRINKLER HEADS

.1 Provide required sprinkler heads in accordance with following:

.1 Rooms/areas with a suspended ceiling:

.1 Victaulic V38/V39 or Tyco Series RFII "Royal Flush II" concealed pendent.

.2 Rooms/areas without a suspended ceiling:

.1 Victaulic V27 or Tyco Series TY-FRB pendent.

.3 Unheated and unfinished areas:

.1 Victaulic V36 or Tyco Series DS-3 ECOH dry horizontal sidewall in wet piping.

.4 At non-rated windows in rated walls:

.1 Tyco Model WS horizontal and pendent vertical sidewall.

.2 Sprinkler head manufacturers indicated on schedule are for type indication purposes. Acceptable manufacturers are listed in Part 2 of this Section.

.3 Coordinate sprinkler head locations with all drawings, including architectural reflected ceiling plan drawings, and, where applicable, electrical drawings. Coordinate sprinkler head locations in areas with suspended ceilings with the location of lighting, grilles, diffusers, and similar items recessed in or surface mounted on the ceiling as per the reflected ceiling plans. In areas with lay-in tile, centre the sprinkler head both ways in the lay-in tile wherever possible. Confirm locations prior to roughing-in.

.4 Maintain maximum headroom in areas with no ceilings.

.5 Provide guards for heads where they are subject to damage.

.6 Provide high temperature heads in equipment rooms and similar areas over heat producing or generating equipment.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit product data sheets for all products specified in this Section.

1.02 QUALITY ASSURANCE

.1 Fire extinguishers are to be in accordance with following Codes and Standards:

.1 National Fire Code of Canada;

.2 NFPA 10, Standard for Portable Fire Extinguishers;

.3 CAN/ULC S508, Standard for the Rating and Testing of Fire Extinguishers.

2. PRODUCTS

2.01 GENERAL

.1 Fire extinguishers are to be pressurized (stored pressure) rechargeable type, in accordance with NFPA 10, and UL and/or ULC listed and labelled for the class of fires and hazard locations for which they are specified.

.2 Each extinguisher is to be complete with:

.1 manufacturer’s identification label indicating extinguisher model number, rating, and operating instructions;

.2 anodized aluminum or chrome plated forged brass valve with positive squeeze grip on-off operation and a pull-pin safety lock;

.3 discharge hose with nozzle or horn and hose securing clip;

.4 for wall mounting extinguishers, a wall mounting bracket.

.3 Fire extinguishers in fire hose cabinets will be supplied with the cabinet and are specified in Section entitled Fire Protection Standpipe System.

2.02 3A10B:C RATED DRY CHEMICAL EXTINGUISHERS

.1 Multi-purpose 3A10B:C dry chemical extinguishers are to be 100 mm (4") dia., 2.27 kg (5 lb.), each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge.

2.03 FIRE EXTINGUISHER CABINETS

.1 Surface Mounted: Rectangular break-glass type enclosures sized to suit the extinguishers to be housed, constructed of #18 gauge corrosion resistant steel with a baked white enamel finish, front glass panel, break-glass mechanism, and keyed alike cylinder lock.

.2 Recessed: Rectangular cabinets sized to suit the extinguishers to be housed, with a #18 gauge corrosion resistant white enamelled steel tub, #14 gauge cleaned and prime coat painted steel door and adjustable trim assembly with rounded corners, semi-concealed piano hinge, safety glass panel, and flush stainless steel door latch.

3. EXECUTION

3.01 INSTALLATION OF FIRE EXTINGUISHERS

.1 Provide fire extinguishers of type(s) in accordance with requirements of NFPA 10.

.2 Unless otherwise shown or specified, wall mount extinguishers using wall brackets supplied with extinguishers.

.3 Do not install extinguishers until after wall finishing work is complete.

.4 Be responsible for maintaining fire extinguishers until Substantial Completion of the Work.

.5 If extinguishers are indicated adjacent to a door, locate extinguishers at the strike side of the door.

3.02 INSTALLATION OF FIRE EXTINGUISHER CABINETS

.1 Provide wall cabinets for fire extinguishers where required.

.2 Unless otherwise shown or specified, locate cabinets so centerline is approximately 1.2 m (4') above finished floor.

.3 Confirm exact locations prior to installation.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe, fittings, and chlorine.

.2 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work.

.3 Prior application for Substantial Performance of the Work, submit a minimum of 3 identified keys for key operated hydrants.

.4 As specified in Part 3 of this Section, submit a letter from anchor design engineer stating anchor installation has been examined at site and anchors are properly fabricated and installed.

1.02 QUALITY ASSURANCE

.1 Domestic water piping and valves are to comply with following codes, regulations and standards (as applicable):

.1 applicable local codes and regulations;

.2 CAN/CSA B125.1, Plumbing Supply Fittings;

.3 CAN/CSA B125.3, Plumbing Fittings;

.4 CAN/CSA B137 Series, Thermoplastic Pressure Piping Compendium;

.5 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies;

.6 CAN/ULC S101, Fire Endurance Tests of Building Construction and Materials;

.7 NSF/ANSI 14, Plastics Piping System Components and Related Materials;

.8 NSF/ANSI 61, Drinking Water System Components – Health Effects;

.9 NSF/ANSI 372, Drinking Water System Components – Lead Content.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on body (per MSS-SP-25). Product shall carry valid CRN (Canadian Registration Number)

2. PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 PVC

.1 ULC listed, rigid, Class 150, DR18, 1035 kPa (150 psi) pressure rated bell and spigot pattern PVC pipe to CAN/CSA B137.3, and CSA certified fittings to CAN/CSA B137.2, and AWWA C900, complete with gasket joints, and Ford "Uni-Flange" or equal restraint collars as per Part 3 of this Section.

.2 Soft Copper

.1 Type "K" soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.

.3 Stainless Steel

.1 Schedule 10S type 304 stainless steel, ASTM A312, factory or site roll grooved, complete with Victaulic or equal type 304 stainless steel roll grooved end fittings and, unless otherwise specified, Victaulic Style 489 or equal lightweight rigid type 304L stainless steel couplings and coupling gaskets equal to Victaulic Grade E or Grade M.

.4 Hard Copper - Solder Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using The Canada Metal Co. Ltd. "SILVABRITE 100" or equal lead-free solder for cold water pipe, and 95% tin/ 5% Antimony or "SILVABRITE 100" solder for other services.

.5 Semi-Rigid Polyethylene Tubing

.1 Versa Fittings and Mfg. Inc. 12 mm (½") dia., high density, semi-rigid polyethylene tubing, 1380 kPa (200 psi) rated.

2.02 SHUT-OFF VALVES

.1 Ball Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves, each complete with a forged brass or bronze body with solder ends, forged brass cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, and a removable lever handle. Valves in insulated piping are to be complete with stem extensions.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5049A-LF;

.2 Flow+ 600FPSLF;

.3 Nibco S-585-66-LF;

.4 Milwaukee Valve Co. #UPBA485B;

.5 Kitz Corporation Code 859;

.6 Apollo Valves #77LF-200;

.7 Watts Industries (Canada) Inc. #LFFBVS-3C.

2.03 CHECK VALVES

.1 Horizontal

.1 Lead-free, Class 125, bronze, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with solder ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 237A-LF;

.2 Nibco S-413-Y-LF;

.3 Milwaukee Valve Co. #UP1509;

.4 Kitz Corporation Code 823;

.5 Apollo Valves #61LF Series.

.2 Vertical

.1 Equal to Kitz Corp. Code 826, lead-free, 1725 kPa (250 psi) WOG rated vertical lift check valve with soldering ends.

2.04 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) water rated, 20 mm (¾") dia., straight pattern full port bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") dia. garden hose, and a cap and chain.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5046;

.2 NCI TFP600-HC;

.3 Nibco T-585-70-HC;

.4 Dahl Brothers Canada Ltd. Fig. No. 50. 430;

.5 Kitz Corporation Code 58CC;

.6 Apollo Valves #78-104-01;

.7 Watts Industries (Canada) Inc. #B6000.

2.05 DOMESTIC HOT WATER PIPING BALANCING VALVES

.1 Solder or flanged end type as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.

.2 Acceptable products are:

.1 S.A. Armstrong Model CBV Series;

.2 Nibco Boss Series;

.3 Tour and Andersson Model TBV Series;

.4 Watts Industries (Canada) Inc. Model CSM Series.

2.06 LAVATORY SUPPLY FITTING TEMPERING VALVES

.1 Lawler 310-SC1 12 mm (½") dia. or 20 mm (¾") dia. as required, each CSA B125 certified, forged brass, tamper-proof thermostatic mixing valves, adjustable for water supply between 29°C and 49°C (85°F and 120°F), sized to suit number of lavatories in grouping, and complete with a stop and check valve and a lockable handle.

.2 For wall hung lavatories, each mixing valve is to be complete with a stainless steel flush wall mounting cabinet with vandal-proof hinged door.

.3 Acceptable manufacturers are:

.1 Lawler Manufacturing Co. Inc.;

.2 Webstone;

.3 Symmons Industries Inc.

2.07 CHLORINE

.1 Sodium hypochlorite to AWWA B300.

2.08 EXTERIOR NON-FREEZE WALL HYDRANTS

.1 Flush-Concealed

.2 Recessed, encased, self-draining hydrants, each complete with a copper casing, operating rod assembly to suit wall thickness, polished nickel bronze box with hinged locking cover, 20 mm (¾") dia. threaded hose connection outlet, vacuum breaker, and a loose tee handle operating key.

.3 Acceptable products are:

.1 Watts Industries (Canada) Inc. #HY-725;

.2 Jay R. Smith #5519-98;

.3 Zurn #Z1320;

.4 Mifab #MHY-26.

2.09 FLOOR DRAIN TRAP SEAL PRIMERS

.1 Primer Valve Type

.1 Precision Plumbing Products Inc. Model P2-500 trap primer valve, constructed of brass, adjustable to high or low water pressures and complete with "O" ring seals, 12 mm (½") threaded inlet and outlet connections, and, for priming two traps from the same primer, a DU-2 dual outlet distribution unit.

.2 Primer Valve Type with Manifold

.1 Precision Plumbing Products Inc. Model P1-500 trap primer valve constructed as specified above for the Model P2-500 primer valve, complete with a Model DU-3 or DU-4, 3 or 4 outlet distribution unit for priming 3 or 4 traps, and at Model "YS-8" supply tube with combinations of Model DU-3 and DU-4 distribution units for priming from 5 to 6 traps.

.3 Electronic Type

.1 Precision Plumbing Products #PT Series surface wall mounting, CSA certified, 115 volt, 1-phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:

.2 galvanized steel cabinet with door;

.3 20 mm (¾") dia. NPT copper pipe inlet with shut-off valve and water hammer arrestor;

.4 solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (½") dia. compression type copper tube connections on 40 mm (1 ½") centres with quantity to suit the number of items to be primed;

.5 control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

2.10 WATER HAMMER ARRESTORS

.1 Piston type, sealed, pressurized water hammer arrestors suitable for either horizontal or vertical installation, each complete with a hard drawn copper body, "O"-ring piston seals, an air charge, and an inlet opening equal to diameter of pipe in which arrestor is required.

.2 Acceptable products are:

.1 Watts Industries (Canada) Inc.;

.2 Zurn #Z1705;

.3 Precision Plumbing Products Inc. #SC;

.4 Mifab MWH Series

2.11 AIR VENTS

.1 Equal to ITT Hoffman Specialty No. 78 cast brass, 1035 kPa (150 psi) rated, 20 mm (¾") straight water main vent valves, each tapped at the top for a 3.2 mm (1/8") safety drain connection.

2.12 DOMESTIC WATER THERMAL EXPANSION TANK

.1 Pre-charged domestic water thermal expansion tank, carbon steel outer shell construction and complete with fixed butyl rubber bladder to prevent water from contacting shell interior, top NPT stainless steel system connection, 7.6 mm to 813 mm (0.301" to 32") charging valve connection and prime painted exterior.

.2 Acceptable products are:

.1 Watts Industries (Canada) Inc. Series PLT;

.2 Amtrol Therm-X-Trol series.

3. EXECUTION

3.01 DEMOLITION

.1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 PIPING INSTALLATION REQUIREMENTS

.1 Provide required domestic water piping.

.2 Piping, unless otherwise specified, is as follows:

.1 for underground piping 100 mm (4") dia. and larger outside and/or inside the building – rigid PVC;

.2 for underground piping less than 100 mm (4") dia. inside building – Type "K" soft copper;

.3 for pipe 100 mm (4") dia. and larger inside building and above ground – Schedule 10 stainless steel;

.4 for 12 mm (½") dia. trap seal primer tubing located underground or in concrete or masonry construction – semi-rigid polyethylene;

.5 for pipe inside building and aboveground in sizes to 100 mm (4") dia. – Type "L" hard copper with solder joints.

.3 Refer to piping hanger and support requirements specified in Section entitled Basic Mechanical Materials and Methods.

.4 Slope piping so it can be completely drained.

.5 Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe or equipment.

3.03 INSTALLATION OF SHUT-OFF AND CHECK VALVES

.1 Refer to Part 3 of Section entitled Basic Mechanical Materials and Methods.

.2 For shut off valves installed on solder joint copper piping up to and including 75 mm (3") diameter, provide ball type valves, and for flanged joints copper or stainless steel piping larger than 75 mm (3") diameter provide butterfly type valves.

3.04 INSTALLATION OF DRAIN VALVES

.1 Provide a drain valve at the bottom of domestic water piping risers, at other piping low points, and wherever else shown.

.2 Locate drain valves so they are easily accessible.

3.05 INSTALLATION OF DOMESTIC HOT WATER PIPING BALANCING VALVES

.1 Provide balancing valves in domestic hot water recirculation piping where shown or required.

.2 Locate each valve so it is easily accessible.

3.06 INSTALLATION OF PARTITION STOPS

.1 Provide partition stops in domestic water piping to each group of suite washroom plumbing fixtures. Locate partition stops in piping near floor level in inconspicuous but accessible locations. Confirm exact locations prior to roughing-in.

3.07 INSTALLATION OF LAVATORY SUPPLY FITTING TEMPERING VALVES

.1 Provide thermostatic water tempering valves for hot water supply to public washroom lavatory supply fittings. Conceal valves and piping.

.2 For wall mounted Lavatories, provide a flush wall mount panel for each valve. Confirm exact location prior to roughing-in.

.3 Install in accordance with manufacturer’s instructions and set mixing valves to deliver 32°C (90°F) tempered water.

3.08 INSTALLATION OF EXTERIOR NON-FREEZE WALL HYDRANTS

.1 Provide non-freeze wall hydrants.

.2 Install hydrants level and plumb such that hose outlets are approximately 600 mm (2') above grade level. Confirm exact locations prior to roughing-in.

.3 Provide a shut-off valve inside building to each exterior non-freeze wall hydrant.

3.09 INSTALLATION OF TRAP SEAL PRIMERS

.1 Provide required accessible trap seal primers to automatically maintain a water seal in floor drain traps, whether shown on drawings or not.

.2 Water closet flush valves may be used for priming washroom floor drain traps if flush tube is properly tapped and primer tubing exposed in washroom is chrome plated.

.3 Provide trap primer valves to prime single or multiple (1 to 6) traps. Install trap primer valves in domestic cold water piping to frequently used plumbing fixtures. Where from 2 to 6 traps are to be primed from same primer valve, provide appropriate supply and distribution tube assemblies. Ensure primer valves are accessible.

.4 Provide 115 volt, electronic, surface wall mounting trap primer assemblies for multiple (4 to 30) traps. Include for a 115 volt 15 ampere panel breaker and wiring in conduit from closest panelboards to primer assembly, all to wiring standards of Electrical Division. Adjust primer water flow and timing to suit number of traps served.

.5 Ensure trap primer piping is secured to floor drain primer tappings and not terminated through the tapping in the throat of the drain.

3.10 INSTALLATION OF WATER HAMMER ARRESTORS

.1 Provide accessible water hammer arrestors in domestic water piping in locations as follows:

.1 in headers at groups of plumbing fixtures;

.2 at top of risers;

.3 at ends of long horizontal runs of piping;

.4 in piping connecting solenoid valves or equipment with integral solenoid valves;

.5 wherever else shown or required by Code.

.2 Install each unit in a piping tee either horizontally or vertically in the path of potential water shock in accordance with manufacturer’s instructions and details.

3.11 INSTALLATION OF AIR VENTS

.1 Provide accessible air vents in domestic water piping to prevent air binding.

.2 Extend copper indirect drain piping from top drain connection of each vent to nearest suitable drain.

.3 Locate exact vent locations on as-built record drawings.

3.12 FLUSHING AND DISINFECTING PIPING

.1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.

.2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.

.3 Flush piping until all foreign materials have been removed and flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.

.4 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601.

.5 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of test results and fill the systems.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.

.2 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.

2. PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 PVC Sewer

.1 DR35 rigid, green PVC hub and spigot pattern sewer pipe and fittings to CAN/CSA B182.2, with gasket joints assembled with pipe lubricant.

.2 DR35 rigid, PVC sewer pipe and fittings, with solvent weld joints, all certified to CSA B182.1 and colour-coded as per local governing codes, regulations and standards.

.2 Embedded/Encased (in concrete): Equal to IPEX System 15 rigid PVC drain, waste and vent pipe and fittings to CAN/CSA B181.2, with solvent weld joints only.

.3 Copper - Solder Joint

.1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.4 Cast Iron

.1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.

.5 Galvanized Steel - Victaulic Coupling Joint

.1 Schedule 40 mild steel, galvanized, ASTM A53, factory or site rolled grooved, complete with Victaulic galvanized ductile iron grooved end fittings and, unless otherwise specified, Victaulic Style 77 hot dip galvanized mechanical joint couplings with Grade M gaskets.

2.02 SHUT-OFF AND CHECK VALVES

.1 Shut-off Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5049A or Fig. 5044A;

.2 Milwaukee Valve Co. #BA-155 or #BA -125;

.3 Kitz Corporation Code 58 or Code 59;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valves # 77-100 or # 77-200;

.6 Watts Industries (Canada) Inc. #FBVS-3C.

.2 Check Valves

.1 Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with solder or screwed ends as required, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with solder or screwed ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 231 or Fig. 236 or Fig. 237;

.2 Milwaukee Valve Co. #1510 or #510;

.3 Kitz Corporation Code 36 or Code 22 or Code 23.

2.03 VENT STACK COVERS

.1 Equal to Lexcor Model "Flash-Tite" seamless, spun aluminum, insulated vent stack covers with caps and a factory applied asphalt primer coating on top and bottom of flange.

.2 Each vent stack cover is to be complete with a vandal-proof cap.

2.04 CLEANOUTS

.1 Horizontal Piping

.1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping

.1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

2.05 FLOOR CLEANOUT TERMINATIONS

.1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware.

.2 Acceptable products are:

.1 Watts Industries (Canada) Ltd. # CO-200-R-1;

.2 Jay R. Smith #4020-F-C Series;

.3 Zurn # ZN-1602-SP Series;

.4 Mifab # C1100-XR-1 or #C1000-R-3.

.3 Cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.

2.06 FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

.1 Unless otherwise specified or indicated, floor drains are to be vandal-proof drains in accordance with drawing symbol list, each complete with a cast iron body and a trap seal primer connection. Cast iron components are to be factory finished with latex based paint coating.

.2 Floor drains in areas with a tile or sheet vinyl floor finish are to be as above but with a square grate in lieu of a round grate.

.3 Acceptable manufacturers are:

.1 Watts Industries (Canada) Ltd.;

.2 Jay R. Smith Manufacturing Co.;

.3 Zurn Industries Ltd.;

.4 Mifab Inc.

2.07 ROOF DRAINS

.1 Unless otherwise specified or indicated, roof drains are to be cast iron body drains with aluminium domes, in accordance with the drawing symbol list. Cast iron components are to be factory finished with latex based paint coating.

.2 Acceptable manufacturers are:

.1 Watts Industries (Canada) Ltd.;

.2 Jay R. Smith Manufacturing Co.;

.3 Zurn Industries Ltd.;

.4 Mifab Inc.

3. EXECUTION

3.01 DEMOLITION

.1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS

.1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:

.1 for underground pipe inside building and to points 1.5 m (5') outside building lines – rigid PVC sewer pipe, minimum 75 mm (3") dia.;

.2 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. (including condensate drainage) – type DWV copper;

.3 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;

.4 for drainage pump discharge pipe connections from pump to and including shut-off and check valve connections –Schedule 40 galvanized steel with Victaulic fittings and couplings.

.2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').

.3 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.

.4 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').

.5 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building exterior as required in order to satisfy local governing codes and authority. Coordinate vent routing with other building services and ensure there is no architectural impact.

.6 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.

.7 All above grade drainage piping associated with waterclosets, showers, or rainwater leaders are to be Class 4000 cast iron.

.8 Refer to piping hanger and support requirements specified in Section entitled Basic Mechanical Materials and Methods.

3.03 INSTALLATION OF SHUT-OFF AND CHECK VALVES

.1 Provide a shut-off valve and a check valve in discharge piping of each drainage pump.

.2 Locate valves so they are easily accessible without the use of ladders or other such devices.

3.04 SUPPLY OF VENT STACK COVERS

.1 Supply a properly sized vent stack cover for each vent stack penetrating roof.

.2 Hand vent stack covers to roofing trade at site for installation and flashing into roof construction as part of roofing work. Coordinate installation to ensure proper locations. Provide waterproofing caps over vent stacks.

3.05 INSTALLATION OF CLEANOUTS

.1 Provide cleanouts in drainage piping in locations as follows:

.1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;

.2 at or as close as practicable to the foot of each drainage stack;

.3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;

.4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;

.5 in the wall at each new urinal or bank of urinals in a washroom;

.6 wherever else shown on drawings.

.2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.

.3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

3.06 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS

.1 Where cleanouts occur in horizontal inaccessible underground piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with finished floor.

.2 In waterproof floors, ensure each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit floor finish.

.3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

.4 Ensure cleanout termination covers in tiled floor are square in lieu of round.

3.07 INSTALLATION OF FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

.1 Provide floor drains, funnel floor drains and hub drains.

.2 Coordinate location of floor drains, funnel floor drains and hub drains with equipment provided by Mechanical Division and Owner's supplied equipment. Install in accordance with manufacturer's instructions.

.3 Equip each drain with a trap.

.4 In equipment rooms and similar areas, exactly locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping. In washrooms, exactly locate floor drains to avoid interference with toilet partitions.

.5 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.

.6 Temporarily plug and cover floor drains during construction procedures. Remove plugs and covers during final clean-up work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates, and refinish any areas of the drain where cast iron finish has been damaged or removed, including rusted areas.

3.08 INSTALLATION OF ROOF DRAINS

.1 Supply roof drains and place roof drain bodies in position for flashing into roof construction as part of roofing work. Connect with piping and provide accessories.

.2 Protect roof drains from damage and entrance of debris until roofing work is complete, and refinish any areas where cast iron factory finish has been damaged or removed, including rusted areas.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings.

.2 Submit fixture manufacturer's standard colour charts for all fixtures where colours are available but a particular colour is not specified.

2. PRODUCTS

2.01 GENERAL RE: PLUMBING FIXTURES AND FITTINGS

.1 Fixtures and fittings, where applicable, are to be in accordance with requirements of CAN/CSA B45 Series, General Requirements for Plumbing Fixtures, including supplements, ASME A112.1.18.1/CSA B125.1, Plumbing Supply Fittings, and CSA B125.3, Plumbing Fittings.

.2 Barrier-free fixtures and fittings are to be in accordance with governing Code requirements.

.3 Unless otherwise specified, vitreous china, porcelain enamelled, and acrylic finished fixtures are to be white.

.4 Unless otherwise specified, fittings and piping exposed to view are to be chrome plated and polished.

.5 Fittings located in areas other than private washrooms are to be vandal-proof.

.6 Fixture carriers are to be suitable in all respects for the fixture they support and construction in which they are located.

.7 Floor flanges for floor mounted water closets are to match the material of the piping they are connecting to, secured to floor to prevent movement and complete with a wax seal and brass or stainless steel bolts, nuts, and washers.

.8 Proper seal to mate with fixture carrier flange and produce a water-tight installation.

.9 Exposed traps for fixtures not equipped with integral traps, such as lavatories, are to be adjustable chrome plated cast brass "P" traps with cleanouts, minimum #17 gauge chrome plated tubular extensions, and chrome plated escutcheons, all to suit fixture type and drain connection.

.10 Concealed traps for fixtures not equipped with integral traps, such as counter sinks, are to be adjustable cast brass with cleanout plugs, all to suit fixture type and drain connection.

.11 Exposed supplies for fixtures which do not have supply trim/fittings with integral stops, i.e. lavatories, are to be solid chrome plated brass angle vales with screwdriver stops for public areas, wheel handle stops for private areas, flexible stainless steel risers, and stainless steel or chrome plated steel escutcheons, all arranged and sized to suit fixture.

.12 Water piping as specified, complete with ball type shut-off valves as specified with water piping, or Dahl Bros. Canada Ltd. ¼ turn Mini Ball Valves.

.13 All above grade drainage piping associated with waterclosets and showers are to be Class 4000 cast iron.

2.02 PLUMBING FIXTURES AND FITTINGS

.1 Plumbing fixtures and fittings are to be in accordance with the following:

.1 BF-1 WALL MOUNTED BOTTLE FILLING STATION

.1 Elkay model EZSDWSLK - ezH2O® Bottle Filling Station with Single ADA Cooler Non-Filtered Non-Refrigerated Light Gray. Features shall include Antimicrobial, Green Ticker, Hands Free, Laminar Flow, Real Drain. Furnished with Flexi-Guard ® Safety Bubbler. Electronic Bottle Filler Sensor with Electronic Front and Side Bubbler Pushbar activation. Product shall be Wall Mount (On Wall), for Indoor applications, serving 1 station(s). Unit shall be certified to UL 399 and CAN/CSA C22.2 No. 120.

.2 McGuire LFHST01 Stop Valves - Lead Free, Chrome-plated finish, 3/8" I.P.S x 3/8" O.D

.3 Carrier - Elkay Model MLP100 - In-wall Carrier for Single-station On-wall Bottle Fillers Coolers & Fountains. Overall dimensions are 20-3/4" x 2-11/16" x 44-1/8". Made of Galvanized Steel.

.4 McGuire 8872C P-Trap - Heavy cast brass, Adjustable P-Trap, 292 mm (11-1/2") distance, With cleanout plug, Steel shallow flange, Neoprene gasket, Slipnuts, 17 gauge seamless tubular wall bend, ASME A112.18.2 CSA B125.2, CSA compliant.

.2 L-2 LAVATORY – WALL HUNG - BARRIER FREE

.1 American Standard 0954004EC.020 Basin - MURRO, Wall-hung Lavatory, Vitreous china, EverClean® antimicrobial surface, White finish, Single hole centerset, Rear overflow, Faucet ledge with recessed self-draining deck, For concealed arm or wall support, Overall Dimensions: 545 mm (21-7/16") long, 540 mm (21-1/4") wide, 152 mm (6") high, Bowl Dimensions: 394 mm (15-1/2") long, 540 mm (21-1/4") wide, 127 mm (5") deep.

.2 American Standard 0059020EC.020 Vitreous china shroud/knee contact guard with EverClean.

.3 Chicago Faucets 420-T45E2805ABCP Faucet - Counter mounted, Manual, Single handle, Lavatory faucet, Polished chrome finish, 102 mm (4") centerset, Lead Free ANSI/NSF 61 and ANSI/NSF 372 compliant, ECAST® brass construction, Thermostatic ceramic cartridge with check valve and scald protection, 1.9 LPM (0.5 GPM) maximum flowrate, 1.3 LPM (0.35 GPM) minimum flowrate for proper functioning of thermostatic protection, Vandal-resistant pressure compensating Econo-Flo™ non-aerated outlet, Fixed Cast brass spout, 118 mm (4-5/8") spout reach, 143 mm (5-5/8") high, Vandal-resistant lever handle, 13 mm (1/2") NPSM supply inlet for 10 mm (3/8") or 13 mm (1/2") flexible riser.

.4 Lawler TMM-1070-87500 Mixing Valve - The point of use mechanical mixing valve with thermostatic limit stop, MECHANICAL MIXING VALVE, Lead free brass body construction, The temperature adjusting dial is located on the cold inlet. Turning the dial clockwise will lower the outlet temperature, turning the dial counter-clockwise will raise it. The valve cannot be adjusted above its shut-off temperature of 120F, 1.8 LPM (0.5 GPM) tempered flowrate @ 5 PSI pressure drop, Compression Fitting, 84 mm (3-5/16") high, ASSE 1070 approved ASSE lead free Certified for ASSE 1070 applications, 3/8" MNPT (9.5 mm) inlet, 3/8" MNPT (9.5 mm) outlet, lintegral rubber duck-bill backflow checks, High temperature limit stop, 125 PSI max supply pressure, Automatically shuts down flow of water when temperature reaches 120 °F, 5 PSI Minimum Operating pressure, 140 °F max, 118 °F ±3 °F, Protects against scalding and chilling, 8 LPM (2.1 GPM) flowrate @ 45 PSI

.5 McGuire 155A Fixture Drain - Straight drain, Cast brass, Chrome-plated finish, Open grid PO plug, 7/32" (5.5 mm) Ø holes size, 17 gauge 32 mm (1-1/4") Ø tailpiece diameter, 17 gauge 17152 mm (6") long, Brass locknut, Heavy rubber basin washer Fiber friction washer, ASME A112.18.2 CSA B125.2, CSA compliant

.6 McGuire LFBV170 Supply - Lead Free, 127 mm (5") length, Convertible quarter-turn supply , Chrome-plated finish, 13 mm (1/2") copper sweat x 10 mm (3/8") outer Ø brass ball valve, 304 mm (12") copper flexible risers, Convertible loose key handle, Lavatory, One deep bell flange

.7 McGuire 8872C P-Trap - Heavy cast brass, Adjustable p-trap, 292 mm (11-1/2") distance, With cleanout plug, Steel shallow flange, Neoprene gasket, Slipnuts, 17 gauge seamless tubular wall bend, ASME A112.18.2 CSA B125.2, CSA compliant

.8 Jay R. Smith Manufacturing Co. 0723-E - Carrier - Single wall-mounted lavatory supports with concealed arms, for high back lavatories to attach to backing plate secured in wall.

.3 WC-1 TOILET - FLOOR MOUNTED WITH FLOOR OUTLET – BARRIER FREE

.1 American Standard 3461001.020 Toilet - MADERA™ FloWise®, Toilet, Floor mounted with floor outlet, Toilet operates in the range of 4.2 to 6.0 LPF (1.1 - 1.6 GPF), White finish Vitreous china, EverClean® antimicrobial surface, Elongated bowl, 419 mm (16-1/2") rim height, 254 mm (10") to 305 mm (12") rough-in from wall to the center of waste outlet, Direct-fed siphon jet flush action, 38 mm (1-1/2") top spud, Flush valve by others, 254 x 305 mm (10" x 12") water surface area, Fully-glazed 54 mm (2-1/8") trapway, Condensation channel, Toilet seat not included, Two (2) colour-matched bolt caps with retainers (481310-100), 356 mm (14") wide, 718 mm (28-1/4") from finished wall, Compliances: ASME A112.19.2 compliant, CSA B45.1 compliant, ADA compliant.

.2 Centoco 820STSFE-001 FAST-N-LOCK, For elongated bowl, Open front, Heavy-duty, For commercial applications, Polypropylene, Toilet seat, With seat cover, Plastic commercial check hinges, and Stainless steel hinge pin, Specified in White finish, FAST-N-LOCK mounting system takes the guess work out when tightening the hardware. The specially designed fasteners in click" when the appropriate torque is reached. The bolt and nut material shall be stainless steel, Dimensions:25 mm (1") high, 470 mm (18-1/2") long, 362 mm (14-1/4") wide.

.3 SL-Regal 111 -1.28 REGAL® Manual Exposed Water closet flushometer, 38mm (1-1/2") spud coupling For top spud toilet, constructed from Semi-red brass, Polished chrome finish, High Efficiency 4.8 LPF (1.28 GPF), Traditional natural rubber segment diaphragm, Metal oscillating handle, Flush tube for 292 mm (11-1/2") rough-in, Adjustable tailpiece, 25 mm (1") I.P.S. screwdriver Bak-Chek® angle stop with control stop plug, Sweat solder adapter kit with cover tube, Vacuum breaker with flush connection, 25 mm (1") supply pipe, Non-hold-open, no external volume adjustment, fixed volume accuracy is controlled by Para-Flo™ technology, Pressure Range: 103 - 552 kPa (15 - 80 PSI) operating water pressure. Compliances: cUPC compliant, ADA Compliant.

2.03 ACCEPTABLE MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, following:

.1 Flush Valves:

.1 Sloan;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commercial.

.2 Plumbing Brass:

.1 Sloan;

.2 Acorn Engineering;

.3 American Standard;

.4 Delta Commercial;

.5 Chicago Faucet;

.6 Moen Commercial.

.3 Stainless Steel Sinks:

.1 Franke Commercial;

.2 Novanni Commercial;

.3 Aristaline;

.4 Arch Metal Ind.

.4 Drain Fittings, Angle Supplies, and Traps:

.1 McGuire;

.2 American Standard;

.3 Delta Commercial;

.4 Zurn Industries.

.5 Fixture Carriers:

.1 Watts Industries;

.2 Jay R. Smith;

.3 Zurn Industries.

.6 Hose Bibbs:

.1 Jay R. Smith;

.2 Zurn Industries.

.7 Water Closets, Lavatories, and Urinal:

.1 American Standard;

.2 Zurn Industries;

.3 Kohler.

.8 Thermostatic Mixing Valves:

.1 Lawler;

.2 Delta Commercial;

.3 Leonard.

.9 Toilet Seats:

.1 Olsonite;

.2 Centoco;

.3 Bemis Commercial.

2.04 CAULKING

.1 General Electric Series SCS-1200 Silicone Construction Sealant or Dow Corning 780 silicone rubber sealant with primers as recommended by sealant manufacturer. Caulking colour(s) for coloured fixtures other than white, if any, will be selected by Consultant from sealant manufacturer’s standard colour range.

3. EXECUTION

3.01 DEMOLITION

.1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

.1 Provide required plumbing fixtures and fittings.

.2 Where new fixtures and fittings are to be connected to existing piping, include for required piping revisions.

.3 Connect plumbing fixtures and fittings with piping sized in accordance with drawing schedule. Refer to manufacturer's published connection (rough-in) requirements. Where manufacturer requires piping connection larger than shown below, provide piping accordingly:

FIXTURE AND/OR FITTING	DRAIN SIZE MM (IN.)	VENT SIZE MM (IN.)	DHW SIZE MM (IN.)	DCW SIZE MM (IN.)	TEMP WATER SIZE MM (IN.)
Water Closets Flush Valve Type	100 (4)	38 (1-½)	----------	25 (1)	----------
Lavatories	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	----------
Lavatories (Electronic Faucet)	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	12 (½)
Counter Sinks	38 (1-½)	32 (1-¼)	12 (½)	12 (½)	----------

.4 Confirm exact location of plumbing fixtures and trim prior to roughing-in. Refer to architectural plan and elevation drawings.

.5 When installation is complete, check, and test operation of each fixture and fitting. Adjust or repair as required.

.6 For barrier-free fixtures, comply with mounting height and other requirements of governing Code(s).

.7 Supply templates for counter mounted fixtures and trim and hand to trades who will cut the counter. Ensure openings in counter are properly located.

.8 Locate control panels for electronic faucets under lavatories and recessed into wall. Coordinate panel installations with electrical trade who will provide 115 volt power wiring to panels. Install flexible conduit (supplied with box) and extend cord from faucet through the flexible conduit to control box. Connect hot and cold water piping to mixing valve in each box, and tempered water piping from each mixing valve to faucet. Set mixing valve maximum temperature limit stops to 43°C (110°F) after domestic water systems (hot and cold) are complete. Ensure each programmable controller is properly programmed and water off after deactivation is set for 3 seconds.

.9 For electronic flush valves, locate transformer in ceiling space above electronic units to be served. Coordinate locations with electrical trade who will provide 120 volt line supply to transformers. Provide low voltage wiring from transformers to each electronic flush valve terminal point. Electrical line supply and low voltage wiring is to be concealed and access to transformer must be provided for servicing.

.10 Protect baths from damage during construction and finishing work. Unless otherwise specified, pack concealed voids under baths with batt type glass fibre insulation as baths are installed.

.11 Protect shower bases from damage during construction and finishing work.

.12 Confirm exact mixing valve and shower head locations prior to roughing-in.

.13 Install refrigerated drinking fountains in accordance with manufacturer’s instructions. Plug into a wall receptacle provided as part of electrical work. Coordinate receptacle installation with electrical trade on site.

.14 For emergency showers, install so bottom of shower head is approximately 2 m (82") above floor, and approximately 400 mm (16") out from the wall. Wall mount mixing valve approximately 1.5 m (5') above floor and adjacent shower head. Set valve temperature limit stop to 35°C (95°F). Ensure valve is open and exposed piping is chrome plated or stainless steel.

.15 Install eye wash fixtures in accordance with manufacturer’s instructions. Ensure exposed piping is painted.

.16 Wall mount mixing valves for emergency fixtures approximately 1.5 m (5') above floor and secure in place. Check and confirm valve operation and temperature of tempered water supply. Provide cabinets. Identify each cabinet and hand 3 identified cabinet keys to Consultant prior to Substantial Performance of the Work.

.17 Set mop service basins on floor over drain piping and connect to roughed-in service. Install wall supply trim and any accessories specified.

3.03 CAULKING AT PLUMBING FIXTURES AND FITTINGS

.1 Caulk around plumbing fixtures and fittings where they contact walls, floors, and any other building surface.

.2 Clean areas/surfaces to be caulked and prime in accordance with sealant manufacturer’s instructions. Where damage to a building surface may occur, mask surface to prevent damage and ensure a clean exact edge to the caulking bead.

.3 Apply caulking using a gun with proper size and shape of nozzle and force sealant into joints to ensure good surface contact and a smooth and even finished bead of sealant.

.4 If joints have been masked sealant may be tooled in a continuous stroke to obtain complete void filling. Remove masking tape immediately after tooling and before sealant begins to skin.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section except piping and unions.

.2 Shop drawings for piping anchors must be prepared and stamped by a professional Structural Engineer registered in the jurisdiction of the work. Refer to requirements for Contractor retained engineers specified in Section entitled Mechanical Work General Instructions.

.3 Submit a letter from pipe anchor design engineer to stating engineer has visited site to examine installation of pipe anchors and pipe anchor installation is in accordance with reviewed anchor shop drawing.

2. PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 Black Steel - Screwed Joint

.1 Mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.

.2 Black Steel - Welded Joint

.1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, with long sweep pattern elbows unless otherwise specified, and welded joints.

2.02 PIPING UNIONS

.1 Screwed Piping

.1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping

.1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

2.03 SHUT-OFF VALVES

.1 Ball Type

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded ends, and removable lever handle.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 5044A;

.2 Watts Industries (Canada) Inc. #FBV-3;

.3 Kitz Corp. Code 58;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valve #77-100;

.6 NCI 600FPT;

.7 NIBCO T-585-70.

.2 Butterfly Type

.1 Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valve, each complete with a neck to permit 50 mm (2") of insulation above the flange, a field replaceable EPDM seat, ductile iron disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 150 mm (6") diameter, a handwheel and gear type operator for valves larger than 150 mm (6") diameter, and each suitable for bubble-tight dead end service with valve closed and either side of connecting piping removed.

.1 Acceptable products are:

.1 DeZurik of Canada Ltd., Figure No. 632;

.2 Watts Industries (Canada) Inc. #BF-03;

.3 Apollo Valve 143 Series;

.4 Kitz Corp. 6112 Series;

.5 Toyo Valve Co. 918DESL/G2;

.6 Flow+ C2421353H (lever) and C2421355H (gear);

.7 NIBCO LD20103 (lever) and LD20105 (gear).

2.04 SWING CHECK VALVES

.1 Bronze - Screwed

.1 Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 236;

.2 Nibco #T-433 and T413-B;

.3 Kitz Corp. Code No. 22;

.4 NCI CKVATBZ2361.

.2 Cast Iron - Screwed and Flanged

.1 Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required.

.2 Acceptable products are:

.3 Toyo Valve Co. Fig. 435A;

.4 Watts Industries (Canada) Inc. #F-511;

.5 Kitz Corp. Code No. 78;

.6 NCI CKVAFCI1330;

.7 NIBCO F918-B.

2.05 VERTICAL LIFT CHECK VALVES

.1 Class 150, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 231;

.2 Watts Industries (Canada) Inc. #600;

.3 Kitz Corp. Code No. 36;

.4 NCI CKVBTBZ2373;

.5 NIBCO T-480.

2.06 WAFER CHECK VALVES

.1 Threaded lug body type, full bore, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe.

.2 Acceptable products are:

.1 Gulf Valve Co. "WAFER CHECK";

.2 Watts Industries (Canada) Inc. Series ICV-125;

.3 The Metraflex Co. Style CVXX;

.4 SSI 125WC/150WC series.

2.07 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (¾") diameter straight pattern bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") diameter hose, and a cap and chain.

.2 Acceptable products are:

.1 Toyo Valve Co. Ltd. Fig. 5046;

.2 Watts Industries (Canada) Inc. #B-6000-CC;

.3 Kitz Corp. Code No. 68AC;

.4 Apollo Valves #78-104-01;

.5 NCI TFP600HC;

.6 NIBCO T-585-70-HC.

2.08 CIRCUIT BALANCING VALVES

.1 Tour & Andersson Series 787 threaded and Series 788 flanged for precise flow measurement, balancing, and positive shut-off with no drip seat. Each valve to be wye pattern, globe style with self-sealing EPDM measurement points, EPDM seat, and wheel handles with locking tamper-proof setting.

.2 Acceptable manufacturer is Tour & Anderson (TA Hydronics) only.

.3 Circuit balancing valves shall be sized based on design water flow and manufacturer's performance data. Refer to the following circuit balancing valve schedule for sizes.

Size (in)	Nominal Flow			
	Min. (gpm)	Max. (gpm)	Min. (l/s)	Max. (l/s)
1/2	0.6	2.8	0.038	0.177
3/4	2.0	6.0	0.126	0.379
1	3.9	10.0	0.246	0.631
1-1/4	5.0	15.0	0.316	0.947
1-1/2	6.6	20.0	0.416	1.262
2	12.6	36.0	0.795	2.272
2-1/2	38.0	100.0	2.398	6.310
3	31.0	130.0	1.956	8.203
4	68.0	200.0	4.291	12.620
5	90.0	320.0	5.679	20.192
6	182.0	450.0	11.48	28.395

2.09 RADIATOR SHUT-OFF AND BALANCING VALVES

.1 Heavy pattern, straight, 1750 kPa (250 psi) rated at 120°C (250°F) bronze radiator valves, each complete with composition disc, spring loaded packing, and union. Equip inlet valves with a handle for shut-off. Equip outlet valves with a lockshield for shut-off and balancing.

.2 Acceptable products are:

.1 Dahl Brothers Canada Ltd. #11042 and #13013;

.2 Spirax Sarco Ltd. Type R.

2.10 PRESSURE RELIEF VALVES

.1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1725 kPa (250 psi) rated pressure relief valves, each capable of relieving full output of equipment it is associated with, and each factory set at 415 kPa (60 psi) unless otherwise specified.

.2 Acceptable products are:

.1 ITT Bell & Gossett 3301/4100, or 790/1170;

.2 Dresser Industries "CONSOLIDATED";

.3 Spirax Sarco Ltd. SVI Series;

.4 McDonnell & Miller Models 250 and 260;

.5 Conbraco 10-600 Series;

.6 Watts Industries (Canada) Inc. 174A or 740.

2.11 AIR VENTS

.1 Manual Air Vents

.1 Equal to Conbraco 27 Series, 3.2 mm (⅛") diameter with a key handle.

.2 Automatic Air Vents

.1 Float actuated air vents, each complete with a semi-steel body and cap, a stainless steel float assembly and seat, and a neoprene head.

.2 Acceptable products are:

.1 Spirax Sarco Ltd., Type 13 W for system working pressures to 1035 kPa (150 psi), 13 WH for system working pressures greater than 1035 kPa (150 psi);

.2 Armstrong International Inc. No. 1-AV.

2.12 STRAINERS

.1 Cast iron wye shaped strainers, minimum 890 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2") diameter and larger, a blowdown pipe connection tapping.

.2 Acceptable products are:

.1 Spirax Sarco Ltd. Type IF-125 screwed or Type AF-250 flanged;

.2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged;

.3 Armstrong International Inc. A1 Series;

.4 Watts Industries (Canada) Inc. #77SCI;

.5 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged;

.6 SSI 125Y (flanged) and 250Y1T (screwed).

2.13 PIPING EXPANSION JOINTS

.1 Steel Piping Mains:

.1 Controlled flexing, flanged expansion joints, 2070 kPa (300 psi) rated, with corrugated stainless steel bellows with closely matched neck rings and reinforcing or control rings, and selected for operating pressure plus 25% safety factor.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series CSF "High-Corr";

.2 The Metraflex Co. Model MC.

.2 Steel or Copper Branch/Runout Piping:

.1 Externally pressurized, 1380 kPa (200 psi) rated expansion joints with a stainless steel bellows and shroud, welding or threaded steel nipple ends for steel piping, and copper sweat nipple ends for copper piping.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series "H";

.2 The Metraflex Co. Model "HP".

2.14 PIPING ALIGNMENT GUIDES

.1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit pipe size and pipe insulation thickness.

.2 Acceptable products are:

.1 Senior Flexonics Ltd. Series PGT;

.2 E. Myatt & Co. Ltd. Fig. 1267;

.3 Empire Tool & Mfg. Inc. Fig 256;

.4 The Metraflex Co. Style IV.

2.15 PIPE ANCHORS

.1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% of axial thrust, and, as specified in Part 1 of this Section, is to be designed and detailed by a Professional Structural Engineer.

2.16 FLEXIBLE PUMP CONNECTIONS

.1 Flexible metal hose assemblies, each complete with annular corrugated unbraided type 321 stainless steel inner core, braided type 321 stainless steel hose, and a collar and flange at each end, all suitable for twice the working pressure of the system.

.2 Acceptable products are:

.1 Senior Flexonics Inc. BSN and BSFS Series;

.2 The Metraflex Co. Model SST and "METRA-MINI".

3. EXECUTION

3.01 DEMOLITION

.1 Perform required hydronic piping system demolition/revision work. Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 PIPING INSTALLATION REQUIREMENTS

.1 Provide required hydronic piping. Pipe, unless otherwise specified, is to be:

.1 for pipe to and including 50 mm (2") diameter, Schedule 40 black steel, screwed;

.2 for pipe 65 mm (2-½") to 300 mm (12") dia. and larger, Standard weight black steel (10 mm [0.375"] thickness) pipe with welding fittings and welded joints;

.2 Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation and maintenance of air vents.

.3 Refer to piping hanger and support requirements specified in Section entitled Basic Mechanical Materials and Methods.

.4 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control work. Refer to drawing control diagrams and details.

.5 Connect equipment provided as part of the work of other Sections with piping as indicated and/or required. Refer to pipe connection details on drawings.

.6 Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on drawings.

.7 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

.8 Provide a check valve in discharge piping of every pump, and elsewhere in piping where shown on drawings. Where check valves are required in vertical piping, ensure they are suitable in all respects for the application. Check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory.

.9 Provide a drain valve at base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.

.10 Provide circuit balancing valves in piping generally where shown on drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation.

3.03 INSTALLATION OF PRESSURE RELIEF VALVES

.1 Provide factory set pressure relief valves. Pipe discharge of each water piping relief valve to drain unless otherwise shown or specified.

.2 Pipe discharge of each glycol solution piping relief valve back to system expansion tank or return piping.

.3 Confirm relief valve settings.

3.04 INSTALLATION OF AIR VENTS

.1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.

.2 Provide 9 mm (3/8") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

3.05 INSTALLATION OF STRAINERS

.1 Provide strainers in piping. Locate strainers so baskets are easily accessible and removable. Clean strainer baskets during and after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.06 INSTALLATION OF EXPANSION COMPENSATORS

.1 Provide expansion compensation in piping.

.2 Generally, locate expansion compensation where shown, but with exact locations to suit piping as installed.

.3 Provide double pipe alignment guides in horizontal piping at each side of expansion compensation facilities to permit movement in axial direction only. Secure guides to building structure only.

3.07 INSTALLATION OF PIPING ANCHORS

.1 Provide anchors to secure piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.

.2 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a signed letter with engineer's stamp from design engineer confirming each anchor is properly installed.

3.08 INSTALLATION OF FLEXIBLE PIPING CONNECTIONS

.1 Provide flexible connectors in piping connections to vibration isolated equipment, and wherever else shown.

.2 Install in accordance with manufacturer's instructions.

3.09 FLUSHING AND CLEANING PIPING

.1 Flush and clean new piping in accordance with requirements specified in Section entitled HVAC Water Treatment.

3.10 TESTING, ADJUSTING AND BALANCING

.1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit motor product data sheets and certified performance curves with all pump shop drawings.

.2 Submit with delivery of each unit a copy of factory inspection and test report, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

.4 Prior to Substantial Performance of the Work, submit a spare seal flush line filter for each pump equipped with a seal flush line.

1.02 QUALITY ASSURANCE

.1 Pump motors are to comply with requirements of Section entitled Basic Mechanical Materials and Methods.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers for pumps are:

.1 Taco Comfort Solutions;

.2 S.A. Armstrong;

.3 ITT Bell & Gossett;

.4 Grundfos CBS Inc. PACO;

.5 Patterson Pump Company.

2.02 SPLIT COUPLED VERTICAL IN-LINE PUMP

.1 Vertical Inline Centrifugal pumps as per the drawing schedule, each non overloading under all operating conditions and factory tested at specified operating conditions.

.2 Split coupled, single stage, vertical in line pumps shall be complete with:

.1 Pump casing shall be constructed of ASTM A48 class 30 cast iron. The pump casing/volute shall be rated for 250 psi working pressure for all jobs. The pump flanges shall be matched to suit the working pressure of the piping components on the job, with either ANSI Class 125 flanges or ANSI class 250 flanges. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.

.2 All casings shall be flanged. Threaded casings not allowed unless extra unions and fittings are provided to allow servicing.

.3 The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.

.4 The impeller shall be ASTM B584-836/875 bronze and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.

.5 The pump shall be manufactured with AISI 416 Stainless Steel shaft.

.6 The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250ºF. The mechanical seal shall be an inside type seal yet engineered and applied in a manner that is as or more accessible than a specialty outside seal. This seal must be capable of being flushed externally via a tapping in the pump cover adjacent to the seal cavity. The entire pump line shall use no more than three different sizes of seals. Outside mechanical seals are NOT acceptable.

.7 The pump shall be coupled via a high tensile aluminum split style coupling. The design must permit easy replacement of the mechanical shaft seal without removal of the motor. The motor mount must be designed to accept several different motor frame standards; CZ and HP. The motor shall be a TEFC, inverter rated motor with class F insulation and shaft grounding ring.

2.03 CIRCULATING PUMP SUCTION CONNECTION ACCESSORIES

.1 Circulating pump manufacturer supplied suction guides with a cast iron body, stainless steel strainer screen, removable fine mesh start-up strainer screen and steel guide vanes. Unless otherwise shown or specified, suction connection accessories are to be piping line size.

3. EXECTUTION

3.01 INSTALLATION OF HVAC PUMPS

.1 Provide centrifugal circulating pumps.

.2 Secure vertical inline pumps in place in accordance with requirements of drawing detail and provide flexible piping connections in vertical suction and discharge piping approximately 450 mm (18") above suction and discharge connection accessories.

.3 Provide a shut-off valve and suction guide in pump suction piping, and a shut-off valve, check valve and balancing valve in pump discharge piping, installed in accordance with manufacturer’s instructions. Remove suction guide start-up strainer screens after piping flushing and cleaning is complete. Valves are to be 150 mm (6") away from pump discharge for discharge piping to 150 mm (6") dia., and 300 mm (12") away from pump discharge for discharge pipe larger than 150 mm (6") dia.

.4 Supply variable frequency drives (VFD) for pumps as scheduled. Hand VFD’s to electrical trade at site for installation as part of the electrical work.

.5 Secure vertical inline pumps in place in accordance with requirements of drawing detail and provide flexible piping connections in vertical suction and discharge piping approximately 450 mm (18") above suction and discharge connection accessories.

.6 Provide a suction guide in pump suction piping as per details, installed in accordance with manufacturer's instructions. Remove suction guide start-up strainer screens after piping flushing and cleaning is complete.

.7 For pumps equipped with seal flush line filters, replace flush line filter cartridge when pipe flushing and cleaning is complete, and hand identified spare filter cartridges to Owner at site.

.8 Supply variable frequency drives (VFD) for pumps as scheduled. Hand VFD's to electrical trade at site for installation as part of the electrical work.

.9 Install horizontal inline pumps in place in vertical piping approximately 1.2 m (4') above floor in accordance with pump manufacturer's instructions.

.10 If circulating pumps are used for piping flushing and cleaning, and pump seal flush line filters are not installed, replace pump mechanical seals when flushing and cleaning is complete.

.11 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.12 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.13 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.02 TESTING, ADJUSTING AND BALANCING

.1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe and fittings.

.2 Submit, in shop drawing form, a schematic piping diagram for each refrigerant piping system indicating pipe sizes, slopes, valves, traps, and piping specialties. Piping schematics must be reviewed, approved, and signed by refrigeration equipment manufacturers prior to being submitted to Consultant for review.

.3 Submit letters from equipment suppliers certifying proper installation and start-up of piping systems and equipment as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Refrigerant piping systems are to be in accordance with CSA B52, Mechanical Refrigeration Code, and any applicable local Codes and Regulations.

.2 Refrigerant piping installing contractor is to be certified by Technical Standards and Safety Authority (TSSA). Installing contractor is to install refrigerant piping in accordance with manufacturer’s installation instructions and in accordance with local codes. Contractor is responsible for all regulatory approvals, if required. Upon completion of installation, documentation of refrigerant amount, test certificates and verification documentation, etc., is to be provided in a binder, in accordance with requirements of local authorities having jurisdiction.

.3 Refrigerant piping and direct expansion refrigeration equipment must be installed by or under direct on site supervision of a licensed journeyman refrigeration mechanic.

2. PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

.1 Type ACR hard drawn seamless copper refrigerant tubing to ASTM B280, factory degreased, dehydrated and capped or nitrogen filled and capped, complete with factory washed and bagged wrought copper soldering fittings to ASME B16.22, and brazed joints made with high melting point silver brazing alloy conforming to AWS Classification BcuP 5.

2.02 PIPING LINE SETS

.1 Equal to Great Lakes Copper Inc. “EZ-Roll” soft annealed copper to ASTM B280, suitable for use with refrigerant involved, factory cleaned and capped, and with sizes and lengths as required.

2.03 GENERAL RE: VALVES AND PIPING SPECIALTIES

.1 Refrigerant valves and piping specialties specified below are to factory cleaned, degreased, and supplied to site with capped ends.

2.04 SHUT-OFF VALVES

.1 Ball Valves

.1 ¼ turn, CSA certified forged brass ball valves, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with carbon filled Teflon ball seals, 2 O-ring stem seals, a gasketed seal cap, a flow direction arrow cast into body, a ball position indicator on stem, and extended copper tube connections to permit brazing the valve into line without disassembling valve.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

.4 Diaphragm Valves.

.2 Forged brass, frost-proof, Type 1 Series, CSA certified packless diaphragm valves, each suitable for a 3445 kPa (500 psi) working pressure and complete with an O-ring to prevent moisture from entering diaphragm chamber, one phosphor bronze and 2 stainless steel diaphragms, and extended copper tube brazing connections.

.1 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.05 CHECK VALVES

.1 Straight through type for valves 6.4 mm to 16 mm (¼" to 5/8") diameter, globe type for valves 22 mm (7/8") diameter and larger, each complete with extended tubing for brazing connections, and as follows:

.1 straight through type check valves complete with a machined brass gasketed body, phosphor bronze spring, and neoprene seat;

.2 globe type check valves complete with a cast bronze body, forged brass cap, phosphor bronze spring, Teflon seat disc, and neoprene O-ring seal.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.06 PIPING TRAPS

.1 Mueller Industries Inc. Style No. WE-554P brazing end copper "P" traps.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.07 PRESSURE VESSEL RELIEF VALVES

.1 Factory set pressure relief valves, straight through or angle type as required, each constructed in accordance with requirements of ANSI B9.1 and the ASME Code for Unfired Pressure Vessels, and each complete with a brass body, neoprene seat disc, and lead seal and locking wire.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.08 REFRIGERANT LIQUID MOISTURE INDICATORS

.1 Forged brass, triple sealed, CSA certified liquid moisture indicators, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with a liquid indicator which shows "FULL" when system is fully charged with refrigerant and remains blank when there is a restriction or shortage of refrigerant in liquid line, a moisture indicator which changes colour from blue to pink when moisture is present in system, a plastic dust cover, and extended copper tube brazing connections.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.09 LIQUID LINE FILTER-DRIER

.1 Mueller Industries Inc. "Drymaster" CSA certified filter-driers, each suitable for a maximum 3445 kPa (500 psi) working pressure and complete with a combination of desiccants in a fluted briquette for drying, and a fluted briquette type filter.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.10 FLEXIBLE PIPING CONNECTIONS

.1 Senior Flexonics Canada "VIBRA-SORBERS" phosphor bronze construction, factory cleaned, dried, and sealed flexible piping connections with copper tube brazing ends.

.2 Acceptable manufacturers are:

.1 Senior Flexonics Canada;

.2 The Metraflex Co.

2.11 THERMOSTATIC EXPANSION VALVES

.1 Factory tested, balanced port design thermostatic expansion valves, with exact selection to suit the application and refrigerant used, each complete within a replaceable stainless steel diaphragm and welded element construction thermostatic element charged with hydraulic fluid, and removable inlet strainer.

.2 Acceptable manufacturers are:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.12 EXECUTION

2.13 DEMOLITION

.1 Perform required refrigerant piping system demolition work. Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

2.14 INSTALLATION OF REFRIGERANT PIPING, VALVES AND SPECIALTIES

.1 Provide required refrigerant piping. Piping is to be type ACR copper with wrought copper fittings. Install piping in accordance with requirements of reviewed refrigerant piping schematics referred to in Part 1 of this Section.

.2 Refer to piping hanger and support requirements specified in Section entitled Basic Mechanical Materials and Methods.

.3 Make refrigerant piping joints using a light coat of approved brazing flux applied to both pipe and fitting. Do not use acid flux. During brazing process, ensure pipe and fittings are kept full of nitrogen or carbon dioxide to prevent scale formation inside pipe and fitting.

.4 Where shown or specified, use soft copper refrigerant piping line sets.

.5 Provide shut-off valves to isolate each piece of equipment if shut-off valves are not supplied integral with equipment. Provide ball or diaphragm type shut-off valves inside building. Provide diaphragm shut-off valves outside building.

.6 Provide a refrigerant charging valve for each system if such a valve is not supplied integral with equipment.

.7 Provide refrigerant piping accessories shown and/or required and install in accordance with manufacturer’s recommendations.

.8 Provide required refrigerant.

.9 Provide flexible connections at piping connections to roof mounted condensing units. Install in accordance with manufacturer’s instructions.

.10 Provide expansion valves where shown and/or required, each matched to coil and installed in accordance with manufacturer’s instructions.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section except shop fabricated ductwork and fittings.

.2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.

.3 Submit manufacturer’s colour chart(s) for all items for which a finish colour is to be selected.

.4 Submit duct leakage test data prior to ductwork being covered from view.

1.02 QUALITY ASSURANCE

.1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

2. PRODUCTS

2.01 GALVANIZED STEEL DUCTWORK

.1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. G60 galvanizing for bare uncovered duct to be finish painted. G90 for all other galvanizing.

.2 Rectangular

.1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.

.3 Round

.1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.

.4 Flat Oval

.1 Factory machine fabricated, single wall, 4-ply spiral lock seam duct, fittings and couplings.

2.02 FLEXIBLE METALLIC DUCTWORK

.1 Bare

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-UN", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, and supplied in 3 m (10') lengths.

.2 Insulated

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-I", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, supplied in 3 m (10') lengths and factory covered with 40 mm (1-½") thick, 12 kg/m3 (0.75 lb/ft³) density fibreglass insulation with a vinyl jacket meeting 25/50 flame spread and smoke developed requirements tested in accordance with CAN/ULC S102.

2.03 FLEXIBLE CONNECTION MATERIAL

.1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber. Acceptable products are:

.1 Duro Dyne Canada Inc. "DUROLON";

.2 Dyn Air Inc. "HYPALON".

2.04 METAL DUCT SYSTEM JOINT SEALANT

.1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.

.2 Acceptable manufacturers are:

.1 Hardcast (Carlisle);

.2 Johns Manville;

.3 Ductmate.

2.05 ACOUSTIC LINING

.1 Minimum 25 mm (1") thick acoustic lining material meeting 25/50 flame spread and smoke developed ratings tested in accordance with CAN/ULC S102, meeting NFPA 90A, ASTM C1071, and ASTM G21 requirements, not supporting microbial growth, flexible for round ducts, board type for rectangular ducts, consisting of a bonded fiberglass mat coated on inside (airside) face with a black fire-resistant coating.

.2 Acceptable manufacturers are:

.1 Johns Manville;

.2 Manson Insulation;

.3 Knauf Insulation.

2.06 CASING AND PLENUM MATERIAL AND ACCESSORIES

.1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.

.2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.07 PLENUM ACCESS DOORS

.1 Factory fabricated, double wall insulated access doors, sized as indicated on drawings, and constructed of same material as connecting ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit operating pressure of the system.

2.08 ROUND TO RECTANGULAR DUCT CONNECTIONS

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

2.09 SPLITTER DAMPERS

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

2.10 AIR TURNING VANES

.1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 For short branch ducts at grille and diffuser connections, air extractor type each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of same material as duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.11 MANUAL BALANCING (VOLUME) DAMPERS

.1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:

.1 hexagonal or square shaft extension through frame;

.2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;

.3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;

.4 linkage for multiple blade dampers;

.5 locking hand quadrant damper operator with, for insulated ducts 50 mm (2") standoff mounting.

.2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.

.3 Round Dampers: Nailor Industries Inc. Model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

.4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.

.5 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 NCA Manufacturing Ltd.;

.4 Greenheck Fan Corp.;

.5 Ruskin Co.

2.12 BACKDRAFT DAMPERS

.1 Nailor Industries Model 1370CB counterbalanced backdraft dampers, vertical or horizontal mounting, 50 mm (2") wide, sized as shown and complete with:

.1 extruded 6063-T5 aluminum frame, 2.3 mm (0.090") nominal wall thickness, with mitred corners;

.2 extruded 6063-T5 aluminum blades, 1.3 mm (0.050") nominal wall thickness on 92 mm (3-5/8") centres, and with extruded PVC blade seals;

.3 corrosion-resistant synthetic bearings;

.4 adjustable plated steel counterweights mounted internally in the airstream;

.5 concealed blade linkage located out of the airstream.

.2 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 NCA Manufacturing Ltd.;

.4 Greenheck Fan Corp.;

.5 Ruskin Co.

2.13 COMBINATION FIRE/SMOKE DAMPERS

.1 Nailor Industries Series 1220, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator.

.2 For applications where supply or return ducts terminate at a grille, at your option, provide:

.1 Nailor Industries 1221-OW “out of wall” high performance combination fire/smoke damper, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator accessible through the front supply/return grille, intumescent thermal insulation on all sides of sleeve.

.2 Nailor Industries 1221G combination fire/smoke damper for grilles, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator accessible through the front supply/return grille, grille mounting flanges. Coordinate grille size and mounting with damper requirements.

.3 ULC 1-1/2 hour fire rated and ULC Class I leakage rated for smoke, and equipped with a 74°C (165°F) ULC classified fusible link that will cause damper to close and lock independent of actuator when duct temperature reaches maximum temperature of damper assembly.

.4 Supply damper with factory installed sleeves of minimum 400 mm (16") length, field verified by contractor dependent on wall thickness. Caulk sleeves to ULC requirements and constructed of 20 gauge for sizes up to 2.1 m (84") wide and 18 gauge for sizes greater than 2.1 m (84") wide.

.5 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.6 Acceptable manufacturers are:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 NCA Manufacturing Ltd.;

.4 Ruskin Co.;

.5 Pottorff;

.6 United Enertech;

.7 Price Industries (E.H. Price).

2.14 DUCT ACCESS DOORS

.1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

2.15 DUCTWORK DRAIN POINTS

.1 Equal to Ductmate Canada Ltd. "Moisture Drain", 20 mm (¾") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

2.16 INSTRUMENT TEST PORTS

.1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.17 WIRE MESH (BIRDSCREEN)

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

2.18 LOUVRES

.1 Price Industries Inc. DE439 or DE635, 100 mm (4") or 150 mm (6") deep (to suit wall thickness) factory assembled stationary, drainable, storm-proof louvres sized as indicated on drawings, each AMCA water penetration and air performance certified, constructed of welded, extruded, alloy 6063-T5 aluminum with drainable blades, mounting and securing hardware to suit the application, and 12 mm (½") mesh aluminum birdscreen in an aluminum frame.

.2 Louvres are to be factory finished with a finish equal to PPG Industries "Duranar" fluoropolymer powder coating over primer with colour as selected from manufacturer’s standard colour range.

.3 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 The Airolite Co. LLC;

.3 Construction Specialities;

.4 Nailor Industries Inc.;

.5 Ventex Inc.;

.6 Pottorff;

.7 Greenheck Fan Corp.

2.19 LOUVRE BLANK-OFF PANELS

.1 Insulated, framed, sandwich construction panels consisting of 40 mm (1-½") thick rigid insulation (meeting NFPA 90A requirements) between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

2.20 GRILLES AND DIFFUSERS

.1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.

.2 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 Anemostat;

.3 Krueger Division of Air System Components Inc.;

.4 Titus;

.5 Nailor Industries Inc.;

.6 MetalAire;

.7 Tuttle & Bailey.

3. EXECUTION

3.01 CLEANLINESS REQUIREMENTS FOR HANDLING AND INSTALLATION OF DUCTWORK

.1 Handle and install ductwork in accordance with SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

3.02 DUCT SYSTEM PROTECTION, CLEANING AND START-UP

.1 Temporarily cover all open ends of ducts during construction.

.2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.

.3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.

.4 Provide cheesecloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.

.5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

3.03 FABRICATION AND INSTALLATION OF GALVANIZED STEEL DUCTWORK

.1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.

.2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.

.3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.

.4 Variable air volume ductwork from supply fans to boxes is as above but rectangular duct take-offs are double side straight taper type with a take-off length equal to 0.5 times the branch duct width but minimum 150 mm (6") length, and double taper side is to have an included angle of minimum 60°.

.5 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.

.6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.

.7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.

.8 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.

.9 Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.

.10 Flange connect ductwork to hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Coils will be suspended independent of connecting ductwork as part of the heat transfer work.

.11 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by Consultant.

.12 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.

.13 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.

.14 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:

.1 ductwork outside building or otherwise exposed to the elements;

.2 dishwasher exhaust;

.3 shower exhaust ducts from grilles to duct main or riser;

.4 minimum of 3 m (10') upstream and downstream of duct mounted humidifiers or humidifier manifolds;

.5 fresh air intakes;

.6 wherever else shown.

.15 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.16 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.17 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.

.18 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.

3.04 INSTALLATION OF FLEXIBLE DUCTWORK

.1 Provide maximum 3 m (10') long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on drawings.

.2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

.3 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.

.4 Do not penetrate fire barriers with flexible duct.

3.05 INSTALLATION OF ACOUSTIC LINING

.1 Provide acoustic lining in ductwork in locations as follows:

.1 Wherever shown and/or specified on drawings;

.2 supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along duct and outward from box in all directions;

.3 all transfer air ducts.

.2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel in accordance with detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.06 INSTALLATION OF CASINGS AND PLENUMS

.1 Provide required shop or site fabricated casings and plenums. Unless otherwise specified or shown, construct casings and plenums of same material as connecting duct system.

.2 Construct and install casings and plenums in accordance with Chapter 6 of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit systems' pressure classification. Ensure plenums and casings secured to building structure are gasketed air-tight and equipped with angle reinforcing.

.3 Provide drain pans with accessible trapped drains for fresh air intake plenums, and wherever else shown.

3.07 INSTALLATION OF CASING AND PLENUM ACCESS DOORS

.1 Provide access doors into all site or shop fabricated casings and plenums requiring access, and wherever shown.

.2 Construct access doors to open in or out to suit positive and negative pressures of system.

.3 Provide pitot tube openings in access doors where required for system air quantity balancing purposes.

.4 Provide suitably sized, engraved, red-white laminated Lamacoid warning nameplates on access doors into casings and plenums where equipment is located, i.e. fans.

3.08 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS

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

3.09 INSTALLATION OF SPLITTER DAMPERS

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

3.10 INSTALLATION OF TURNING VANES

.1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.11 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

.1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.

.2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.

.3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.12 INSTALLATION OF BACKDRAFT DAMPERS

.1 Provide backdraft dampers.

.2 Install and secure dampers so they cannot move or rattle.

3.13 INSTALLATION OF COMBINATION FIRE/SMOKE DAMPERS

.1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer’s instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.14 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL

.1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or easings connect to fans, and wherever else shown or specified.

.2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of flexible fabric and to fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure connections to flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

3.15 INSTALLATION OF DUCT ACCESS DOORS

.1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.

.3 When requested, submit a sample of proposed duct access doors for review.

.4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

3.16 INSTALLATION OF INSTRUMENTS TEST PORTS

.1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.

.2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

3.17 INSTALLATION OF WIRE MESH (BIRDSCREEN)

.1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.

.2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

3.18 INSTALLATION OF LOUVRES

.1 Provide louvres for wall openings.

.2 Install louvre assemblies and secure in place in accordance with manufacturer’s instructions and details.

.3 Confirm exact louvre sizes and finish prior to ordering.

3.19 INSTALLATION OF LOUVRE BLANK-OFF PANELS

.1 Provide blank-off panels for inactive portions of exterior wall louvres.

.2 Secure panels in place with non-ferrous hardware so they cannot move or rattle, yet are easily removable.

.3 Confirm exact finish of panels prior to fabrication.

3.20 INSTALLATION OF GRILLES AND DIFFUSERS

.1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.

.2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.

.4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.

.5 Confirm grille and diffuser finishes prior to ordering.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop product data sheets for silencers. Include all construction, acoustic and aerodynamic performance data, and details with submission. Acoustical data is to demonstrate that duct systems with silencers will reduce mechanical fan system noise to required levels in occupied spaces.

.2 Submit manufacturer's test data to indicate results of factory tests on the silencers prior to shipment.

.3 Submit a copy of the silencer manufacturer's National Voluntary Laboratory Accreditation Program (NVLAP) accreditation certificate for latest ASTM E477 test standards.

.4 Submit an installation certification letter from silencer manufacturer as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Silencer performance must be substantiated by laboratory testing in a duct-to-reverberant room test facility according to ASTM E477, Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Material and Prefabricated Silencers.

.2 Silencer acoustic media and any lining/wrapping material must have a maximum flame spread rating of 25 and a smoke developed rating of 50 when tested in accordance with CAN/ULC S102, Surface Burning Characteristics of Building Materials, and Accessories.

2. PRODUCTS

2.01 ACCEPTALBE MANUFACTURERS

.1 Acceptable silencer manufacturers are:

.1 Vibro-Acoustics Ltd.;

.2 Kinetics Noise Control Vibron Products Group;

.3 VAW Systems Ltd.;

.4 Price Industries Inc

2.02 GENERAL RE: SILENCERS

.1 Silencers are to be factory fabricated by same manufacturer and are to be in accordance with drawing schedule, and tested in accordance with ASTM E477 through National Voluntary Laboratory Accreditation Program (NVLAP) with valid accreditation certificate.

.2 Silencer inlet and outlet dimensions are to be equal to duct sizes shown on drawings. Unless otherwise shown or specified, transitions will not be permitted.

.3 Silencers are to be constructed in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit duct system pressure and velocity classification. Unless otherwise specified, casing seams and joints are to be lock-formed and sealed or stitch welded and sealed, and silencers are to be constructed so as not to fail when subjected to an internal static pressure of 3.9 kPa (8" wg).

.4 Perforated steel is to be adequately stiffened to ensure flatness and form, and welds are to be shop painted with zinc rich paint.

.5 Silencers are to be shipped with factory installed end caps.

.6 Galvanized steel is to be in accordance with ASTM A653.

2.03 OUTER CASING MATERIALS

.1 Rectangular Straight and Transitional Straight Silencers: Minimum #22 gauge lock forming quality galvanized steel.

.2 Elbow and Transitional Elbow Silencers: Minimum #18 gauge for elbow lock forming quality galvanized steel.

.3 High Transmission Loss (HTL) Rectangular and Elbow Silencers: # 16 or #10 gauge stitch-welded and caulked galvanized steel in accordance with drawing schedule.

.4 Circular Silencers: Lock forming quality galvanized steel with minimum gauges as follows:

.1 300 mm to 660 mm (12" to 26") dia. - #22 gauge;

.2 675 mm to 1.52 m (27" to 60") dia. - #18 gauge;

.3 1.55 m to 2.13 m (61" to 84") dia. - #16 gauge.

2.04 INTERIOR BAFFLE-LINER-BULLET MATERIAL

.1 Minimum #22 gauge lock forming quality galvanized steel.

2.05 INTERIOR BAFFLE TRANSITION

.1 Transitioning for interior transition silencers is to occur internal to silencer such that height of air passage is uniformly changing with the length of the air passage.

2.06 ACOUSTIC MEDIA MATERIAL

.1 Except for no media silencers, and unless otherwise specified, inert, inorganic glass fibre of a density to obtain specified acoustic performance, packed under not less than 5% compression to eliminate voids due to vibration and settling.

2.07 HIGH TRANSMISSION LOSS CASINGS

.1 High transmission loss (HTL) casings for silencers as scheduled are to be externally shop applied, and completely sealed to silencer casing. HTL walls are to consist of media, air space, mass, and an outer protective metal skin as required to obtain room noise criteria.

3. EXECUTION

3.01 INSTALLATION OF SILENCERS

.1 Provide silencers. Ensure silencers are installed with airflow arrows in the direction of airflow.

.2 Support each silencer independent of connecting ductwork.

.3 Properly layout ductwork for silencer locations to provide a minimum of 5 diameters of straight duct upstream of silencer and 10 diameters of straight duct downstream of silencer.

.4 Unless otherwise specified, do not install silencers in walls or slabs.

.5 Seal all silencer connections to ducts with proper fire/smoke rated duct sealer.

.6 When silencer installations are complete, arrange, and pay for silencer manufacturer to examine silencer installations. Perform any corrective work required by manufacturer, then obtain from manufacturer and submit a signed letter certifying proper installation and operation of all silencers.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for fans and accessories. Include following:

.1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;

.2 dimensional drawings and fan weight;

.3 certified sound power data that conforms to specified levels;

.4 product data sheets for all accessories;

.5 product data sheets for fan motors.

.2 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer’s representative as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Fan manufacturers, as applicable, are to be current members of the Air Movement and Control Association International Inc. (AMCA), and fans are to be rated (capacity and sound performance) and certified in accordance with requirements of following standards:

.1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;

.2 AMCA Standard 211, Product Rating Manual for Fan Air Performance;

.3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans;

.4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance;

.5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

1.03 WARRANTY

.1 Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

.2 The warranty of this equipment is to be free from defects in material and workmanship for a period of one (1) year from the purchase date.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers are:

.1 Greenheck Fan Corp.;

.2 Loren Cook Co.;

.3 Soler & Palau;

.4 PennBarry;

.5 Canarm;

.6 Twin City Fan and Blower.

2.02 INLINE CENTRIFUGAL FANS

.1 Centrifugal, ULC listed, factory run tested rectangular inline fans in accordance with drawing schedule.

.2 Heavy-gauge galvanized steel housing with removable side panels to permit removal of power assembly without disturbing duct connections, universal mounting brackets and hardware including spring vibration isolators to accommodate horizontal or vertical mounting as required, a flanged inlet panel with inlet venturi, a flanged outlet panel, both with duct connection collars, and galvanized steel wire grid fan inlet/outlet guard(s).

.3 Non-overloading aluminium wheel with backward inclined blades with matching inlet venturi, statically and dynamically balanced as an assembly.

.4 For direct drive fans, provide speed controller.

.5 TEFC motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, mounted out of the airstream, complete with a cover, and factory pre-wired to a NEMA 4 disconnect switch.

3. EXECUTION

3.01 INSTALLATION OF INLINE CENTRIFUGAL FANS

.1 Provide inline centrifugal fans.

.2 Secure each fan in place from structure with vibration isolation, independent of connecting ductwork and in accordance with fan manufacturer’s instructions.

.3 Ensure duct connections are made using flexible connection material.

.4 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.6 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for air terminals. Include following:

.1 capacity and pressure drop;

.2 sound power data to verify conformance with specified sound power levels;

.3 leakage and dimensions;

.4 mounting details to suit locations shown, indicating methods and hardware to be used;

.5 control components and a control wiring schematic.

.2 Submit with shop drawings/product data, a test report in accordance with ANSI/AMCA 210 requirements and ISO 3741, published test data on DIN (Direct Internal Noise) made by an independent testing agency for 2.5 and 6 m/s (8.2 and 19.7 ft/min) branch velocity or inlet velocity, sound power levels with a minimum inlet pressure of 0.25 kPa (0.036 psi) in accordance with ISO 3741 for the 2nd through 7th octave bands, and confirmation pressure loss through a silencer will not exceed 60% of inlet velocity pressure maximum.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

.1 Air terminals manufacturers are to be current members of Air-Conditioning, Heating and Refrigeration Institute (AHRI), and terminals are to be in accordance with requirements of following standards:

.2 ANSI/AHRI Standard 880, Performance Rating of Air Terminals;

.3 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;

.4 International Organization of Standardization (ISO) Standard 3741, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Rooms.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers are:

.1 Price Industries Inc.;

.2 Titus;

.3 Nailor Industries Inc.;

.4 Krueger Division of Air System Components Inc.

3. PRODUCTS

3.01 VARIABLE AIR VOLUME (VAV) TERMINAL BOXES

.1 Single duct, controller type, pressure independent variable air volume boxes in accordance with drawing schedule, each individually field adjustable to minimum and maximum air volumes, and complete with:

.1 #22 gauge galvanized steel housing, sealed and gasketed, internally lined with 25 mm (1") thick glass fibre duct lining material with a neoprene coating meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with:

.1 exposed cut edges of the liner material factory coated with NFPA 90A and CAN/ULC S102 approved sealant;

.2 50 mm (2") long, round inlet duct connection;

.3 rectangular discharge opening with slip and drive cleat duct connection facilities;

.4 protective galvanized steel shroud for controller and damper actuator.

.2 air valve damper, normally open, galvanized steel blade with peripheral gasket, pivoting in self-lubricating bearings and with air leakage past a closed damper of 2% or less of rated capacity at 750 Pa (3" wc) inlet static pressure;

.3 air flow sensor located at box inlet, complete with gauge taps, multiple pressure sensing ports, and an averaging chamber designed to accurately average the flow across the inlet of box with an accuracy of within 5% with a 90° sheet metal elbow located directly at inlet, and amplify the sensed air flow signal;

.4 controller/actuator supplied as part of controls work specified in Section entitled Automatic Control Systems, shipped to box manufacturer’s plant by controls supplier, and factory installed, connected, tested, calibrated and set by box manufacturer;

.5 Where boxes are provided with hot water reheat coils, factory tested hot water reheat coils in accordance with drawing schedule, each complete with copper tubes mechanically expanded into plate type aluminum fins, factory mounted in an enclosure insulated with foil faced insulation meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with a quick-opening insulated access panel sized and located for coil inspection and maintenance;

.6 galvanized steel attenuators, lined as per box housings, each factory supplied loose and with a length in accordance with drawing schedule;

3.02 EXECUTION

.1 INSTALLATION OF TERMINAL BOXES

.1 Provide ceiling mounted terminal boxes.

.2 Secure each box in place from structure by means of galvanized steel angles and hanger rods, independent of connecting ductwork.

.3 Coordinate provision of transformers, actuators and controllers with Controls Contractor.

.4 Connect each box with ductwork as indicated. Provide straight inlet duct same size as box inlet and of a length equal to a minimum of 4 duct diameters. Refer to drawing detail. Coordinate final box adjustments and settings with personnel doing system testing and balancing work.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.6 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, and setting and adjusting controls.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section.

.2 Prior to Substantial Performance of the Work, submit a set of spare filters in original identified packaging for each air handling unit requiring filters. Store filters on site where directed by Consultant or Owner.

2. PRODUCTS

2.01 GENERAL

.1 Unless otherwise specified or noted, filters are to be synthetic and/or glass fibre disposable media type in accordance with drawing schedule(s).

.2 Minimum Efficiency Reporting Values (MERV) ratings in accordance with ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Sizes.

.3 Unless otherwise specified or noted, filters are to be ULC Class 1 in accordance with ULC S111, Standard Method of Fire Tests for Air Filter Units.

.4 Acceptable manufacturers are:

.1 AAF International;

.2 Camfil Farr Inc.;

.3 Modern Air Filter Corp.

2.02 CONSTRUCTION FILTERS

.1 Roll type, disposable, MERV 7 to 9 woven glass fibre media, ULC Class 2.

2.03 DIAL TYPE AIR FILTER GAUGE

.1 Dwyer Instruments Inc. Series 2000 "Magnehelic" differential dial type filter gauge, accurate to within ± 2% of full scale and complete with a die-cast aluminum housing and bezel, acrylic cover, over-pressure relief plug, a pair of 3.2 mm (1/8") dia. female NPT pressure taps at both the side and back of gauge, 2 pressure tap plugs, flexible vinyl tubing, a scale overlay or marker to indicate dirty filters, and all other required mounting and connection accessories.

.2 Each filter gauge is to be complete with contacts suitable for connection into building automation system.

3. EXECUTION

3.01 INSTALLATION OF CONSTRUCTION FILTERS

.1 Provide roll type medium efficiency disposable media filter(s) across entire filter bank of each supply air handling unit, either at factory where fan is produced or at site as soon as fan is installed. Secure media in place so it will not be dislodged by fan operation. Replace roll media periodically if it becomes loaded and clogged.

.2 For exhaust systems, secure filter media across exhaust air openings and ductwork to prevent construction dirt and dust from fouling the fan

.3 Leave media in place until fan start-up, at which time remove and dispose of construction media.

3.02 INSTALLATION OF FILTERS

.1 Provide required filter media when fan equipment is ready for start-up and performance testing. Provide any required filter framing/racks.

.2 Prior to Substantial Performance of the Work, supply a complete spare set of filter media in original packaging and clearly identified as to the applicable system for each air handling system with filters. Store filters at site where directed by Owner.

3.03 INSTALLATION OF DIAL TYPE FILTER GAUGES

.1 Provide dial type filter gauges for air handling system filter banks.

.2 Secure gauge to filter section casing and install differential pressure tubing and accessories. Set gauges to suit fresh clean filter media and mark scales at point where filter media requires replacement.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for air cooled condensers, including control and accessories. Include certified power and control wiring schematics.

.2 Submit with delivery of each unit a copy of the factory inspection and test report, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer’s representative as specified in Part 3 of this Section.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers of air handling unit are:

.1 Trane;

.2 Daikin Industries Ltd. – Rebel Applied;

.3 Engineered Air;

.4 AAON.

2.02 AIR COOLED CONDENSING UNIT

.1 Factory assembled and tested, package type, weather-proof exterior condensing unit as per the drawing schedule, ULC listed, CSA or ETL listed and labelled, AHRI rated and certified, and in accordance with requirements of ANSI/ASHRAE 15, CSA B52, and ASME Code.

.2 Weather-proof G90 galvanized steel cabinet with a galvanized structural steel framework and base, control box, and casing panels, all factory finished with baked powder coat epoxy enamel and equipped with stainless steel or plated hardware. Separate removable access panels provided for control centre and compressor compartments, and top panel and condenser fan deck are also to be removable.

.3 Vibration isolated, air or refrigerant gas cooled semi-hermetic scroll type compressor(s) with forced feed oil lubrication, crankcase heater, solid-state current and thermal overload motor protection, high pressure protection, suction and discharge valves, suction strainer, oil filter, and oil pump if required.

.4 ULC/CSA certified and equipped with a fusible plug for receivers 150 mm (6") diameter and smaller, or complete with a CRN or ASME "U" stamp and relief valve for receivers larger than 150 mm (6") diameter, and supplied with inlet and outlet back-seated "Rotalock" valves and, for low ambient operation if required, factory installed insulation and heater.

.5 Unless otherwise noted, resiliently mounted direct driven aluminium blade propeller type fan(s) arranged for vertical discharge, statically and dynamically balanced and complete with a permanently lubricated motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, corrosion-resistant fan-motor shaft, and PVC or baked-on powder epoxy coated galvanized steel wire safety guards.

.6 Factory leak pressure tested coil(s) with collared aluminium fins mechanically expanded to seamless copper tubes and complete with a sub-cooling circuit.

.7 Refrigerant circuit components are to include a liquid line and suction line service valve, refrigerant charging valve, a full charge of compressor oil, and a holding charge of, unless otherwise specified refrigerant as specified below.

.8 Factory pre-wired power and control components in a weather-proof NEMA 4X cabinet, complete with power and control wiring terminal blocks, compressor and condenser fan motor contactors, weather-proof door interlock disconnect switch, indoor fan relay, 24 volt secondary control transformer, safeties, low ambient control to maintain proper head pressure at ambient temperatures to -28°C (-20°F), and, when indicated, all hardware necessary for interfacing with building automation system in accordance with drawing points list.

.9 Refrigerant is to be:

.1 HFC 410a.

3. EXECUTION

3.01 INSTALLATION OF CONDENSING UNIT

.1 Provide an air cooled condensing unit.

.2 For roof mounted units, secure unit in place, level, and plumb, on vibration isolation pads on sleepers as indicated.

.3 Connect condensing unit and indoor evaporator with refrigerant piping in accordance with piping shop drawing schematic. Refer to Section entitled Refrigerant Piping, Valves, and Accessories. Provide all required refrigerant.

.4 Perform required control wiring (except building automation system connection) between condensing unit and evaporator in conduit in accordance with manufacturer’s control wiring schematic and wiring standards of the electrical work.

.5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.7 `Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for all make-up air units. Include following:

.1 certified fan performance curves;

.2 certified sound power data;

.3 computer generated psychrometric chart for each cooling coil;

.4 hardware for section-to-section site connections;

.5 dimensioned layouts, including dimensioned curb layouts as applicable;

.6 product data for fan motors.

.2 Submit with delivery of each unit a copy of the factory inspection and fire test report as specified in Part 2 of this Section, and include a copy of each report with O & M Manual project close-out data.

.3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

.4 Submit spare air filters as specified in Part 2 of this Section.

1.02 QUALITY ASSURANCE

.1 Make-up air units and installation are to be in accordance with requirements of following:

.1 all applicable Provincial Codes and Standards;

.2 CAN/CSA B149, Natural Gas and Propane Installation Codes;

.3 CSA or ETL listed and labelled electrical components.

.2 Unit installation tradesmen are to be journeyman and licensed gas fitters.

1.03 WARRANTY

.1 The warranty period shall commence at the date of Substantial Performance of the Contract as certified by the consultant and shall continue for a period of five (5) years for Labour and ten (10) years for Materials/Parts.

.2 Manufacturer shall furnish a factory trained service technician to perform the unit start-up assistance to the installing contractor with licensed gas personnel. Factory technician to provide copy of start-up log to owner and to demonstrate operation and maintenance to owner's representative.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers of air handling unit are:

.1 Trane – Voyager;

.2 Daikin Industries Ltd. – Rebel Applied;

.3 Engineered Air;

.4 AAON.

2.02 GENERAL

.1 The units shall be dedicated downflow, horizontal, or mixed airflow configuration. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for all units. Cooling performance shall be rated in accordance with AHRI testing procedures.

.2 All units shall be factory assembled, internally wired, fully charged with R-454B refrigerant and 100% run tested to check cooling operation, fan and blower rotation and control sequence before leaving the factory.

.3 Wiring internal to the unit shall be numbered for simplified identification.

.4 Units shall be UL listed to U.S. and Canadian safety standards.

2.03 CERTIFIED AHRI PERFORMANCE

.1 Packaged Rooftop units cooling, heating capacities and efficiencies shall be rated within the scope of the Air-Conditioning, Heating & Refrigeration Institute (AHRI) Certification Program and display the AHRI Certified® mark as a visual confirmation of conformance to the certification sections of AHRI Standard 340-360 (I-P) and ANSI Z83.8/CSA 2.6 and 10 CFR Part 431 pertaining to Commercial Warm Air Furnaces.

2.04 CASING

.1 Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel phosphatized, and finished with a pre-applied baked polyurethane enamel.

.2 All components shall be mounted in a weather resistant steel cabinet with a painted exterior. Cabinet surface shall be tested 672 hours in salt spray in compliance with ASTM B117.

.3 Fully gasketed removable access panels.

.4 Structural members shall be heavy gauge with access doors and removable panels of heavy gauge.

.5 Provide 1/2 inch thick foil faced fiberglass insulation on all exterior panels and roof in contact with the return and conditioned air stream. Where top cover seams exist, they shall be double hemmed and gasket sealed to prevent water leakage.

.6 Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have handles and shall be removable while providing a water and air tight seal. Control box access shall be hinged.

.7 The indoor air section shall be completely insulated with fire resistant, permanent, odorless, foil faced glass fiber material.

.8 The base of the unit shall have provisions for crane lifting.

2.05 FILTERS

.1 MERV 13, 100mm (4") "high efficiency" filters.

2.06 COMPRESSORS

.1 The 3-D Scroll shall include a direct-drive, 3600 rpm, suction gas cooled hermetic motor.

.2 Dependent on the compressor model, motor protection shall be provided by either a patented motor cap and integral line break motor protector or an external 24 Vac module which provides protection against incorrect phase sequence, excess motor temperatures, over current protection, and phase loss.

.3 Trane 3-D compressor shall include centrifugal oil pump, scroll tips seals, internal heat shield that lowers the heat transfer from discharge and suction gas, oil level sight glass and oil charge valve. Where required, compressor models shall also provide a dip tube that allows for oil draining, in addition to a low leakage internal discharge check valve to help prevent refrigerant migration.

.4 Each compressor shall have a crankcase heater installed, properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

2.07 COMPRESSOR STAGING OPTION

.1 The compressor staging option shall provide five stages of mechanical cooling with the ability to be at or below 25% compressor displacement at stage one.

2.08 REFRIGERANT CIRCUITS

.1 Each refrigerant circuit shall have independent thermostatic expansion devices, service pressure ports and refrigerant line filter driers factory-installed as standard. An area shall be provided for replacement suction line driers.

2.09 LEAK DETECTION SENSORS

.1 Unit shall be furnished with a leak detection system from the factory when a circuit refrigerant charge exceeds 4 lbs. The leak detection system shall consist of one or more refrigerant detection sensors. When the system detects a leak, the unit controller shall initiate mitigation actions.

2.10 COILS (HEAT PUMP)

.1 Coils shall be internally finned Copper tubes mechanically bonded to high performance Aluminum plate fins.

.2 All coils shall be leak tested at the factory to ensure pressure integrity.

.3 The evaporator coil is pressure tested to 450 psig and the condenser coil at 650 psig. All dual circuit evaporator coils shall be of intermingled configuration.

.4 Sloped condensate drain pans are standard.

2.11 HEATING COILS:

.1 Coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.

.2 Coils shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

.3 Coils shall be one row, half serpentine circuitry, and 8 fins per inch.

.4 Coils shall be located in the reheat position downstream of the cooling coil.

.5 Control valves shall be field supplied and field installed.

.6 Heating capacity shall be available for operation when heat pump heating is in operation and when heat pump heating is not in operation.

2.12 OUTDOOR FANS

.1 The outdoor fan shall be direct-drive, statically and dynamically balanced, draw through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and have built-in thermal overload protection in a weather tight casing.

2.13 INDOOR FAN

.1 Units shall have belt driven, FC, centrifugal fans with fixed motor sheaves. Complete fan assemblies shall be statically and dynamically balanced. Fan shaft shall be mounted on grease lubricated ball bearings. All motors shall be circuit breaker protected. All 50 Hz indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT). All 60 Hz indoor fan motors meet the Energy Independence & Security Act of 2007 (EISA).

2.14 VARIABLE FREQUENCY DRIVES (VFDS)

.1 VFDs shall be factory installed and tested to provide supply fan motor speed modulation. If the unit is configured for traditional VAV control, the VFD shall receive a signal from the unit controls via Modbus communication based upon supply static pressure and shall cause the drive to accelerate or decelerate as required to maintain the supply static pressure setpoint. The VFD shall receive a feedback signal from the unit controls via Modbus communication based on zone demand if configured for Single Zone VAV control and shall cause the drive to accelerate or decelerate as required to maintain the load of the zone. When subjected to high ambient return conditions the VFD shall reduce its output frequency to maintain operation. Bypass control to provide full nominal air flow in the event of drive failure shall be provided.

2.15 ECONOMIZER

.1 Economizer shall be factory installed. The assembly includes: fully modulating 0-100 percent motor and dampers, minimum position setting(s), preset linkage, wiring harness, and fixed dry bulb control. Differential enthalpy control shall be provided.

2.16 CLOGGED FILTER INDICATION

.1 This optional factory installed differential pressure switch allows dirty filter indication at the zone sensor with service LED. When closed, the dirty filter switch will light the service LED on the zone sensor and allow the unit to continue normal operation.

2.17 CONDENSER COIL GUARDS

.1 Factory installed condenser vinyl coated wire mesh coil guards shall be available to provide full area protection against debris and vandalism.

2.18 GFI CONVENIENCE OUTLET (FIELD POWERED)

.1 A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed and shall be field powered by 115V circuit.

2.19 HINGED SERVICE ACCESS

.1 Filter access panel and supply fan access panel shall be hinged for ease of unit service.

2.20 NON-FUSED DISCONNECT SWITCH

.1 A factory installed non-fused disconnect switch with external handle shall be provided and shall satisfy NEC requirements for a service disconnect. The non-fused disconnect shall be mounted inside the unit control box.

2.21 PHASE MONITOR

.1 Standard on all Voyager 3 units. Protects 3-phase equipment from phase loss, phase reversal, and phase unbalance. Any fault condition shall send the unit into an emergency stop condition that shall not require field adjustments for resets. cULus approved.

2.22 ROOF CURB

.1 The roof curb shall be designed to mate with the unit and provide support and a water tight installation when installed properly. The roof curb design shall allow field-fabricated rectangular supply/return ductwork to be connected directly to the curb when used with downflow units. Curb design shall comply with NRCA requirements. Curb shall ship knocked down for field assembly and include wood nailer strips.

2.23 SERVICE VALVES

.1 Discharge service valve standard with all units. Suction service valve optional.

2.24 STAINLESS STEEL DRAIN PANS

.1 Sloped stainless steel evaporator coil drain pans shall be durable, long-lasting and highly corrosion resistant.

2.25 CONDENSATE OVERFLOW SWITCH

.1 This option shall shut the unit down in the event that a clogged condensate drain line prevents proper condensate removal from the unit.

2.26 THROUGH-THE-BASE ELECTRICAL PROVISION

.1 An electrical service entrance shall be provided which allows access to route all high and low voltage electrical wiring inside the curb, through the bottom of the outdoor section of the unit and into the control box area.

2.27 ENERGY RECOVERY SYSTEM

.1 Energy Wheel:

.1 The rotor media must be made of aluminum, which is coated to prohibit corrosion; etched, polymer, or oxidized surfaces are not acceptable.

.2 All surfaces must be coated with a non-migrating adsorbent layer of desiccant prior to being formed into the honeycomb media structure to insure that all surfaces are coated and that adequate latent capacity is provided.

.3 The desiccant must be designed for the adsorption of water vapor. Equal sensible and latent recovery efficiencies must be clearly documented through a certification program conducted in accordance with ASHRAE 87-78P and ARI 1060 standards.

.4 The certification must have been conducted by a qualified independent organization. The cross-contamination and performance certification reports must be provided for engineering review as part of the submittals for this project.

.5 The media shall be cleanable with low temperature steam, hot water or light detergent without degrading the latent recovery. Dry particles up to 800 microns shall freely pass through the media. Wheel media shall be independently tested and shown to have a flame spread of less than 25 and a smoke generation rating of less than 50 when tested in accordance with ASTM-E-87.

.6 The wheel media “flutes” shall have laminar flow and the openings shall allow particles to pass without clogging. Larger particles can collect on the face and be removed as the wheel turns to the exhaust side. This non clogging feature allows the wheel to be used without filters with only periodic cleaning of the face, with compressed air and a mild cleaner such as 409, thus reducing costly filter maintenance costs.

.2 Bypass: Wheel section will be capable of taking in 100% outside air around the wheel during the unit’s economizer cycle.

.3 Purge Sector: The unit must be provided with a factory set, field adjustable purge sector designed to limit cross-contamination of the exhaust air stream concentration when operated under appropriate design conditions.

.4 Rotor Seals:

.1 The rotor shall be supplied with labyrinth seals, which at no time are required to make contact with any rotating surface of the exchanger media.

.2 These multi-pass seals shall utilize four labyrinth stages for optimum performance.

.5 Rotor Support System:

.1 The rotor media must be provided in segmented fashion to allow for field replacement of one section at a time.

.2 The media shall be rigidly held by a structural spoke system made of extruded aluminum.

.6 Wheel Housing:

.1 The rotor housing must be a structural framework that limits the deflection of the rotor due to air pressure loss to less than 1/32 inch.

.2 The housing sheet metal shall be made of galvanized steel to prevent corrosion.

.3 The rotor shall be supported by two pillow block bearings which can be maintained or replaced without the removal of the rotor from its casing or the media from its spoke system.

.7 Drive System:

.1 The rotor must be driven by a self adjusting belt system.

.2 An A/C motor is utilized for constant and variable speed applications.

.8 Installation: The rotor must be installed in the RTU by the RTU manufacturer for single-point power and single-point lift. Field-installation or bolt-on modules are not acceptable.

3. EXECUTION

3.01 INSTALLATION OF SEMI-CUSTOM ROOFTOP UNITS

.1 Provide semi-custom air handling units on roof.

.2 Provide required rigging and hoisting/moving equipment required to move units to required locations. Perform rigging/hoisting/moving in accordance with unit manufacturer’s directions and details.

.3 Locate curbs on roof where required for installation and flashing into roof construction as part of roofing work of Division 07. Secure units in place, level, and plumb, on gasketing material.

.4 Remove fan base hold-down clamps and other shipping restraints and protective packaging.

.5 Carefully coordinate installation of each unit with other trades making connections to unit, in particular, control connections.

.6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start- up requirements.

.7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification. Submit a copy of the letter prior to Substantial Performance.

.8 Include for a one half day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for radiation units, including accessories, and any required control wiring schematics.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

.3

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers for fin-tube radiation are:

.1 Engineered Air;

.2 Sigma Corporation;

.3 Rosemex Inc.

2.02 FIN-TUBE TYPE RADIATION

.1 Hot water fin-tube type direct radiation units with capacities/lengths as indicated on the floorplans. Heating capacities and element lengths indicated are based on design values listed in schedules.

.2 Wall-fin convectors complete with:

.1 copper-aluminum elements consisting of minimum 32 mm (1-¼") IPS seamless copper tubing mechanically expanded into and permanently bonded to 110 mm (4-½") square plate type aluminum fins;

.2 enclosures, as indicated on drawings, each removable and constructed of #16 gauge cold rolled steel, factory cleaned, phosphatized and finished with primer, and equipped with stamped grilles, flush slip joint enclosure to enclosure joints where required, access doors for valve access, and any required enclosure trim such as column to column extension pieces, column enclosures, etc.;

.3 continuous minimum #20 gauge steel top support wall guard strip prime coat painted as for enclosure and arranged to maintain the top back edge of enclosure 20 mm (¾") from face of wall, enclosure supports with enclosure locks constructed and finished as for wall strip and designed to hook onto top strip, and steel element support cradles which attach to slots in wall guard strip;

3. EXECUTION

3.01 INSTALLATION OF FIN-TUBE TYPE RADIATION UNITS

.1 Provide fin-tube type direct radiation units.

.2 Secure enclosure brackets in place at maximum 900 mm (35") centres and install element supports or cradles. Slope elements to ensure proper water circulating and to eliminate air. Ensure enclosures are level and plumb. Provide required enclosure accessories.

.3 Connect elements with piping. Provide radiator type valves in piping at each element or group of series connected elements, shut-off type in supply piping, balancing type in return piping. Unless otherwise noted or specified, locate valves and accessories inside enclosures or behind trim, and ensure valves are accessible.

.4 Where 2 or more heating elements are connected in series, join elements with piping the full size of the element tubes or use piping sized to supply pipe size and connect elements with eccentric fittings.

.5 Equip each element or group of series connected elements with a manual air vent installed in an accessible location.

.6 For free-standing radiation units, provide proper height, cleaned and prime coat painted, flanged steel pipe supports. Size inside diameter of supports to suit diameter of heating piping which is to extend through the supports to the elements. Secure supports to floor over floor openings.

END OF SECTION

1. GENERAL

1.01 SUBMITTALS

.1 Submit shop drawings/product data sheets for motorized heaters, including accessories, and colour chart.

.2 Submit a site start-up report from manufacturer's representative as specified in Part 3 of this Section.

2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers for motorized heaters are:

.1 Engineered Air

.2 Modine Manufacturing Co.;

.3 Rosemex Inc.;

.4 Sigma.

2.02 CABINET UNIT HEATERS

.1 CSA certified hot water cabinet unit heaters in accordance with drawing schedule, each complete with:

.2 cabinet, of welded fabrication, constructed from one-piece top and sides, and one-piece partition panels and backsheet, both die-formed from single sheets of minimum #18 gauge insulated furniture grade steel and complete with minimum 825 mm (32 ½") space at each end for piping and wiring, stamped grilles where required, and, for surface floor and wall mounted cabinets, key lock access doors for access to valves and speed controls;

.3 #16 gauge removable front panel with tamperproof fasteners, stamped grille where required, and insulation applied to the inside face;

.4 for all exposed cabinet surfaces, a baked enamel prime coat finish applied to cleaned metal surfaces;

.5 factory leak tested heating coil, consisting of seamless copper tubing mechanically expanded into and permanently bonded to continuous plate type aluminum fins, and equipped with screwed steel supply and return piping connections and silver brazed tube joints;

.6 removable galvanized steel fan board with centrifugal forward curved, formed aluminum fan wheel(s) with galvanized steel housings, direct connected to a continuous duty, three-speed, permanent split capacitor motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods;

.7 permanent, cleanable aluminum mesh filter.

3. EXECUTION

3.01 INSTALLATION OF MOTORIZED HEATERS

.1 Provide motorized heaters.

.2 Carefully coordinate installation of cabinet heaters with trades constructing building surfaces in or on which heaters are located. Confirm exact locations prior to roughing-in.

.3 Connect with piping in accordance with drawing detail.

.4 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.5 Include for a 4 hour on-site heater operation demonstration and training session. Training is to be a full review of all components including but not limited to construction details, operation, and maintenance.

END OF SECTION

1. GENERAL

1.01 SHOP DRAWINGS

.1 Submit shop drawings for the following:

.1 all control system components;

.2 identified schematic control diagrams with component catalogue numbers and typed operational sequences for all systems;

.3 drawings of each system showing all connected devices, all wiring, all connections, all data (connected and calculated) point addresses and operator notations;

.4 complete sequences of operation of the BAS systems in both flow chart and program format;

.5 technical specification data sheets for each system component;

.6 descriptive data and sequence of operation of all operating, user, and application software including a complete Operator's Manual and Programmer's Manual tailored to the job.

1.02 SUBMITTALS

.1 Submit the following to the Consultant for review:

.1 a sample standard control damper section with linkage, operator, and certified air flow and leakage characteristics;

.2 a sample, coloured, system flow diagram;

.3 an identified sample of each type of thermostat and room temperature sensor to be used.

1.03 WARRANTY

.1 Equipment and Materials:

.1 All equipment and materials supplied by the Contractor shall be provided with a minimum three (3) year warranty against defects of design or manufacturing.

.2 All equipment and materials found to be defective during the warranty period shall be repaired or replaced by the Contractor at no cost to the Owner.

.3 The Contractor shall provide approved temporary replacement equipment and materials such that the system remains fully functional as designed and commissioned during repair or replacement activities and at NO cost to the Owner.

.4 The Contractor must designate warranties on manufactured equipment and materials to the Owner on the date of final acceptance and include them in the training manual.

.2 Workmanship:

.1 The Work shall be provided with a three (3) year warranty by the Contractor against faults or failures of any element of the system as a result of the workmanship of the Contractor and its Subcontractors.

.2 The Contractor shall remedy all such faults or failures such that the system remains fully functional as designed and commissioned during remediation work periods and at NO cost to the Owner.

.3 A signed letter in the maintenance and operations manuals outlining warranty dates shall be included.

1.04 EQUIPMENT AND MATERIALS

.1 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Canadian Standards Association (CSA) Standards and/or Underwriters Laboratories of Canada (ULC) Standards and the requirements of the authorities having jurisdiction. Unless otherwise specified, similar products i.e.: all valves, all control components, all vibration isolation, etc., shall be the product of one (1) manufacturer.

.2 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.

.3 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimensions of such equipment differs from the specified equipment, prepare and submit for review, accurately dimensioned layouts of rooms affected.

.4 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment.

.5 Where products you intend to provide are proposed as "an equal" and/or "or approved equal", to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.

.6 Only base specified products, specified acceptable products or equipment listed as alternate will be considered for acceptance by the School Board. No proposed substitutions will be accepted.

.7 Indicate in Form of Supplementary Controls Tender, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer’s name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.

2. PRODUCTS

2.01 CONDUITS

.1 Service Areas

.1 Nylon Metallic Tubing (NMT) - Grey

.2 Electrical Metallic Tubing (EMT) - Rigid

.3 Liquidtite

.2 Public Areas

.1 Wiremold - Colour: Match existing surfaces and wall box.

.2 Fittings: Suitable for the type of conduit.

2.02 WIRING

.1 All control cabling shall be FT6, plenum rated and yellow jacket in colour.

.2 All network wiring between controllers shall be FT6, and plenum rated.

.3 Power wiring sizing as per code requirement.

2.03 DAMPER ACTUATORS

.1 Actuators to be 24V only and operate on a 0-10VDC or 2-10VDC signal.

.2 Two-position (on/off) actuator are not acceptable.

.3 Each actuator shall be "fail safe" and complete with external adjustable stops to limit the length of stroke in either direction. Operators shall be mounted on adjustable brackets. Operating arms shall have double yoke linkages and double set screws for fastening to the damper shaft. Damper operators shall be selected to operate maximum damper loads of 20 sq. ft. (1.9 sq.m). Where damper sizes exceed this area rating, multiple damper operators shall be provided.

.4 Damper actuators shall be spring return to fail safe position.

.5 Damper actuators associated with air handling units shall operate on a 0-10 VDC signal only.

.6 Damper actuators exposed to the exterior elements shall be provided with a Belimo ZS-100 Series Weather Shield, or equivalent, weatherproof enclosure.

.7 Belimo MFT actuators are not acceptable.

.8 Acceptable actuator manufacturers are Johnson Controls Inc. and Belimo.

2.04 AUTOMATIC CONTROL VALVES AND OPERATORS

.1 Actuators to be 24V only and operate on a 0-10VDC or 2-10VDC signal.

.2 All valve actuators shall be as follows:

.1 Valves serving Air Handling Units - Spring return to fail safe position;

.2 Valves serving terminal unit heating coils and perimeter heaters – non-spring return.

.3 Unless otherwise indicated control valves shall be fully modulating type with equal percentage characteristics. Two-position (On/Off) control valves are not acceptable.

.4 Automatic control valves for air handling systems and heat exchanger to be globe style valves.

.5 Automatic 3-way control valves to be globe style valves.

.6 Automatic 2-way control valves to be ball style valves.

.7 Each automatic control valve must provide the design output and flow rates at pressure drops compatible with equipment selected, must be suitable for the particular system working pressure, and shall be fitted with a position indicator and "fail safe" operator capable of tight shut off against the differentials imposed by the system.

.8 Heating valves shall be normally open unless otherwise noted. Cooling valves shall be normally closed unless otherwise noted.

.9 Butterfly type control valves with motorized gear operators will be acceptable where shown and/or specified on the drawings.

.10 Belimo MFT actuators are not acceptable.

.11 Acceptable valve manufacturers are Johnson Controls Inc. and Belimo.

2.05 FIELD DEVICES

.1 Combination Temperature-Occupancy Sensors:

.1 Johnson Controls Inc. NS8000 Series Networks sensor model NSB9MTN240-0 for motion and temperature complete with:

.1 Fixed segment display;

.2 White Colour;

.3 Occupancy sensor.

.2 Damper Status Switches:

.1 Lever operated switches secured to damper frames, rated 5.0 amp, 120/1/60 Hz. AC full load, ULC listed and CSA approved, and activated by damper blade movement.

.3 Temperature Sensors:

.1 Temperature sensors shall be factory calibrated, resistant temperature type (RTD) of 100, 1000 or 3000 ohm platinum or 5000 ohm Balco with ± 0.5°C. accuracy over a range of 0°C to 100°C.

.2 Temperature sensors utilized for measuring duct temperatures shall incorporate an averaging style temperature element (RTD) of sufficient length to ensure a proper average of the variation across the full cross section of the duct. Thermistor type sensors are not acceptable.

.3 Temperature sensors utilized for measurement of fluid temperatures shall incorporate a separate well of a material suitable for the service.

.4 Water service - brass.

.5 Where temperature sensors are specified to measure outdoor ambient temperature, they shall be installed so as not to be affected by exhaust air or reverse flow of warm air through supply units.

.6 Room temperature sensors controlled by the Building Automation System (BAS) complete with hard plastic exterior with no display or adjustments capabilities. RJ-11 jack on sensor is not required.

.4 Water Flow Sensors:

.1 Water flow analog sensors shall be provided complete with flow element and shall be an all solid state precision industrial type with stainless-steel meter body, maximum error of no more than 0.5% of span, and 4 to 20 ma output. Sensor shall be rated for 1725 kPa minimum and installed in strict accordance to the manufacturer’s instructions complete with three-vale manifold for calibration and maintenance.

.5 Water Flow Switches:

.1 Water flow switches shall have a paddle actuated, snap acting SPDT switch rated at 16 amp 120/1/60 Hz. AC full load.

.6 Air Proving Switches:

.1 Air proving switches shall utilize a differential pressure activated, diaphragm actuated, snap acting SPDT switch rated at 9.8 amp 120/1/60 Hz. AC full load.

.7 Electronic Humidity Sensors:

.1 Humidity sensors shall be capacitance type, suitable for operating ranges of 10 to 90% RH with a sensor accuracy shall be ±2% over a range of 10 to 90% RH.

.8 Air Flow Sensors:

.1 Flow measuring arrays shall be electronic thermal type mounted in an extruded aluminum strut with a 4 20 mA transmitter producing a non linear output signal based on an 18 24 VDC supply to the unit. Each unit shall be supplied with a polynomial equation by the manufacturer for use in relating the output signal with duct velocity. Provide the required number of sensors in each array at the locations indicated on drawings to produce an accuracy of ±3% of full scale flow. Response time 100 ms, repeatability ±1/2% FS, operating range 40°C to 65°C.

.9 Current Sensing Relays:

.1 Current sensing relays used for proof-of-loading for fans and pumps shall be suitable for 2 to 200 amp and shall have adjustable trip thresholds of ± 2% of range. Each relay shall be provided with an LED to allow ready observation of the relay status.

.2 All current sensing relays serving supply and return fans shall display amperage readings (AI) to the BAS and not an On/Off Signal (DI).

.3 Current sensing relays serving exhaust fans shall be On/Off (DI) signals.

.10 Freezestat:

.1 Two pole manual reset type freezestat, each complete with 6 m of capillary tubing.

.11 Differential Pressure Switch:

.1 Setra Systems Model 264 differential pressure transducer, capable of providing a 4 – 20 mA output signal, temperature compensated to 0.033% FS/□F (0.033% FS/□C) thermal error over a temperature range of 0□F to 150□F (-18□C to 65□C), utilizing a tensioned stainless steel diaphragm and an insulated stainless steel electrode enclosed in a fire-retardent glass filled polyester casing and complete with brass pressure fitting ports for differential pressure measurement and a screwed terminal strip for electrical output signals.

.12 Carbon Dioxide Sensor:

.1 Veris CDE series duct mounted, maintenance free, non dispersive infrared carbon dioxide sensor capable of monitoring concentration of CO2.

.1 Method: I.R.;

.2 Gas: Carbon Dioxide;

.3 Range: 0-2000 PPM;

.4 Power Source: 24 VAC;

.5 Output Signal: 0-10 VDC;

.13 Photo Sensor:

.1 Greystone model PSR-1 sensor, CSA approved, light sensitive resistor, mounted on a weatherproof enclosure. The unit shall produce a 4-20mA output signal, coupled with a transmitter.

.14 Occupancy Sensor:

.1 WattStopper model CB-100 passive infrared occupancy sensor, CSA approved device to provide automatic control of HVAC equipment with the following components:

.1 Gasketted, watertight enclosure capable of preventing moisture and dust from entering the sensor;

.2 Temperature compensated, dual element sensor and multi-element Fresnel lens;

.3 Single pole, double throw isolated relay with normally open, normally closed, and common outputs rated for 1 Amp at 24 VDC for use with HVAC control, data logging and other control options;

.4 DIP switch controlled digital time delay setting, adjustable from 15 seconds to 10 minutes;

.5 Mounting hardware concealed under a removable cover to prevent tampering of adjustments and hardware.

2.06 RELAYS

.1 All start/stop equipment must have a pilot relay between the controller and the controlled equipment to prevent damage to the electronic equipment.

.2 All relays used for motors, electric heat, and corridor lighting shall be a load rated RIB relay (20 amp minimum) or an approved equivalent. Relays shall have a led pilot light.

.3 All pilot relays shall be plug in socket mounted style. Relays to have an LED light to show when it is energized.

.4 Ice cube relays:

.1 Used for pilot relays only.

.5 RIB relays with Hand-Off-Auto selector switch shall not be used.

2.07 IDENTIFICATION

.1 Panels:

.1 Engraved, laminated, black white Lamacoid nameplates, sized to suit wording requirements and complete with bevelled edges and stainless steel securing screws.

.2 Each DCP shall have a list of all points either directly or indirectly controlled by the DCP inserted in a plastic pocket or folder inside the panel door of the DCP.

.2 End Devices:

.1 Label shall be yellow or orange background, sized to suit wording requirements.

.2 Within concealed space:

.1 Affix a label on the end device and t-bar grid or access door below the end device.

.3 In exposed room

.1 Affix a label on the end device.

.3 Wiring:

.1 Each wire shall be labelled with its point descriptor at the point where it attaches to the panel and end device.

.2 Any terminal blocks used will have all wires labelled or a terminal block wiring diagram fastened to the door.

.4 Provide wiring diagrams for each panel and install plastic laminated copy inside each panel or provide folder inside cabinet door with wiring diagrams.

.5 Label all junction boxes “BAS” on the exterior of the cover plate.

.6 For all transformers, label the junction box indicating the power circuit it is fed from.

.7 A sample of each type of control component identification, as specified above, shall be submitted to the Consultant for approval prior to installation.

3. EXECUTION

3.01 GENERAL RE: INSTALLATION OF CONTROLS AND INSTRUMENTATION

.1 Provide complete systems of control and instrumentation to control and supervise operation of the new environmental systems.

.2 The control systems shall be installed by the control component manufacturer or under direct supervision of the control component manufacturer.

.3 The control systems generally shall be as outlined on the control diagrams on the drawings and shall have all the elements and perform all the sequences therein indicated or implied.

.4 The control diagrams show only the principal items of equipment controlling the systems. Supplement each control system with multiple-pole relays, transformers, sensors, etc., as required to enable each system to perform as specified and to permit proper operation and supervision of same.

.5 All relays shall be grouped together in a hinged electrical cabinet and rated for their operation needs.

.6 Current transducers shall be installed for all status points where noted. Amperage input from the variable speed drives shall not be used.

.7 All freezestats and safeties shall be accessible with a 1829 mm (6') ladder. Contractor to contact YCDSB prior to installation if the freezestat cannot be installed in an accessible location.

3.02 INSTALLATION OF CONTROL DAMPER OPERATORS

.1 Provide all required automatic control damper operators.

.2 Provision of dampers in air handlers and in ductwork will be done by Mechanical Division. Inspect each damper assembly and ensure that it is properly mounted, accessible for damper operator installation, complete, damage free and provides satisfactory operation. Report defects in writing to Consultant. Installation of your work shall constitute acceptance of dampers being satisfactory.

.3 Locate damper motors so they are accessible from outside ducts, plenums and equipment casings wherever possible. Where sequence operation is indicated, or where multiple operators drive a series of dampers, provide equipment pilot positioners to couple their action.

.4 Unless otherwise indicated, provide one (1) controller per function or system. Equip controllers with a separate shut off so they may be serviced without interruption of other system components.

.5 Bracket mount controllers on ducts or plenums out clear of the insulation and ensure that they are vibration free.

3.03 INSTALLATION OF AUTOMATIC CONTROL VALVES AND OPERATORS

.1 Unless otherwise noted, supply all required automatic control valves.

.2 Mounting of valves in piping, unless otherwise noted, will be done as part of the piping work specified in preceding Sections of this Division of the Specification. Make the valves available at the site, at the locations where they are required, and ensure that each valve is properly mounted.

.3 Provide an operator from each valve, connect complete, check and test operation, and adjust as required.

3.04 INSTALLATION OF FREEZESTATS

.1 Provide freezestats as follows:

.1 For air handling units with hot water heating coils, install freezestat downstream of the heating coil.

.2 For air handling units with glycol heating coils, install freezestat in the supply air ductwork after the supply fan.

.3 For air handling units with gas fired heating, install freezestat in the supply air ductwork after the supply fan and inside the building.

.2 Wire freezestats to shut down the respective fan or fans and close associated dampers and modulate associated coil control valves to normal position upon activation.

.3 Provide a high limit temperature control in each plenum or section housing heating coil(s) to prevent the normally open heating valve from overheating the plenum and setting off the firestats. This control shall be operable when the fans are shut down.

.4 Provide local temperature indication (averaging sensor tubing not thermometers) on each section or plenum housing a coil.

.5 For all supply systems with no recirculation, arrange controls so that the outdoor air and exhaust air dampers are fully open before the fans can start.

.6 All freezestats shall be accessible with a 1829 mm (6') ladder. Contractor to contact YCDSB prior to installation if the freezestat cannot be installed in an accessible location.

.7 Refer to the drawings for other specific requirements and control sequences.

3.05 INSTALLATION OF CONTROL WIRING

.1 The controls contractor shall provide all required control wiring work for control systems including power wiring connections to equipment and panels.

.2 120 volt power wiring shall be extended from junction boxes to each DDCC, MEC and ASC. Power serving DDCCs, MECs and ASCs must be on a dedicated circuit.

.3 All control wiring shall be in conduit in accordance with the standards and requirements of Electrical Division except for horizontal control wiring above the ceiling grids of classrooms which may be in FT6 plenum rated cable. FT6 plenum rated cable in classroom ceilings must be tied up and secured off of ceiling tiles. The controls contractor shall provide all required boxes, connectors, and other wiring accessories. All vertical drops to temperature sensors and valves must be in conduit.

.4 Where plenum rated cable is used and where plenum rated cable passes through walls on any kind, the cable shall be installed in a conduit sleeve complete with bushings at both ends of the conduit.

.5 All control wiring in mechanical rooms shall be in conduit with final three (3) feet to all devices in seal tight flexible conduit. Control wiring penetrations of devices in mechanical rooms shall be provided such that water damage of equipment cannot occur through conduit openings. Top penetrations of controls cabinets will not be accepted.

.6 All control wiring exposed in finished areas (e.g. corridors, classrooms, etc.) shall be installed in wiremold (colour to match surrounding area).

.7 All control wiring inside of RTU's or AHU's will be in EMT conduit with final two (2) to three (3) feet to all end devices in NMT or liquid tight including plnuem whip on damper actuators. No exceptions.

.8 BX sheathing shall not be used.

.9 Use flexible conduit where conduits run across flexible duct connectors.

.10 All control wiring in corridors shall be in cable trays or conduits provided by Div. 26.

.11 Control wiring shall be in EMT conduit with bushing at both ends where control wiring penetrates through walls. For wiring passing through fire separations, both ends of the conduit shall be fire stopped.

.12 Control wiring not in conduit shall be installed and neatly secured to the existing structure. Loosely hung wiring and wiring secured to non-structural objects will not be accepted. Wiring shall run parallel to building lines. Multiple wires shall be grouped together.

.13 All wiring between panels and end devices shall be continuous, terminations/splicing/joints are not acceptable.

3.06 CONTROL WORK TESTING

.1 Arrange for the automatic control systems to be adjusted, calibrated, set and tested by a qualified member of the control component manufacturer's personnel, after which obtain from the manufacturer and forward to the Consultant a letter stating that the control systems have been adjusted, calibrated, set and tested and are in perfect operating condition.

.2 In addition, arrange for the control system manufacturer to supply at the site, qualified control system technicians to make adjustments to control systems to suit air and water balancing and testing.

.3 Arrange for the control system supplier to completely train a minimum of two (2) designated Owner's representatives in operation and maintenance of the system. Include all costs for such training in your Tender Price.

3.07 "AS BUILT" DRAWINGS AND OPERATOR MANUALS

.1 The record drawings for this project will be prepared on a CAD system utilizing AutoCAD Release 2011 Software.

.2 On completion of the Contract Work, the Contractor shall provide a set of CAD produced reproducible contract drawings and associated diskettes of relevant approved, "As built" controls documentation. This documentation must identify and show all controls work for each phase or project.

.3 "As built" documentation shall also include the following as a minimum:

.1 schematic outline of the BAS for quick reference of overall system scope;

.2 adequate record of the Work as installed, including its exact location and the wiring and route;

.3 system hardware specification manual, which provides a functional description of all hardware components;

.4 system operator's manual which provides concise instructions for the operation of the system and an explanation and recovery route for all system alarms;

.5 system engineering manual which provides all of the information, for system set up, definition and application;

.6 system data manual which provides the applications data programmed into the system;

.7 system servicing and maintenance manuals for central unit components including:

.1 video monitor;

.2 printer;

.3 digital control panels (DCP);

.4 application specific controllers (ASC);

.5 field devices (sensor, switches).

.8 all data specified in the shop drawings section in its final "As built" form;

.9 system software documentation;

.10 list of equipment supplied, including its make, model number, name of local suppliers, and quantity;

.11 all manuals will be constructed in the following manner:

.1 3 ring binders complete with index pages indexing tabs and cover identification at front and side;

.2 size of the manuals will be 8-1/2” x 11” (215 mm x 280 mm) extension type catalogue binders bound with heavy weight yellow fabric hot stamped in black lettering front and spine;

.3 each spine shall be lettered with full identification of the project, the front face of each binder shall contain the following:

.1 full identification title of the Project and Project No.;

.2 full identification title of the Consultant;

.3 full identification title of the Contractor;

.4 should there be more than one (1) volume for each type of application, then each volume will be so identified;

.5 a detailed description and configuration of these manuals will be submitted to the Engineer for approval.

3.08 OPERATOR TRAINING

.1 The Contractor shall provide training programs for the Owner's personnel. Training will be co-ordinated with the York Region District School Board's Plant Services Department. The Owner will assign the personnel to participate in these training programs prior to commencing with work and during the start up of the system. This training shall allow the Owner's operator(s) to understand the operation and programs of the BAS including the Operator Workstation and its controllers.

.2 The Operator training program phase shall be divided into two (2) parts namely project inception and completion. During the inception stage the Contractor shall review the systems and familiarize the Owner with required operating functions in order that the Owner is prepared to operate the system. During the start up of the system and upon completion of the project, the Contractor shall provide training. The Contractor shall supply an Engineer or Certified Engineering Technologist for these workshop days. The Contractor shall also supply a working prototype of the BAS for each workshop day.

.3 The training program shall include the following:

.1 system configuration of the environmental control system;

.2 treatment units operation concepts;

.3 system data reading;

.4 equipment operation and software commands;

.5 operator monitoring and control intervention;

.6 calibration of data acquisition devices;

.7 preventive maintenance;

.8 trouble shooting of the environmental control system;

.9 programming.

.4 A training program for the Owner's maintenance personnel shall be provided. This training shall allow the maintenance personnel to understand the basic operations of the BAS and also the basic commands both on the Operator Workstation, Standalone Digital Control Panels and Application Specific Controllers. The training program shall review the basic maintenance requirements for the BAS. The Contractor shall be responsible for delivering the maintenance training session. In the allowed time, the training program shall consist of the basic maintenance needs of all this equipment.

.5 Notwithstanding the above, the contractor will provide a minimum of forty hours of training to be used at the discretion of the York Region District School Board in however way they deem fit.

.6 All documentation related to the training program, including training manual and quick reference “cheat sheets”, shall be submitted in three (3) copies.

3.09 CONTROLS CONTRACTOR'S RESPONSIBILITIES

.1 The Controls Contractor shall comply with applicable responsibilities specified below:

.1 provide start up, test procedures and O & M manual;

.2 provide a print out of all points connected to the BAS;

.3 provide a detailed consolidate wiring diagram showing the interface of the BAS controls with packaged controls;

.4 responsible for component and point to point testing;

.5 responsible for sensor calibration and actuator adjustment;

.6 provide calibration procedure for each analog sensor;

.7 operate systems during testing;

.8 provide training and instruction;

.9 responsible for the acceptance test for a 21 day period;

.10 set up trend logs and group logs which shall be stored on hard disk;

.11 re visit site during the first year of operation to review BAS performance.

END OF SECTION

1. GENERAL

.1 Refer to Mechanical Drawings for associated control diagrams and control components.

2. PRODUCTS

.1 Not used.

3. EXECUTION

3.01 RTU-1 – ROOFTOP UNIT CONTROL SEQUENCE

.1 Integration with Other Systems:

.1 Air Handling Unit will monitor heat, cool, and pressure requests from associated zones as well as lowest, highest, and average zone temperatures.

.2 Run Conditions:

.1 Occupied - Scheduled:

.1 The unit shall run when the time schedule is set to Occupied. During Occupied times the outside air dampers are enabled to provide a minimum percentage of outside air. See DCV sequence for details.

.2 Standby - Scheduled:

.1 The unit shall run when the time schedule is set to Standby. During Standby mode the minimum outside air % shall be 0%. DCV shall override the minimum outside air % if CO2 levels are above setpoint.

.3 Standby – Triggered by Motion Sensor:

.1 When in Unoccupied mode, the unit shall turn on in Standby Mode if the following conditions are true:

.1 Motion sensor control is true. This point is scheduled.

.2 AND the BAS has detected motion in a definable number of zones (initially set to 1).

.2 During Standby mode the minimum outside air % shall be 0%. DCV shall override the minimum outside air % if CO2 levels are above setpoint.

.3 The unit shall have minimum on/off times of 30 minutes.

.4 Unoccupied Mode (System Off):

.1 The supply and return/exhaust fans will be off. The return air dampers shall be positioned for full recirculation, exhaust air and fresh air dampers shall be fully closed.

.5 Warmup Mode:

.1 Warmup mode shall be activated if either of the following conditions are true:

.1 The optimal start algorithm is requesting heating.

.2 During warmup mode, the mixed air dampers shall be positioned for full recirculation and the discharge air setpoint shall be 32 deg C.

.6 Cooldown Mode:

.1 Cooldown Mode shall be activated if the optimal start algorithm is requesting cooling. During cooldown mode, the mixed air dampers shall be positioned for full recirculation unless free cooling is available. The discharge air setpoint shall be 13 deg C.

.7 Optimal Start:

.1 The unit shall start prior to scheduled occupancy based on the time necessary for the zones to reach their occupied setpoints. The start time shall automatically adjust based on changes in outside air temperature and zone temperatures. Optimal Start shall be limited to the following times:

.1 Heating: 1 hour prior to Occupancy

.2 Cooling: 1 hour prior to Occupancy

.3 Unit Control:

.1 BAS sends occupancy signal and setpoints to the rooftop unit via BACnet communication. The rooftop unit controls supply and return/exhaust fans, heating, cooling, economizer and heat pump via factory controls. The BAS commands the following setpoints/parameters:

.1 Discharge Air Temperature Setpoint

.2 Space Temperature

.3 Occupancy Request

.4 Heat Pump Compressor Heat Lockout Setpoint

.5 Building Pressure Control Setpoint

.6 Mechanical Heating OA-T Lockout Setpoint

.7 Mechanical Cooling OA-T Lockout Setpoint

.8 Economizer Enable Setpoint

.9 Occupied Heating Setpoint

.10 Unoccupied Heating Setpoint

.11 Occupied Cooling Setpoint

.12 Unoccupied Cooling Setpoint

.13 Minimum Economizer Position

.4 Discharge Air Temperature Setpoint Calculation:

.1 The heating discharge air temperature setpoint shall be reset using the table below:

Average Zone Temperature	Discharge Air Temperature Setpoint
22°C	21°C
16°C	32°C

.2 The cooling discharge air temperature setpoint shall be reset using the table below:

Average Zone Temperature	Discharge Air Temperature Setpoint
23°C	18°C
26°C	13°C

.3 The BAS shall command the Supply Air Setpoint Override to the values below based on the current HVAC Mode of the unit:

Heat Cool Mode Status	**Discharge Air Setpoint Source**
Heating	Heating Discharge Air Setpoint Reset
Cooling	Cooling Discharge Air Setpoint Reset
Warmup	32°C
Cooldown	13°C
Other Modes	20°C

.5 Cooling Setpoints:

.1 The unit shall maintain the following temperatures:

.1 Average zone temperature of 23°C during occupied mode.

.2 Average zone temperature of 25°C during standby mode.

.3 Average zone temperature of 32°C during unoccupied mode.

.6 Heating Setpoints:

.1 The unit shall maintain the following temperatures:

.1 Average zone temperature of 21°C during occupied mode.

.2 Average zone temperature of 19°C during standby mode.

.3 Average zone temperature of 13°C during unoccupied mode.

.7 Demand Control Ventilation – CO2 control:

.1 During Occupied mode, the outside air dampers shall maintain the return/space CO2 setpoint by modulating between the Area Outdoor Air Rate and the Combined Outdoor Air Rate (Area Outdoor Rate + People Outdoor Air Rate) defined in Table 6.1 of ASHRAE 62-1 (both in L/s). The balancer shall determine the corresponding outdoor air damper positions for each flow rate.

.1 OA Damper Minimum Position: Area Outdoor Air Rate (%)

.2 OA Damper Maximum CO2 Reset Limit: Combined Outdoor Air Rate (%)

.2 The return/space CO2 setpoint shall be 1000 ppm. DCV strategy shall be achieved by setting the following BACnet points to the values below:

.1 Minimum Economizer Position = Area Outdoor Air Rate (%)

.2 Maximum Economizer CO2 Reset Limit = Combined Outdoor Air Rate (%)

.3 Minimum Carbon Dioxide Setpoint = 800 PPM

.4 Maximum Carbon Dioxide Setpoint = 1000 PPM

.8 Alarms:

.1 The BAS shall monitor the following unit alarms:

.1 Refrigerant Leak Detection System Input

.2 Program Control Request Configuration

.3 Supply Control Request Configuration

.4 Liquid Pressure Source Failure

.5 Low Discharge Air Temp Lockout

.6 High Discharge Air Temp Lockout

.7 Safety Check Failure

.8 Manual Reset Required

.9 Compressor Heat or Cool Unit Lockout

.10 Exhaust Fan Failure

.11 Supply Fan Failure

.12 Clogged Filter Status

.13 Emergency Stop

.14 Damper Not Modulating

.15 Low Ambient Lockout

.2 The BAS shall provide the following alarms:

.1 Low Discharge Air Temperature: If the discharge air temperature is less than 5°C for 5 minutes and the supply fan status is on.

.2 High Discharge Air Temperature: If the discharge air temperature is more than 49°C for 5 minutes and the supply fan status is on.

.3 Low Mixed Air Temperature: If the mixed air temperature is less than 5°C for 5 minutes and the supply fan status is on.

.4 High Return Air Carbon Dioxide Concentration: If the return air CO2 concentration is

.5 greater than 1100 ppm for 30 minutes and the supply fan status is on.

.6 Supply Fan Status: Mismatch between the unit command and the fan status for 30 minutes.

.9 Points

.1 Control points for the unit are to be provided as per the control diagram.

3.02 AHU-1, AHU-2, AND AHU-3 – EXISTING AIR HANDLING UNITS

.1 Integration with Other Systems:

.1 Existing Controls for Air Handling Units are to remain. Additional controls to be provided for new cooling coils and associated condensing units.

.2 Air Handling Unit will monitor cooling and heating requests from associated zones as well as lowest, highest, and average zone temperatures.

.2 Fan Speed Control:

.1 On call for supply and return fans to be enabled, VFDs shall gradually increase fan speed for soft start of units.

.2 During cooling season, fans shall operate a full speed once enabled.

.3 During heating season, fans shall operate at full speed during occupied mode, but shall ramp down to 50% (adjustable) during standby mode. Schedule for standby mode to be confirmed with owner during commissioning.

.3 Condensing Unit Control:

.1 The BAS commands the following setpoints/parameters:

.1 Discharge Air Temperature Setpoint

.2 Cooling Enable

.2 The cooling discharge air temperature setpoint shall be reset using the table below:

Average Zone Temperature	Discharge Air Temperature Setpoint
23°C	18°C
26°C	13°C

.3 The BAS shall command the Supply Air Setpoint Override to the values below based on the current HVAC Mode of the unit:

HVAC Mode	Discharge Air Setpoint Source
Cooling	Cooling Discharge Air Setpoint Reset
Cooldown	13°C

.4 Cooling Setpoints:

.1 The unit shall maintain the following temperatures:

.1 Zone temperature of 23°C during occupied mode.

.2 Zone temperature of 25°C during standby mode

.3 Zone temperature of 32°C during unoccupied mode

.5 Alarms:

.1 The BAS shall monitor the following unit alarms:

.1 Manual Reset Required

.2 The BAS shall provide the following alarms:

.1 Low Discharge Air Temperature: If the discharge air temperature is less than 5°C for 5 minutes and the supply fan status is on.

.2 High Discharge Air Temperature: If the discharge air temperature is more than 49°C for 5 minutes and the supply fan status is on.

.3 Low Mixed Air Temperature: If the mixed air temperature is less than 5°C for 5 minutes and the supply fan status is on.

.6 Points:

.1 Control points for the condensing unit are to be provided as per control diagrams.

3.03 VAV BOXES

.1 The variable volume terminal consists of a damper air flow sensor and modulating two-way hot water reheat control valve.

.2 The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes as follows:

.1 Occupied Cooling

.1 The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. The controller monitors the room temperature

sensor and air velocity sensor and modulates the supply air damper to maintain the room temperature at set point.

.2 Occupied Heating

.1 The VAV terminal unit is set to user defined minimum supply air volume setpoint. The VAV box heating control valve is normally closed. The controller monitors the room temperature sensor modulates the perimeter heating control valve to maintain the room temperature at set point. If setpoint is not satisfied within 15 minutes (adjustable), then the controller shall modulate the VAV box heating control valve to maintain the room temperature at set point until setpoint is satisfied.

.3 Unoccupied

.1 The two-way hot water reheat control valve is closed to boiler plant hot water.

.2 Perimeter heating to maintain Unoccupied Heating Setpoint.

.3 Should additional heat be required at night the controller may reset to the terminal unit Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

.3 Points List. Refer to Controls Schematic.

3.04 STORAGE ROOM TEMPERATURE CONTROL (SRE-1)

.1 Room Temperature Control:

.1 The room temperature control consists of a temperature sensor, a perimeter heater, modulating control valve, an exhaust fan, and an outdoor air motorized damper.

.2 The DDC will control using electric actuation.

.3 The controller monitors the room temperature sensor.

.4 On a call for cooling the heater control valve is closed, the fan motor is off, controller will start exhaust fan motor/open OA damper to maintain room temperature setpoint.

.5 Exhaust air fan shall not start until OA damper has been proved open.

.6 On a call for heating the exhaust fan motor is off, the controller will modulate control valve to maintain room temperature setpoint.

.7 The DDC system uses current sensors to confirm fan operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.2 Points List. Refer to Controls Schematic.

3.05 TYPICAL MOTORIZED HEATER

.1 Room Temperature Control:

.1 The room temperature control consists of a temperature sensor and a motorized heater.

.2 The BAS monitors the room temperature sensor.

.3 On a call for cooling the motorized heater shall be disabled.

.4 On a call for heating the BAS will enable/disable the motorized heater to maintain room temperature setpoint of 18°C (adjustable).

.5 The DDC system uses current sensors to confirm heater operation. Provide a dual voltage relay adjacent to the BAS panel. DDC system generates an alarm if status deviates from DDC start/stop control.

.2 Points List. Refer to Controls Schematic.

3.06 STANDALONE WALL-FIN HEATER

.1 Room Temperature Control:

.1 The room temperature control consists of a temperature sensor, a perimeter heater, and a modulating control valve.

.2 The BAS monitors the room temperature sensor.

.3 On a call for cooling the heater control valve is closed.

.4 On a call for heating the BAS will modulate control valve to maintain room temperature setpoint of 22°C (adjustable).

.2 Points List. Refer to Controls Schematic.

END OF SECTION

DIVISION 26 ELECTRICAL

SECTION 26 05 00 FORM OF SUPPLEMENTARY ELECTRICAL TENDER
SECTION 26 05 01 ELECTRICAL WORK GENERAL INSTRUCTIONS
SECTION 26 05 21 WIRES AND CABLES
SECTION 26 05 28 GROUNDING
SECTION 26 05 31 SPLITTERS, JUNCTION, PULL BOXES AND CABINETS
SECTION 26 05 32 OUTLET BOXES, CONDUIT BOXES AND FITTINGS
SECTION 26 05 33 SURFACE RACEWAYS
SECTION 26 05 34 CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS
SECTION 26 05 40 DUAL HANGER SYSTEM
SECTION 26 05 41 SEISMIC BRACING FOR ELECTRICAL EQUIPMENT
SECTION 26 08 10 ACCESS PANELS
SECTION 26 08 20 ELECTRIC HEATING SYSTEM
SECTION 26 08 30 PIPE TRACING SYSTEM
SECTION 26 08 40 BUILDING AUTOMATION SYSTEM
SECTION 26 08 50 HAND DRYERS
SECTION 26 09 24 LIGHTING CONTROL DEVICES
SECTION 26 24 16 PANEL BOARDS
SECTION 26 24 17 POWER PANELS
SECTION 26 27 19 CLASSROOM CONTROL PANEL MODULE
SECTION 26 27 26 WIRING DEVICES
SECTION 26 28 13 FUSES
SECTION 26 28 23 DISCONNECT SWITCHES-FUSED AND NON-FUSED
SECTION 26 29 01 CONTACTORS
SECTION 26 29 10 MOTOR STARTERS
SECTION 26 50 00 LIGHTING
SECTION 26 52 00 EMERGENCY LIGHTING
SECTION 26 53 00 EXIT SIGNS

DIVISION 27 COMMUNICATIONS

SECTION 27 11 19 STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS
SECTION 27 51 16 PUBLIC ADDRESS SYSTEM
SECTION 27 51 20 TELEPHONE SYSTEM
SECTION 27 53 13 CLOCK SYSTEM

DIVISION 28 ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 00 INTRUSION DETECTION SYSTEM

SECTION 28 46 00 FIRE DETECTION AND ALARM SYSTEM

SECTION 28 46 01 FIRE DETECTION AND ALARM SYSTEM VERIFICATION

END OF SECTION

PROJECT NAME: Eight Classroom Addition – St. Luke the Evangelist Catholic School

RDZ PROJECT NUMBER: 25041

Following Supplementary Electrical Bid Form is submitted by:

…….

(Bidding Company)

…….

(Street Address or P. O. Box No.)

…….

(City, Province and Postal Code)

Dated …… And which is an integral part of Bid Form.

In accordance with Instructions to Bidders, we provide the Supplementary Electrical Bid Form. We understand that the information provided to be considered an integral part of Bid Form and is to be completed in full.

Unless otherwise noted, submit Supplementary Electrical Bid Form **within Twenty-Four (24) hours of Bid closing**, via e-mail addressed to:

RDZ Engineers Ltd.
Attention: Fei Han
E-mail : Fei@rdzeng.ca
cc'd: rsukumaran@bba-archeng.com

Supplementary Bid Form Signature:

…….

(Signature of Authorized Representative)

…….

(Print Name)

…….

(Title)

A. LIST OF MANUFACTURERS/SUPPLIERS

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based and which we will supply. If no name is indicated, or if name identified is not listed in issued documents, or if more than one name is indicated for a particular product, we will if requested, provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance, and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance, and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us. Acceptance of non-base specified manufacturers with respect to their equivalency shall be as sole discretion of consultant.

We also acknowledge that failure to submit this list as specified or failure to submit within time defined may result in provision of base specified manufacturer's product, at discretion of consultant.

SECTION	PRODUCT	MANUFACTURER/SUPPLIER & CATALOGUE NUMBER
26 24 16	Panel Boards	
26 24 17	Power Panels	
26 27 26	Wiring Devices	
26 28 23	Disconnect Switches-Fused and Non-Fused	
26 29 01	Contactors	
26 50 00	Lighting	
26 52 00	Emergency Lighting	
26 53 00	Exit Signs	
27 11 19	Structured Cabling For Communication Systems	
28 46 00	Fire Detection and Alarm System	

B. SUBCONTRACTORS

We enclose herewith a list of Subcontractors to the Electrical Building Services which is an integral part of the Bid. We agree that the Subcontractors shall not be changed without good reason and permission for same must be obtained from the Owner.

Section — Subcontractor

27 11 19 – Structured Cabling for Communications Systems _____

27 51 16 – Public Address System _____

28 31 00 – Intrusion Detection System _____

28 46 00 - Fire Detection and Alarm System _____

C. UNIT PRICES AND LABOUR RATES

We enclose herewith Unit Prices and Labour Rates which are an integral part of the Bid. Unit prices and labour rates are in effect for the duration of this Project's construction period. Owner is not obligated to accept unit prices and labour rates quoted.

1. Labour Rates:
   Labour at the following rates shall be applied for additions or deletions to the work not covered by unit prices. The prices consist of salary, all agreed local union benefits. The rate quoted represents the net cost to the Contractor, exclusive of overhead and profit.

   Journeyman $/hour _____

   Foreman $/hour _____

2. Unit Prices:
   The following unit costs will apply to all additional or deleted work from the Contract and should include their proportional share of all labour equipment, materials, accessories, profits, overhead and taxes for a job completely installed. Applications of unit prices will be to the net difference of quantities of individual products and materials in each contemplated Change Notice or Revision Notice.

3. The unit prices will be used for additions and deletions. Credit rate for deletions shall be at 80%

4. Conduit and Cable:
   Supply and install the following conduit and cables including fastenings, clips, connectors, coupling boxes, etc. as required based on length as shown.

27mm Empty Conduit for length of 3500mm	$ _____
2#12-16mmC for length of 3500mm	$ _____
3#12-16mmC for length of 3500mm	$ _____
2#10-21mmC for length of 3500mm	$ _____
3#10-21mmC for length of 3500mm	$ _____
3#8-21mmC for length of 3500mm	$ _____

5. Receptacles:
   Supply and installation of one duplex receptacle, shall include the receptacle box, cover plate, 3000mm of conduit and wiring, including connection to adjacent receptacle and/or outlet box.

   $ _____

6. Fire Alarm System:
   Supply and installation of one fire alarm pull station, including conduits, wiring and connections,
   to the nearest fire alarm pull station based on 15000mm conduit and wiring length.

$ _____

Supply and installation of one fire alarm audible device complete with strobe lights including, conduit, wiring and connections to nearest fire alarm audible device based on 15000mm conduit and wiring length.

$ _____

7. Light Fixtures:

Supply and installation of the following lighting fixtures. The supply and installation of lighting fixtures shall include the fixtures, flexible conduit, wiring and connection to nearest outlet box containing 347 and/or 120volt circuits and the supply and installation of built-in drivers, 0-10V dimmers, etc. (Base conduit and wiring on 4500mm length).

.1 Supply and installation of one type 'A' fixture. $ _____
.2 Supply and installation of one type 'AA' fixture. $ _____
.3 Supply and installation of one type 'B' fixture. $ _____
.4 Supply and installation of one type 'C' fixture. $ _____
.5 Supply and installation of one type 'R' fixture. $ _____

END OF DOCUMENT

1. General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26, Division 27, and Division 28. The General Conditions, Supplementary Conditions and Division 1 are a part of this Specification and shall apply to this Division. This section also supplements requirements of Division 1, Division 23, Division 27, Division 28, Division 33, and Division 34.

.2 Issued for Construction documents are issued for Contractors' convenience for reference only and are a consolidation of issued drawings, specifications, and addenda. Consultant makes no representation of their completeness. Exact construction requirements to be based on official Bid issued drawings, specifications, and issued separate addenda. Contact Consultant for any clarifications.

1.2 APPLICATION

.1 This Section specifies requirements that are common to Electrical Divisions work Sections, and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence.

.2 Mention herein, or indication on the Drawings of articles, materials, operations, or methods requires that all such items shall be provided in the quality and quantity required, and that the operations shall be performed according to the methods prescribed, complete with all necessary labour and incidentals.

.3 <u>These Specifications shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings, but which is mentioned or reasonably specified in the other shall be considered as properly and sufficiently specified and shall be provided.</u>

1.3 REFERENCES

.1 All work shall conform to the latest Codes, requirements and approval of the Authorities having jurisdiction and shall be subject to acceptance by the Consultant, and the following codes and standards:

- OBC, Latest Edition and Local Building Department requirements.
- Ontario Fire Marshal latest requirements.
- OESC – Latest Edition
- Electrical Safety Authority – Latest Inspection Bulletins
- CSA C22.1, Canadian Electrical Code, Part 1 - Latest Edition

1.4 DEFINITIONS

.1 The following are definitions of words found in Electrical Divisions of the Specification and on associated drawings:
  .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, and partitions.
  .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
  .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
  .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete. Include labour, materials, and services necessary to supply and install items or work referred to.
  .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify, and certify.

.6 "As instructed" or where instructed" – means as instructed by the Consultant including supplementary instruction notices and job site instruction notices.

.7 "listed" - means that the materials or equipment has been tested in accordance with applicable standards and methods and has been approved and listed for the intended use by a testing company approved by the Authorities having jurisdiction.

.8 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery, and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties, and assistance to Contractor.

.9 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, remove obsolete materials and patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by consultant.

.10 "BAS" – means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.

.11 "Governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules, and regulations that apply to and govern work and to which work must adhere.

.12 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.

.13 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.

.14 "Approved" or "Approval" - means approved by Authorities having jurisdiction as conforming to Codes, Standards, By-Laws, etc.

.15 "Acceptable" or "Acceptance" – means acceptable to the Consultant as conforming together to the requirements of the contract documents.

.16 "Submit for Review" or "Submit Notice" – means submit to the Consultant.

.17 "Subject to Review" – means work shall be laid out for review by the Consultant. No work shall proceed until instructions have been obtained from the Consultant. Submit further information, shop drawings, samples etc. as specified and as may be requested by the Consultants.

.18 "Accessible" - means reachable by person with tools as required and where obstacles may be removed and replaced without cutting or breaking out materials.

.19 "board", "owner" - means School board.

.2 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

.3 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.5 DOCUMENTS

.1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.

.2 Drawings and Specifications are portions of Contract Documents and identify labour, products, and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.

.3 Read Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.

.4 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Electrical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

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

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

.7 Locations of equipment and materials shown may be altered, when reviewed by consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

.8 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa in Specification.

.9 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission and confirm exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

.10 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered a contract and there are no representations of any kind made by consultant to any other party.

.11 When scale and date of Drawings are the same, or when discrepancy exists within Specification, include most costly arrangement to take precedence.

.12 Unless otherwise specified in Division 00, Division 01, or "General Conditions", in the case of discrepancies or conflicts between Drawings and Specification, documents will govern in following order:
- .1 Specification.
- .2 Drawings of larger scale.
- .3 Drawings of smaller scale.
- .4 Drawings of later date when scale of Drawings is same.

1.6 IMPERIAL AND METRIC MEASUREMENTS

.1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.7 EXAMINATION OF DOCUMENTS AND EXISTING SITE CONDITIONS

.1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work and include for such conditions in Bid Price.

.2 Carefully examine electrical, structural, mechanical, and architectural drawings, and fully understand the functioning of the system described and specified under this Section. If in doubt, contact the engineer before submitting the Bid Price.

.3 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.

.4 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.8 WORK STANDARDS

.1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction are quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards, or amendments issued by local governing authorities.

.2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by consultant.

.3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:
- .1 Ontario Building Code (OBC)
- .2 Electrical Safety Authority (ESA)
- .3 Ontario Electrical Safety Code (OESC)
- .4 Canadian Standards Association (CSA)
- .5 Underwriters' Laboratories of Canada (ULC)
- .6 National Standards of Canada (CAN)
- .7 National Building Code of Canada (NBC)
- .8 National Fire Protection Association (NFPA)
- .9 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE)
- .10 National Electrical Manufacturers Association (NEMA)
- .11 Electrical and Electronic Manufacturers Association of Canada (EEMAC)
- .12 American National Standards Institute (ANSI)
- .13 Illuminating Engineering Society (IES)
- .14 Building Industry Consulting Services, International (BICSI)
- .15 Electronic Industries Association (EIA)
- .16 Canadian General Standards Board (CGSB)
- .17 Institute of Electrical and Electronic Engineers (IEEE)
- .18 Occupational Health and Safety Act (OHSA)
- .19 Technical Standards and Safety Authority (TSSA)
- .20 Workplace Hazardous Materials Information System (WHMIS)

.21 International Standards Organization (ISO)
.22 Material Safety Data Sheets by product manufacturers.
.23 Local utility inspection permits.
.24 Codes, standards, and regulations of local governing authorities having jurisdiction.
.25 Additional codes and standards listed in Trade Sections.
.26 Owner's standards.

.4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.

.5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay associated costs associated with these submittals.

.6 Unless otherwise specified, equipment is to be installed in accordance with the equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

.7 Work is to be performed by journeyperson tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined as stated in Ontario College of Trades and Apprenticeship Act.

.8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review by consultant at any time.

.9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

.10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to consultant and submission of reports and certificates to consultant.

.11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

.12 Electrical equipment and devices shall be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

.13 Makes and quality of the materials used shall be approved by the Consultants and authority having jurisdiction.

.14 Products and materials provided shall be new and free from all defects. Related materials shall be of the same manufacturer throughout the Project.

.15 Products and materials called for on the drawings or in the specifications by trade names, manufacturer names and catalogue reference are those which shall be used based on the Tender.

.16 Alternative products and materials to those specified shall only be considered if they are shown in the Tender as a material variation with an appropriate price adjustment. The Consultant reserves the right to accept or reject any alternative without explanation.

.17 Assume full responsibilities for ensuring that when providing alternative products or materials, all space, weight, connections, power, and wiring requirements, etc., are considered. Any costs incurred for additional components, changes to services, structural or space requirements, layouts, and plans, etc., that may be necessary will be borne by this Division.

.18 Materials or equipment rejected by the Consultants shall be immediately removed from the project and suitable materials shall be provided.

1.9 PERMITS, CERTIFICATES AND FEES

.1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

.2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work.

.3 Submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities.

.4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities to certify that completed Work is in accordance with regulations of regulatory authorities and is acceptable to them.

1.10 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

.1 Professional engineers retained to perform consulting services with regards to Project work, i.e., seismic engineer, fire protection engineer, structural engineer, are to be members in good standing with local Association of Professional Engineers and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer’s professional liability insurance is to protect Contractor's Consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned Consultants and their respective servants, agents, and employees in regard to the Work of this Contract.

.3 Liability insurance requirements are as follows:
- .1 coverage is to be a minimum of $1,000,000.00 inclusive of any one occurrence.
- .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice.
- .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work.
- .4 retained Consultants are to ascertain that Sub-Consultants employed by them carry insurance in the form and limits specified above.
- .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner’s Consultant, and Municipal Authorities as required prior to commencement of aforementioned Consultant’s services.

1.11 WORKPLACE SAFETY

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required and maintain one copy at site in a visible and accessible location available to personnel.

.2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces".

1.12 PLANNING AND LAYOUT OF WORK

.1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

.2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
.1 large ducts (main runs)
.2 cable tray and bus duct
.3 conduit 100 mm (4") dia. and larger
.4 smaller branch ductwork
.5 conduit less than 100 mm (4") dia.

.3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.

.4 Do not use Contract Drawing measurements for distribution equipment layout, conduit installation work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established benchmarks for both horizontal and vertical measurements. Coordinate with and make allowances for work of other trades. Accurately layout work and be entirely responsible for work installed in accordance with layout drawings. Where any grade or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

.5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼"=1' 0") of the work for coordination with General Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, disks of engineering drawings for this use. Prints and/or disks of Contractors' interference drawings are to be distributed among other Trade Contractors and General Contractor. Submit drawings to consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.

.6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

.7 Junction boxes for lighting, power, fire alarm, power packs, lighting controllers and such other systems devices and products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination by this Division.

1.13 COORDINATION OF THE WORK

.1 Fully understands the functions of the systems specified and have no doubts regarding the extent of the Contract.

.2 Examine the Architectural, Structural, Mechanical and Electrical drawings and become fully familiar with the work of other Divisions.

.3 Co-ordinate with all Divisions providing equipment and services and ensure that there is no confliction. Coordination requirements are to include but not be limited to following:
- .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work.
- .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.
- .3 depth and routing of excavation required for work, and requirements for bedding and backfill.
- .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.

.4 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes to enter building and be moved into spaces where they are to be located without difficulty.

.5 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building and protected from elements.

.6 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.

.7 Arrange equipment in proper relation with other apparatus, the building construction, the Architectural finish and with all work specified.

.8 Where space is shown for future equipment leave such space clear and ensure that the necessary connections can be made to the future equipment.

.9 Where work is to be integrated or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

.10 Failures to fully understand Drawings and allow for the work of other Divisions or where relocations are necessary due to lack of co-ordination between Divisions shall be remedied at the expense of this Division.

1.14 WORKMANSHIP

.1 All work shall be executed in a workmanlike manner and present a neat mechanical appearance.

1.15 EQUIPMENT AND MATERIALS

.1 Be responsible for ordering of products (equipment and materials) in a timely manner to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.

.2 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Canadian Standards Association (CSA) Standards and/or Underwriters Laboratories of Canada (ULC) Standards and the requirements of the authorities having jurisdiction.

.3 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.

.4 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Note that above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.

.5 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimension of such equipment differs from the specified equipment, prepare, and submit for review, accurately dimensioned layouts of rooms affected.

.6 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment.

.7 Where products you intend to provide are proposed as "an equal" and/or "or approved equal", to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.

.8 Only base specified products specified acceptable products or equipment listed as alternate will be considered for acceptance by the owner. No proposed substitutions will be accepted.

.9 Indicate in Form of Supplementary Electrical Tender, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for products unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.

1.16 SHOP DRAWINGS

.1 At start-up meeting, confirm with consultant products to be included in shop drawing submission. Prepare and submit list of products to consultant for review.

.2 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
.1 Product literature cuts.
.2 Equipment data sheets.
.3 Equipment dimension drawings.
.4 System block diagrams.
.5 Sequence of operation.
.6 Connection wiring schematic diagrams.
.7 Functionality with integrated systems.

.3 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification section reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.

.4 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.

.5 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated, and signed will be returned to be resubmitted. Submit electronic copies of shop drawings unless otherwise directed by consultant. Confirm exact requirements with consultant.

.6 Approval of a drawing by this Division implies the following:

1. The drawing has been checked by the person making the approval.

2. The equipment or material complies in all respects with the requirements of the specifications and drawings.

3. The quantities, if indicated on the drawing, are correct.

4. The physical dimensions of the components are such that they can be installed without interference with the building structure or other equipment, and that, after installation, there are sufficient clearances on all sides for the maintenance, servicing, and operation of the equipment.

.7 Consultant will review shop drawings and indicate review status by stamping shop drawing copies as follows:
.1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing.
.2 "REVISE AND RESUBMIT" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.

.8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each shop drawing or product data sheet submitted:

"THIS REVIEW BY CONSULTANT IS FOR THE SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAIL DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR, AND SUCH REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."

.9 Resubmit any drawing on which notations have been made, after it has been modified or corrected.

.10 Drawings that are re-submitted shall have a distinct notation of the fact made on each drawing.

.11 Works shall not proceed on any equipment, material or installation until the drawings have been reviewed by the Consultant.

.12 Each system and each major component are to be separate shop drawing submissions. Shop drawings for common devices such as devices of each system are to be submitted together.

.13 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

.14 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.

1.17 EQUIPMENT LOADS

.1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to consultant, via shop drawing submissions, prior to construction.

.2 When choice of specific equipment is made by Contractor, actual weight, location, and method of support of equipment may differ from those initially given to consultants and thus from those assumed for design. Consequently, it is necessary to back-check equipment loads, location, and supports.

.3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Be responsible for confirming locations of equipment with consultant prior to construction.

1.18 OPENINGS

.1 Supply opening sizes and locations to consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.

.2 No openings are permitted through completed structure without written approval of consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to consultant for review, well in advance of doing work.

.3 Chases, openings, cutting, patching, etc. shall be provided by this Division in accordance with those sections of the specification detailing the requirements.

.4 Flashing required for openings in walls, floors and roofs shall, unless otherwise noted, be provided by this Division.

.5 Electrical conduit roof flashing shall be similar to National Roofing supply product code# ECP-PVCH (electrical conduit post PVCH), Gooseneck S.S.A ARPGN2 (2”)/ ARPGN3 (3”).

.6 Drilling for hangers, rods, inserts and work of a similar nature shall be provided by this Division.

.7 Provide all necessary sleeves, inserts, anchor bolts, etc., prior to pouring of concrete or building of walls, roofs, etc.

.8 Advise the extent of such work and supply all information and details as to sizes and locations within thirty days after the award of the Contract.

.9 Failures to comply with the above requirements shall be remedied at this Division's expense.

.10 Where conduits pass through fire rated walls/ areas, proper fire stop material shall be used by Division 26. Submit shop drawings for review before installation.

1.19 SCAFFOLDING, RIGGING, AND HOISTING

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to review by and coordination with consultant.

.2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from consultant.

1.20 TEMPORARY CRANES

.1 Submit following to consultant for review:
- .1 Propose details showing existing structures and surfaces being used for lifting locations.
- .2 Copies of approvals of authorities for work.
- .3 Copies of approvals of property management of buildings affected by hoisting work, allowing for work.
- .4 Copies of required insurance for work.

1.21 CHANGES OR REVISIONS TO THE WORK

.1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of work from that required by Contract Documents, prepare, and submit to consultant for approval, a quotation being proposed cost for executing change or revision.

.2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as confirmed with consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

.4 Unless otherwise specified in Divisions 00 or 01, following requirements apply to all quotations submitted:
- .1 When change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work.
- .2 Material costs are not to exceed those published in local estimating price guides.
- .3 Electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labour Units.
- .4 Costs for journeyperson and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work.
- .5 Cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision and change or revision must be such that site superintendent's involvement is necessary.
- .6 Costs for rental tools and/or equipment are not to exceed local rental costs.
- .7 Overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals.
- .8 Quotations, including those for deleted work, to include a figure for any required change to Contract time.

.5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.

.7 Do not execute any change or revision until written authorization for the change or revision has been obtained from consultant.

1.22 BREAKDOWN OF ELECTRICAL WORK COST

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Consultant's approval and progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including system testing and verification, and project closeout submittals.

.3 Indicate equipment, material, and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.23 NOTICE FOR REQUIRED FIELD REVIEWS

.1 Whenever there is a requirement for consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to consultant.

.2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.

.3 Do not conceal work until consultant advises that it may be concealed.

.4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.24 PRELIMINARY TESTING

.1 When directed by consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.

.2 When, in Consultant’s opinion, tests are required to be performed by a certified testing agency, arrange, and pay for such tests.

.3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.

.4 When, in Consultant’s opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.25 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION

.1 Confirm with Consultant what equipment can be used during construction.

.2 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.

.3 During this period of construction, such systems/equipment to not become property of Owner or be Owner’s responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment to maintain validity of warranties after turning over to Owner.

.4 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, such systems/equipment to be cleaned, restored to "new" condition, paint finishes "touched up" etc.

1.26 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

.1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing, and commissioning.

1.27 PROTECTION

.1 Protect all finished and unfinished work from damage due to carrying out the work specified.

.2 Repair all damage resulting from execution of the work to the satisfaction of the Consultant.

.3 Should the project be stopped for any cause, provide all necessary protection to prevent damage by weather or other causes while such stoppage exists.

1.28 HANDLING AND STORAGE

.1 Materials and equipment shall be handled and stored in such a manner so that no damage shall be done to the materials, the structure of the building or surrounding property.

.2 Packaged or bundled materials and equipment shall be stored in dry weathertight secure enclosures in original undamaged condition with manufacturer's seals and labels intact.

.3 All metals shall be protected against corrosion and bending.

.4 Storage of materials, equipment etc. in the building structure shall not be permitted unless otherwise noted.

1.29 MINOR FIELD CHANGES

.1 The location, arrangement and connection of equipment and materials as shown on the drawings represents a close approximation to the intent and requirements of the Contract.

.2 The right is reserved to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes, if made prior to the installation, shall be done at no additional cost, unless the location, arrangement or connection is more than six feet from that shown on the drawings.

1.30 CLEANING UP

.1 During construction, and daily, keep the site reasonably clear of rubbish and waste material resulting from electrical work to the satisfaction of the Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove all rubbish and debris, and arrange for and pay for the repair of any damage caused as a result of electrical work.

.2 Clean the interior and exterior of all equipment and remove any debris during construction.

.3 Inspect and clean all systems and equipment prior to energizing and ensure that they are safe.

Perform a complete and thorough clean-up to the exterior and interiors of all systems and equipment before the final inspection. The interiors shall be cleaned using an industrial vacuum cleaner.

1.31 ELECTRICAL CONDUCTOR FIRE PTROTECTION

.1 Fire rated enclosures shall be provided to form service spaces for conduits containing electrical conductors for emergency power, elevators, and life safety equipment in accordance with the requirements of the Authorities having jurisdiction.

.2 Fire rated access panels shall be provided in the enclosures where required.

.3 The fire rated enclosures required by this Division shall, unless otherwise noted, be provided by this Division and shall be in accordance with the sections of the specification detailing the fire rated enclosures requirements.

.4 Advise the extent of the fire rated enclosures required and supply all information and details as to size and locations within thirty days after the award of the contract.

.5 Failures to comply with the above requirements shall be remedied at this Division's expense.

.6 Where fire rated cables, that comply with the requirements of the Authorities having jurisdiction, are provided it shall not be required that they be installed in fire rated enclosures.

1.32 SPRINKLER PROOF EQUIPMENT

.1 Where sprinklers are installed; electrical equipment shall be constructed so that water from the sprinkler heads shall not impair the effectiveness of the equipment.

.2 A separate and complete roof shall be provided on free standing or surface mounted equipment. An overhang at the front, rear and sides shall prevent the entrance of water either at the top or through projecting face plates, meters, etc. Provide complete gaskets to suit.

.3 Where openings are required in the roofs or sides of incoming and outgoing conduits and cables, removable gasketed plates shall be provided and the conduits and cables shall be installed using waterproof fittings. The plates are to be grounded by a separate copper strap to the equipment.

.4 Distribution and power panels, panel boards, etc. and switchboards shall be complete with gaskets and doors.

1.33 EQUIPMNENT AND MATERIAL COLOURS

.1 Where materials and equipment are specified to be a specific colour, a sample of the colour proposed by the manufacturer shall be submitted with the shop drawing.

.2 Where materials and equipment are specified to be of colours as selected by the Consultant, these shall be determined during the Contract. Obtain the colour requirements from the Consultant prior to submitting shop drawings so that the appropriate sample of the colour can be submitted with the shop drawings.

1.34 SLEEVES

.1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits passing through walls, partitions, ceilings, floors, etc.

.2 For wall partitions and ceilings, the ends of the sleeves shall be flush with the finish on both sides. For floors they shall extend 50mm above and below finished floor level.

.3 The space between the sleeve and the conduit and spare sleeves shall be filled with Dow Corning silicone RTV foam for fire stop. Caulk around the top and bottom with approved permanently resilient, non-flammable and weatherproof silicone base compound.

1.35 EXCAVATION AND BACKFILL

.1 The excavation and backfill required by this Division shall, unless otherwise noted, be provided by this Division and shall be in accordance with the Sections of the Specification detailing the excavation and backfill requirements.

.2 Advise the extent of the excavation and backfill work required by this Division and supply all information and details as to size and locations within thirty days after the award of the Contract.

.3 Failures to comply with the above requirements shall be remedied at this Division's expense.

1.36 HOUSEKEEPING PAD

.1 All floor mounted electrical equipment installed by this Division shall be mounted on concrete housekeeping pads which shall, unless otherwise noted, be provided by this Division.

.2 Advise the extent of the housekeeping pads required by this Division and supply all information and details as to size and location within thirty days after the award of the Contract.

.3 Failures to comply with the above requirements shall be remedied at this Division's expense.

1.37 CONCRETE

.1 The concrete and reinforcing required by this Division shall, unless otherwise noted, be provided by this Division and shall be in accordance with the Sections of the Specifications detailing the concrete and reinforcing requirements.

.2 Advise the extent of the concrete and reinforcing work required by this Division and supply all information and details as to size and locations within thirty days after the award of the Contract.

.3 Failures to comply with the above requirements shall be remedied at this Division's expense.

1.38 PAINTING

.1 All equipment shall be supplied with manufacturer's standard finish coat, unless otherwise noted.

.2 All supports, hangers, etc. provided or fabricated by this Division shall be painted with two coats of zinc chromate primer.

.3 Where the finish on any materials or equipment installed by this Division is damaged, it shall be touched-up, completely repainted or replaced to the satisfaction of the Consultant.

1.39 IDENTIFICATIONS

.1 Identify each item of equipment installed by this Division, whether supplied by it or not.

.2 Metal surfaces shall be thoroughly cleaned before application of identification.

.3 Identifications shall be installed after painting has been completed and shall be secured with self-tapping screws or rivets except when installed on the inside of doors when gluing will be acceptable.

.4 Manufacturer's nameplates shall be affixed to each item supplied showing the size, name of equipment, serial number and all information usually provided including voltage, cycle, phase, horsepower, etc., and the name of the Manufacturer and his address. Ensure that all stamped, etched, or engraved lettering on plates is perfectly legible. Do not paint over nameplates and where equipment is to be concealed attach the nameplates in an accessible location.

.5 Panels and all other equipment which have exposed faces in finished areas shall not have any visible trademarks or other identifying symbols. Nameplates shall be mounted on the inside of the doors.

.6 Each lighting panel shall have a directory mounted on the inside of the door behind a protective plastic screen. The directories shall be typewritten and shall identify each branch circuit used. Spares and spaces shall be noted in pencil.

.7 The nameplates for switchboards, distribution panels, power panels, etc. shall be Lamicoid with 13mm high letters with typical identification of e.g., "PP`AA, 600V 3 PH., 4W, fed from Switchboard `A' ".

.8 The nameplates for panel boards shall be Lamicoid with 9.5mm high letters with typical identification of: e.g., "LP`B', 208V, 3Ph, 4W, fed from PP'A'".

.9 Each breaker, switch, instrument, meter, etc. in switchboards, distribution panels, power panels, etc. shall have a Lamicoid nameplate with 6.4mm high letters with typical identification of: e.g., "Elevator #1" or “Pump-1A”.

.10 The nameplates for disconnect switches, starters, time clocks, dimmers etc. shall be Lamicoid with 6.4mm high letters with typical identification of: e.g., "Supply Fan "S4", 5 HP, 600V, 3Ph., 3W, fed from `PP-1'".

.11 Each feeder cable and feeder conduit shall be identified with 25mm high letters with typical identification of "208V, 3Ph, 4W to LP'B'". The identification shall be provided at each access door, each change of direction, each junction box, at each floor or platform for vertically exposed conduits or cables at 2 metres above floor, at not more than 15 metres apart in straight runs, and on both sides of sleeves through walls.

.12 The interior, exterior and lids of all junction boxes and outlet boxes shall be neatly identified with different colours of paint. The colours shall be consistent throughout the project for the following systems:
- .1 347/600 Volt System – Black
- .2 120/208 Volt System – Blue
- .3 120/208 Volt Lighting – Yellow
- .4 120/208 Volt Emergency Lighting System – Orange
- .5 Intrusion Detection System – Purple
- .6 Computer System – Pink
- .7 Fire Detection and Alarm System – Red
- .8 Telephone System – Brown
- .9 P.A./Telephone System – Green
- .10 Cable TV – White (Co-ordinate with the Board)

.13 Provide all signs and marking of equipment as required by the Authorities having jurisdiction.

.14 Outlet boxes for light switch(es) and receptacle(s) and junction boxes provided for lighting or power connections shall be identified on the box cover with circuits contained in the box, the panels from which they are fed, the voltage and the purpose of the outlet.

.15 Each power switch and receptacle shall be complete with permanent printed adhesive label installed on faceplate, identifying panel and circuit from which it is fed.

1.40 MOCK-UP

.1 A mock-up of the ceiling shall be provided by another Division of the Specification.

.2 Provide samples of the lighting fixtures, fire alarm devices and all other items of equipment mounted in or on the ceiling and obtain acceptance for the samples and their installation.

1.41 TEMPORARY AND TRIAL USAGE

.1 When it is claimed that a portion of the work is completed and in accordance with the Drawings and Specifications, the Owner shall have the privilege of temporary and trial usage for a reasonable length of time for making a complete and thorough test of the portion of the work completed.

.2 Temporary or trial usage by the Owner of any electrical device, machinery, apparatus, equipment or any other work or materials supplied under this Contract before final completion and written acceptance, is not to be construed as evidence of acceptance of same.

1.42 RECORD (AS-BUILT) DRAWINGS

.1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version confirmed with consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from consultant by paying $2,500. Drawings may also to be used for preparation of layouts and interference drawings.

.2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes, and deviations from routing of services and locations of equipment shown on Contract Drawings, daily. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep always set up to date, and ensure set is always available for periodic review. As-built set is also to include the following:
- .1 Dimensioned location of inaccessible concealed work.
- .2 Locations of control devices with identification for each.
- .3 Location of all pull boxes and junction boxes.
- .4 Locate, with dimensions to the building grid and datum lines, all buried and concealed services, pull boxes, junction boxes, etc. for all systems.
- .5 Location of all conduits, ducts, wiring, and conductor runs for all systems including sizes, types of components, circuit numbers, etc. exactly as installed.
- .6 Location of concealed services terminated for future extension.
- .7 Room names and numbering, equipment names, etc. shall be in accordance with the Owner's designation and may not necessarily be those shown on the drawings.

.3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to consultant for review. Make necessary revisions to drawings as per Consultant’s comments, to satisfaction of consultant.

.4 Reviews of the record drawings by the Consultant shall be for general conformance only and is not an approval of the accuracy of the drawings. Electrical Division shall be responsible for the accuracy of the record drawings.

.5 Submit final reviewed "as-built" drawing set to consultant to produce final “as-built” CAD drawings for submission to the School Board.

.6 Transfer all recorded information from marked-up set of As-Built condition to AutoCAD.

.7 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of consultant.

1.43 TESTING AND COMMISSIONING

.1 All systems, equipment and installation shall be inspected, tested, adjusted, and commissioned to ensure compliance with the Drawings, Specifications and the Requirements of the Authorities having jurisdiction.

.2 Provide testing equipment, instruments, material and labour for all testing and commissioning.

.3 Submit reports of all testing and commissioning for review by the Consultants.

.4 This Division shall include for the cost of one qualified serviceman, completely familiar with the project, complete with appropriate spare parts and tools, to become part of the commissioning team for the project. The serviceman shall assist the Owner for a total of 60 hours during the commissioning process. This work will be required at or near the substantial completion phase of the project. Each Division and/or trade providing serviceman shall ensure continuity of their function by having only one such person assigned to the commissioning team.

.5 The actual performance of this work will be scheduled and coordinated by the Owner.

1.44 SYSTEM ACCEPTANCES

.1 Prior to requesting final inspection, submit, for review by the Consultant, letters from the manufacturers of equipment and systems indicating that their Technical Service Representatives have inspected and tested the equipment and systems and are satisfied with the methods of installation, connections, and operation.

.2 Acceptance letters shall be submitted for the following, when applicable:
.1 Switchboard
.2 Distribution Panels
.3 Power Panels
.4 Panel Boards
.5 Fire Detection and Alarm System
.6 Emergency Lighting System
.7 Intrusion Detection System
.8 Video Surveillance System
.9 Public Address System
.10 Lighting Control System

1.45 INSTRUCTIONS AND DEMONSTRATIONS

.1 Instruct the Owner's designated personnel during construction and prior to requesting final inspection so that they are fully familiar with all aspects in the function, installation, operation and maintenance of all systems and equipment.

.2 Arrange for and pay for the services of manufacturer's service technicians, engineers and other personnel required for instruction on specialized systems or installation.

.3 After commissioning of the systems, equipment, and installation they shall be fully demonstrated by this Division and representatives of the manufacturers to the Authorities having jurisdiction.

.4 Prior to requesting final inspection submit, for each system, the following:
.1 Dates and durations of instructions given to designated personnel and the names of persons instructed.
.2 Signature of each person instructed stating that they understand and are familiar with the function, installation, operation, and maintenance of the system.
.3 Dates and durations of demonstrations to Authorities having jurisdiction and names of all persons present.

1.46 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

.1 Supply one hard copy of operating and maintenance (O&M) manuals consolidated in hardcover three "D" ring binders with each binder sized to include approximately 25% spare space for future data. Confirm exact quantity of manuals with consultant. Each binder to include:
.1 On front cover: project name; wording – "Electrical Systems Operating and Maintenance Manual"; and date.
.2 Introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses.
.3 Equipment manufacturer's authorized contact person name, telephone number and company website.
.4 Table of Contents sheet, and corresponding Index tab sheets for all electrical specification sections.
.5 Copy of each "Reviewed" or clean, updated "Reviewed As Noted" shop drawing or product data sheet, with manufacturer’s/supplier’s name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;

.6 Testing and commissioning reports, and certificates issued by governing authorities.
.7 Operating data is to include:

.1 Demonstration and instruction certificate.
.2 Description of each system and its controls.
.3 Control schematics for equipment/systems.
.4 Description of operation of each system.
.5 Operation instruction for each system and each component.
.6 Description of actions to be taken in event of emergencies and/or equipment failure.
.7 Testing procedures.
.8 Trouble finding procedure.

.8 Maintenance data is to include:

.1 Servicing maintenance, operation, and trouble-shooting instructions for each item of equipment and each system.
.2 Schedules of tasks, frequency, tools required, and estimated task time.
.3 Complete spare parts lists with numbers.
.4 Catalogue sheets for all components.
.5 Approved shop drawings.
.6 Wiring diagram.

.9 Copies of warranties.
.10 Items requested specifically in Section Articles.

.2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner’s building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

.3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O&M Manual and submit to consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

.4 Provide 1 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as confirmed with consultant and enhanced with bookmarks and internal document links. Each PDF file name shall be the same as that indicated in the binder. The contents in each PDF file shall be searchable.

1.47 COMMISSIONING

.1 A commissioning Authority will be appointed by the Board/Owner to oversee the commissioning activities of the electrical contract. Cooperate and coordinate with the Authority. Perform all commissioning activities for all aspects of work provided in Electrical Divisions. Perform all corrective work identified by the Authority.

.2 Comply with the requirements of sections 20 05 40 and 25 05 15, prepared by Commissioning consultant.

1.48 WARRANTY

.1 Unless otherwise specified in Divisions 00 and 01, warrant electrical work to be in accordance with Contract Documents and free from defects for a period of one (1) year from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., five (5) years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner.

.3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.

.4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.

.5 Do not include Owner deductible amounts in warranties.

.6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.

.7 Submit signed and dated copies of extended warranties to consultant which clearly states herein specified requirements.

.8 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:
   .1 once during first month of building operation.
   .2 once during third month of building operation.
   .3 once between fourth and tenth month in a season opposite to first- and third-month visits.

.9 The following table indicates the warranty period that shall be provided for the following equipment:

EQUIPMENT	ITEMS	WARRANTY
LIGHTING	All types of lighting fixtures including LED lamps, drivers, and other associated components.	5 YEARS
LIGHTING CONTROLS	Lighting controls components including occupancy sensors, power packs, dimming switches, room controllers, control wiring and other associated components	5 YEARS
DISTRIBUTION	Electrical distribution including switchboard, power panels, panel boards, contactors, transformers, relays, cables, wiring etc.	1 YEAR
FIRE ALARM SYSTEM	Fire alarm system	1 YEAR

EQUIPMENT	ITEMS	WARRANTY
	completes with all components, devices etc.	
TELECOMMUNICATIONS NETWORK INSTALLATIONS	Data system completes with all components, devices etc.	1 YEAR WARRANTY COVERING THE INSTALLED CABLING SYSTEM. MINIMUM 15 YEAR MANUFACTURER'S EXTENDED ASSURANCE WARRANTY FOR THE ENTIRE COMMUNICATIONS CABLING SYSTEM.
PUBLIC ADDRESS SYSTEM	Public address system complete with all components, devices etc.	1 YEAR
SECURITY SYSTEM	Security system complete with all components, device etc.	5 YEAR

.10 The Owner/Board reserves the right to initiate a service contract for all equipment with one of the boards approved certified service companies. This shall not affect any of the above extended warranties provided by the manufacturers.

1.49 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

.1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for equipment/system manufacturer's authorized representative to visit site to examine installation, and after any required corrective measures have been made, to certify in writing to consultant that equipment/system installation is complete and in accordance with equipment/system manufacturer's instructions.

1.50 EQUIPMENT AND SYSTEM START-UP

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in electrical work Sections in accordance with following requirements:
  .1 Submit a copy of each equipment/system manufacturer's start-up and verification report sheet to consultant for review and incorporate any comments.
  .2 Under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit a complete set of start-up and verification documentation sheets signed by manufacturer/supplier and Contractor, to consultant.

1.51 PROJECT CLOSEOUT SUBMITTALS

.1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
  .1 Operating and Maintenance Manuals.
  .2 As-built record drawings and associated data.
  .3 Extended warranties for equipment as specified.
  .4 Operating test certificates, i.e., Fire alarm verification Certificate.

.5 Final commissioning report.
.6 Identified keys for equipment and/or panels for which keys are required, and other items required to be submitted.
.7 Other data or products specified.

1.52 INSTRUCTIONS TO OWNER

.1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.

.2 Train Owner’s designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.

.3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner’s choice), of Owner’s designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.

.4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
.1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations.
.2 Troubleshooting – diagnostic instructions, test, and inspection procedures.
.3 Documentation – equipment/system warranties, and manufacturer’s/supplier’s parts and service facilities, telephone numbers, email addresses, and the like.
.4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools.
.5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
.6 The training sessions shall be scheduled and co-ordinated by the Commissioning Agent. The Commissioning Consultant shall video tape the sessions. Refer to Section 20 05 40 for further requirements.

.5 Before instructing Owner's designated personnel, submit to consultant for review a preliminary copy of training manual and a proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.

.6 Obtain in writing from consultant a list of Owner’s representatives to receive instructions. Submit to Consultant prior to application for a Certificate of Substantial Performance of the Work, a complete list of systems for which instructions were given, stating for each system:
.1 Date instructions were given to Owner’s staff.
.2 Duration of instruction.
.3 Names of persons instructed.
.4 Other parties present (manufacturer’s representative, consultants, etc.).

.7 Obtain signatures of Owner’s staff to verify they properly understood system installation, operation, and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

.8 Submit to Consultant, copy of electronic version of training materials used to train Owner's designated personnel. Include in operating and maintenance manuals submission.

1.53 FINAL INSPECTION

.1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
  .1 Deficiencies noted during job inspections have been completed.
  .2 Field quality control procedures have been completed.
  .3 Systems have been tested and verified, adjusted, and are ready for operation.
  .4 Maintenance and operating data have been completed and submitted to, reviewed, and accepted by consultant.
  .5 Tags and nameplates are in place and equipment identifications have been completed.
  .6 Clean-up is complete.
  .7 Spare parts and replacement parts specified have been provided and acknowledged by consultant.
  .8 As built and record drawings have been completed and submitted to, reviewed, and accepted by consultant.
  .9 Owner's staff has been instructed in operation and maintenance of systems.
  .10 Commissioning procedures have been completed.

1.54 SUB-CONTRACTORS TO THE ELECTRICAL CONTRACTOR

.1 The Electrical Contractor agrees to employ those sub-contractors proposed in the Electrical Form(s) of Tender and accepted by the Board/Owner at the signing of the Contract with the General Contractor.
  .1 The Board/Owner may, for reasonable cause object to the use of a proposed Sub-Contractor and consequently, may require the Electrical Contractor to employ one of the other Sub- Contractors or Bidders.

.2 If the Board/Owner requires a change from a proposed Sub-Contractor originally proposed by the Electrical Contractor, the Contract Price shall be adjusted by the difference in cost.

.3 The Electrical Contractor shall not be required to employ as a Sub-Contractor, a firm to whom he may reasonably object.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
- .1 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.
- .2 CSA-C22.2 No. 51 (latest edition), Armoured Cables.
- .3 CSA C22.2 No. 38 (latest edition), Thermoset-Insulated Wires and Cables.
- .4 CSA C22.2 No. 75 (latest edition), Thermoplastic-Insulated Wires and Cables.
- .5 CSA C22.2 No .0.3 (latest edition), Test Methods for Electrical Wires and Cables.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Low voltage wires and cables up to 4/0 shall, unless otherwise noted, have copper conductors with T90 Nylon, 600-volt insulation.

.3 Low Voltages wires and cables 250 MCM and larger shall, unless otherwise noted, have copper conductors with RW90 X-Link minus 40 degrees F, 1000-volt insulation.

.4 Aluminium sheathed feeder cables shall, unless otherwise noted, have a corrugated seamless aluminium sheath, copper conductors, RA90 X-Link minus 40 degrees F, 1000-volt insulation and <u>without P.V.C. jacket</u>.

.5 M.I.C.C. cables shall have solid copper conductors insulated with magnesium oxide and enclosed in a seamless copper sheath with a protective jacket where required.

.6 All outdoor and underground wiring shall have copper conductors with RWU-90, X-Link, minus 40 degrees F, 1000-volt insulation.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Wires and cables shall be selected so that their current carrying capacity conforms to the standards of the Authorities having jurisdiction.

.3 Feeders and branch circuits shall be as indicated on the drawings. Supporting of wires and cables with tie wires, perforated straps, etc., shall not be permitted. Electrical Contractor shall use approved clips.

.4 <u>Unless otherwise indicated on the drawings no wire smaller than #12 AWG shall be used except for internal wiring of lighting fixtures which can be #14.</u>

.5 BX90 aluminium sheathed cable, unless otherwise noted, may be used in accessible ceiling space and where concealed only. Install BX cables with anti-short bushings.

.6 Aluminium sheathed and M.I.C.C. cables shall be installed with horizontal supports at not more than 1220mm intervals and shall be spaced, bonded, and grounded in accordance with the requirements of the Authorities having jurisdiction.

.7 Aluminium sheathed and M.I.C.C. cables shall be terminated with moisture proof connectors.

.8 Where single conductor cables enter a ferrous box, provide the required non-ferrous plates. Slotting between the knockouts shall not be accepted.

.9 Aluminium sheathed and M.I.C.C. cables shall be suitably protected, when installed within 5 feet of the floor and in all locations where they might be subject to mechanical injury.

.10 Joints in feeder cables shall not be permitted.

.11 Joints in branch circuit wiring shall only occur where such circuits divide at a junction box and shall be mechanically and electrically sound and shall be securely fastened by means of "Ideal" 600V special service wire nut connectors.

.12 Conductors shall be colour coded and the colour coding shall be consistent throughout the project.

.13 Conductors shall be identified with self-sticking wire markers, indicating circuit number at all terminations and joints, at panels, pull boxes, junction boxes, etc.

.14 Termination lugs for feeder cables shall be compression type.

.15 All outdoor and underground wiring shall have copper conductors with RWU-90, X-Link, minus 40 degrees F, 1000-volt insulation.

.16 Wiring terminated in an outlet box for future lighting or power shall have 250mm of slack and each cable shall be terminated in a connector.

.17 Exposed cable runs shall be installed parallel to, or horizontally on, the walls of the building.

.18 Loads shall be circuited to provide fully balanced feeders.

.19 Only lubricants approved by the Authorities having jurisdiction shall be used and they shall be suitable for the type of cables installed.

END OF SECTION

1.1 GENERAL

1.2 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 OESC – Latest Edition.
  .2 Electrical Safety Authority – Latest Inspection Bulletins.
  .3 CSA C22.1, Canadian Electrical Code, Part 1 – Latest Edition.
  .4 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, where applicable.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The grounding equipment shall be in accordance with CSA C22.2 and the copper grounding conductors in accordance with ASA G7.1.

.3 Provide non corroding accessories necessary for the grounding system.

.4 Building ground system to consist of a grid of copper welded ground rods (minimum 4' to 10' (1.2m to 3m) long spaced minimum of 10' (3m) apart, interconnected with bare minimum No. 3/0 AWG copper loop. Ground rods shall be driven sufficiently to contact permanent water table. Provide minimum No. 3/0 AWG copper ground loop inside electrical room and vaults for grounding of equipment enclosures and connect to ground grid. Connect building water service pipes (both street and building sides), gas service pipes and sprinkler system pipes, supply and return hot water heating pipes to ground system with minimum No. 3/0 AWG copper ground conductor in conduit. Perform resistivity test on soil to determine exact quantity of rods (minimum of 4).

.5 All buried ground connections shall be Thermit welded type.

.6 Provide one (1) No. 3/0 AWG insulated green copper ground conductor in conduit from the main building ground to the main Telephone/LAN Room. Provide a minimum 24" (600mm) long x 2" (50mm) high x 3/8" (10mm) thick copper ground bus and install on wall with standoff isolators and connect to 3/0 cable. Ground bus to have eight drilled taps. Provide one (1) #6 AWG green ground conductor in conduit from this ground bus and extend to each satellite LAN Room and coil for future connection to computer cable termination rack.

.7 Where cable trays are used for the data cabling pathways, ensure that they are grounded and bonded in accordance with the Ontario Electrical Safety Code.

.8 Continuous rows of fluorescent/LED fixtures shall be equipped with No. 12 bare copper ground wire for the full length of fixture row.

.9 The accessories shall be as manufactured by Burndy, Erico, Amp or Caldweld.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide complete permanent and continuous, system and equipment grounding systems including, ground rods, conductors, connectors, accessories, to conform to requirements of the Authorities having jurisdiction.

.3 Install connectors to manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 All non-current carrying metal parts shall be bonded in accordance with ESA, CSA, and provincial inspection department standards.

.6 The neutrals of the dry-type transformer shall be connected by a separate copper ground wire to the ground bus in the switchboard.

.7 A separate copper ground wire to the ground bus in the switchboard shall be provided for each isolation transformer and isolated ground lighting panel.

.8 Separate copper wire shall be installed in all flexible conduits, in all rigid conduits, in wall or below slab conduits, EMT conduits and all non-metallic conduits.

.9 Connect the ground bus in the main switchboard to the main ground and incoming water main ahead of the water meter and provide a water meter shunt.

.10 The grounding system in the main switchboard shall be suitable for use with the ground fault system.

.11 Install separate grounding/bonding systems for telephone system, fire detection and alarm system, public address system, video surveillance system and intrusion detection system, in accordance with the systems suppliers' requirements.

.12 Install grounding system for pad mounted transformer in accordance with ESA and Local Hydro requirements.

.13 All grounding conductors run inside of building, except in electrical and LAN rooms, shall be run in EMT conduit.

.14 Install separate ground conductor for outdoor lighting standards.

.15 Install grounding connections to typical equipment included in, but not necessarily limited to following list: Service equipment, transformers, switchgear, duct systems, motor frames, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting etc.

.16 Install electrode interconnections where metal parts, circuits, or grounding conductors and/or electrodes are in proximity to lightning rod conductors.

.17 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Owner's Representative and local authority having jurisdiction over installation.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Type `C', `D', `T' and `E' pull boxes, junction boxes and cabinets shall be made of code gauge steel with corners lapped and welded and shall be painted and identified as noted in this specification.

.3 Cabinets shall provide proper space for conduits, wires and connections and their size shall be in accordance with the requirements of the Authorities having jurisdiction.

.4 The trim and cover shall be as required by the service and location.

.5 Splitters shall be sheet metal enclosure complete with welded corners and formed hinged cover suitable for locking in closed position.

.6 Splitters main and branch lugs/connection bars shall match the required size and number of incoming and outgoing conductors as indicated on drawings.

.7 At least three spare terminals shall be provided on each set of lugs in splitters less than 400A.

.8 The metal cabinets shall be as manufactured by Eaton, Square-D, Siemens, or Hammond.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Pull boxes, junction boxes and cabinets shall be independently supported from the conduit connected to them.

.3 Pull boxes shall be installed in inconspicuous but accessible locations.

.4 The cabinets shall be suitable for the installation and location.

.5 Cabinets shall be mounted with top not higher than 2m above finished floor.

.6 All electrical pull boxes above drywall ceilings shall be accessible via a properly sized access door installed directly below the respective pull box in drywall ceilings. Temporary removal of electrical light fixtures will not be considered safe access to above ceiling electrical boxes and shall not be permitted and acceptable.

.7 Install splitters and mount plumb, true and square to the building lines.

.8 All pull boxes, cabinets, equipment shall be identified in accordance with Section 26 05 01, Electrical Work General Instructions.

.9 Identification labels shall be provided indicating system name voltage and phase.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.1, Canadian Electrical Code, Part 1.
  .2 OESC – Latest Edition.
  .3 Electrical Safety Authority – Latest Inspection Bulletins.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Size boxes in accordance with latest edition of OESC and/or CSA C22.1.

.3 102 mm square or larger outlet boxes shall be provided as required for special devices.

.4 Blank cover plates shall be provided for all outlet boxes without wiring devices.

.5 347 V outlet boxes shall be provided for 347 V switching devices.

.6 Barriers shall be provided for outlet boxes where more than one system are grouped.

.7 Outlet boxes used with rigid steel conduit shall be `FS' or `FD' Feraloy condulets.

.8 Outlet boxes used with EMT conduit shall be electro-galvanized and made of code gauge steel except when they are surface mounted on walls and then they shall be `FS' or `FD' Feraloy condulets.

.9 Outlet boxes installed outside the building shall be weatherproof type, with neoprene gasket and cast cover.

.10 Electro-galvanized steel masonry single and multi-gang boxes shall be provided for devices flush mounted in exposed block walls.

.11 Electro-galvanized sheet steel concrete type boxes shall be provided for flush mount in concrete with matching extension and plaster rings as required.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 All outlet boxes shall be supported independently of connecting conduits.

.3 Outlet boxes shall have adequate knockouts, but only those knockouts actually required shall be opened.

.4 Outlet boxes shall be securely fastened to the surface on which they are mounted. If the boxes are not mounted on a surface, then adequate and independent supports must be provided.

.5 Outlet boxes shall be provided for each surface mounted lighting fixture.

.6 Outlet boxes shall be provided for each recessed mounted lighting fixture.

.7 Multi-gang outlet boxes with single cover plate shall be used where switches are grouped.

.8 Unused opened knockouts shall be closed with steel knockout plugs.

.9 Correct size of openings shall be provided in boxes for conduit, mineral insulated and armoured cable connections. Installation of reducing washers will not be acceptable and allowed.

.10 All electrical outlet boxes above drywall ceilings shall be accessible via a properly sized access door installed directly below the box in drywall ceilings. Temporary removal of electrical light fixtures will not be considered safe access to above ceiling electrical boxes and shall not be permitted and acceptable.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CAN/CSA-C22.2 No. 62 (latest edition), Surface Raceway System.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Supply and install a surface raceway system. The raceway is to be wall mounted or otherwise supported as indicated. It is to be used as a flexible wiring system and for the installation of receptacle outlets and computer in heavily serviced areas, as shown on the drawings.

.3 The raceway is to be two channels with removable cover to provide access to wiring and to permit the easy addition or alteration of circuits and devices at any time. Fabricate raceway and cover shall be from high impact plastic material and homogeneous coloured plastic. Finish Colour to be selected by the Architect.

.4 Multi-channel raceway is to be provided for power circuits and computer wiring as indicated.

.5 The system shall be suitable for 120/208V, 3 phase, 4 wire distribution.

.6 The system shall be Panduit T70 two channel raceways for locations as shown on Drawings.

.7 Provide all fittings and covers necessary for the installation. Fittings and covers shall be tampered resistant to prevent unauthorized access to the wiring. This shall include but not limited to the following items:
  .1 Raceway base and cover
  .2 Divider wall
  .3 Wire retainer
  .4 Base coupler fitting
  .5 Cover coupler fitting
  .6 T70 right angle fitting
  .7 T70 end cap fitting
  .8 Mounting bracket
  .9 Connector clip
  .10 2-port screw-on sloped faceplate – data
  .11 2-port screw-on sloped faceplate - power
  .12 Device box/ bracket for standard data/communication and electrical devices
  .13 Cover plates for standard data/communication and electrical outlets

.14 Duplex receptacle outlets

.8 Receptacles shall be as specified in Section 26 27 26.

.9 Computer outlets/ jacks shall be as specified in Section 27 11 19.

.10 Devices shall be flush mounted inside the raceway.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install the raceway and accessories in a neat and orderly manner.

.3 Raceways shall be installed horizontally on millwork, walls above counters, baseboards, and backsplash, fixed to drywall or masonry wall surfaces, at mounting heights indicated on the drawings.

.4 Arrange for the installation of backing in drywall partitions to ensure that the raceway is securely fastened. Horizontal metal studs mounted with sheet metal screws are satisfactory. Fasten raceway base to backing.

.5 Use continuous lengths for standard lengths. For shorter lengths, field cut to suit. Carefully cut all barriers, covers and bases. Make cuts at right angles. Cut edges to be free from burrs, sharp edges, bends, and other distortions. Use a floor mounted power hacksaw or similar device for cuts.

.6 In-feeds are to be conduit run concealed in walls and ceiling space for new walls and vertical raceway for existing walls.

.7 Install wire and devices as required.

.8 Mount Lamacoid nameplates on raceway devices plates, above or below each outlet. Attach with screws. Adhesive fasteners are not acceptable. Engrave with circuit number, including panel designation, and computer outlet number.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 45, Rigid Metal Conduit.
.2 CSA C22.2 No. 83, Electrical Metallic Tubing.
.3 CSA C22.2 No. 211.2, Rigid PVC (Un-plasticized) Conduit.
.4 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.5 CAN/CSA C22.2 No. 227.3, Flexible PVC conduit. Non-metallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit the following to the Consultant for review:
.1 Location drawings for all required sleeves and formed openings in poured concrete or precast concrete construction.
.2 Samples of materials and any other items as specified in succeeding Sections of this Division of the Specification.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Rigid metal conduits shall be electro-galvanized and made of standard weight steel pipe and connected with electro-galvanized threaded couplings.

.3 Electrical metallic tubing shall be a metal raceway which has a wall thinner than that of rigid metal conduit and an outside diameter sufficiently different from that of rigid metal conduit to render it impracticable for anyone to thread it with a standard pipe thread.

.4 Rigid PVC conduits shall be a rigid non-metallic conduit of un-plasticized polyvinyl chloride.

.5 Rigid Type I shall be similar to rigid PVC duct, Type EB1, to CSA Standard B196.1 requiring encasement in concrete.

.6 Rigid Type II shall be similar to Type I except of heavier construction and suitable for direct burial.

.7 Flexible conduits shall be liquid-tight flexible metal conduit.

.8 Rigid metal conduits entering boxes in dry locations shall be secured with galvanized steel locknuts and nylon insulated steel bushings.

.9 Rigid metal conduits entering boxes in wet locations shall be secured with steel bullet hub connectors, nylon insulated with neoprene `O' ring.

.10 Connectors for EMT surface mounted conduit shall be steel, set screw and nylon insulated.

.11 Connectors for EMT conduit in concrete shall be steel, raintight, concrete tight and nylon insulated.

.12 Couplings for EMT conduit surface mounted shall be steel set screw type.

.13 Couplings for EMT conduit in concrete shall be steel, rain tight and concrete tight.

.14 Connectors for flexible conduit shall be steel, liquid-tight, nylon insulated with neoprene `O' ring.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change, or violate any part of the installed system components or the CSA/UL certification of these components.

.3 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.4 Raceways shall be as shown on the Drawings and as detailed in the Specification.

.5 The size of conduit shall be in accordance with the requirements of the Authorities having jurisdiction.

.6 All conduits inside the building shall, unless otherwise noted, be electrical metallic tubing.

.7 Unless otherwise noted branch circuit conduits shall be concealed in wall and ceilings or exposed in unfinished areas and shall not be installed below or in any concrete slab unless otherwise approved by the owner/consultant. Where it is noted that branch circuit conduits can be installed in a concrete slab that is not on grade the conduit shall be electrical metallic tubing with a copper ground wire.

.8 Conduits exposed to the weather, in wet locations, subject to mechanical injury or in any hazardous locations, shall be rigid metal conduit.

.9 Conduits in plenums shall be rigid metal conduit.

.10 Telephone zone conduits shall be PVC conduit when installed in concrete and EMT in other locations.

.11 Telephone distribution conduits shall be rigid P.V.C. conduit when installed in concrete or underground and EMT conduit in other locations.

.12 Motor feeder drops shall be in rigid conduit with a maximum 910mm of flexible metal conduit. Rigid conduit for the drops shall start at least 910mm ahead of the actual bend and have two additional clips over normal requirements. The minimum conduit size for the drops shall be 19mm.

.13 Liquid tight flexible metal conduit shall be used for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.14 Explosion proof flexible connection shall be used for connection to explosion proof motors.

.15 Conduit sealing fittings shall be installed complete with compound in hazardous areas.

.16 Conduits in finished areas shall be concealed and those in unfinished areas shall be surface mounted unless otherwise noted.

.17 Feeder conduits shall not be installed in or below any concrete slab, unless approved by the Consultant.

.18 Conduits shall be installed so that the conductors can be drawn in without strain or injury.

.19 Expansion fittings shall be installed in conduits crossing expansion joints.

.20 Conduits shall be installed to provide for expansion and expansion fittings shall be provided where required.

.21 Conduits shall not be installed within 75mm of water, sprinkler, drain or waste piping.

.22 Exposed conduits shall run parallel to or horizontally on the walls of the building.

.23 Conduit ends shall be carefully plugged during construction with steel capped bushings.

.24 The use of running threads shall not be permitted. Ericson couplings shall be used where required.

.25 Conduits shall not pass-through structural members without the approval of the Consultants.

.26 Powder activated fastenings can only be used if approved by the Consultant.

.27 Conduits shall be fastened with approved clips. Supporting of conduits with tie wires, perforated straps, etc. shall not be permitted. If a conduit rests on structural steel, etc., this will not be considered as a support. Provide proper supports, hangers, etc. and supports conduits from the top of structural beams/joists.

.28 Conduits shall not be attached or suspended from the metal deck unless approved by the Consultant.

.29 Conduit supports shall be spaced in accordance with the requirements of the Authorities having jurisdiction.

.30 An adequate number and size of pull boxes shall be installed where required in all conduits runs to facilitate the installation of the conductors.

.31 Fish wires shall be installed in all empty conduits, including telephone conduits.

.32 Excessive lengths of flexible conduit shall not be accepted. Maximum 10'-0" of length will be acceptable.

.33 Proper metallic contacts shall be made between conduit, boxes, etc.

.34 Maximum size of conduit on which ground bushings can be used is 32mm.

.35 A separate ground wire shall be installed in all flexible conduits, EMT conduits, underground conduits, in wall or below a concrete slab, underground parking lot lighting and in all non-metallic conduits or ducts.

.36 Installation of conduit in oversize knockouts shall not be accepted.

.37 Joints in conduits installed underground, in concrete slab on grade or in a concrete duct bank shall be pitched on the outside and made completely watertight.

.38 Minimum concrete thickness over a conduit in a concrete slab where applicable shall be 50mm.

.39 Spare or unused conduits that terminate in an enclosure shall be capped.

.40 Conduits passing through concrete and/or masonry floors, walls, roof and any other such construction shall be provided with sleeves.

.41 Electrical conduit roof flashing shall be similar to National Roofing supply product code# ECP-PVCH (electrical conduit post PVCH), Gooseneck S.S.A ARPGN2 (2")/ ARPGN3 (3").

.42 Protect conduits from damage where they stub out of concrete. Use rigid steel conduit for stub-up and adapt to in floor rigid PVC conduit.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit manufacturer's instructions, printed product literature and data sheets. Include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Provide dual hanger system as described below and as shown on drawings.

.3 Hangers where noted are to be complete with the following features:
.1 4" J-Hook; Legrand cat. # CJ64H.
.2 Approximately 150 mm (6") high by 50 mm (2") wide.
.3 Constructed from steel.
.4 Pre-galvanized finish.
.5 Suitable for wall or suspended mounting.
.6 J-Hooks shall be installed as per details as shown on drawings.
.7 Mono systems; J-Hook/Steel Cat. #H-433-S shall be considered equivalent.

.4 As an alternate to the hanger system detailed, the contractor may use as an equal, one run of 50 mm (2") x 150 mm (6") wire mesh cable management system equal to Cablofil Cat. #CF 54/150 EZ complete with Cat. #FAS L 150 universal wall bracket where, noted shall be wall mounted and Cat. #FAS C 200 where, noted shall be hung. The hangers shall be installed at intervals as recommended by the manufacturer but not greater than 2.4 m (8'-0") on centre.

.5 Cable Tray/ Management System:
.1 The system, where noted, shall be a continuous, rigid, welded steel wire mesh cable management system with the following features:

.1 Permits continuous ventilation of cable and maximum dissipation of heat.
.2 Continuous safety edge T-welded wire lip.
.3 Welded at all intersections.
.4 Straight sections 4" x 12" (100 mm x 300 mm) in configurations noted on the drawings.
.5 Constructed of carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent and surface treated after manufacture.
.6 Post fabrication finish of electro-plated zinc galvanizing:

.1 ASTM B 633, Type III, SC-1.

.7 Fittings:

.1 Field fabricated in accordance with manufacturer's instructions for straight sections.

.2 The support system shall be Cablofil FAS CH hanger.
.3 The necessary hardware, including splice connectors and support components furnished by manufacturer.
.4 The product shall be Cablofil Cat. #CF105/300 EZ complete with Cat. #FAS P300 CH at intervals as recommended by the manufacturer.
.5 The manufacturer shall be Cablofil Inc.
.6 Flextray, Cat. #FT4x12x10 complete with 12 CTR HGR shall be considered equivalent.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical

.2 Cable Management Hangers:
.1 Install hangers as per details in configuration noted.
.2 Prior to installation co-ordinate location with other services within the ceiling space.
.3 Co-ordinate with noted sub-contractors to install cables noted to be utilizing these hangers. Cables are to be installed such that the maximum sag between hangers does not exceed 25 mm (1”). This electrical contractor is to coordinate.
.4 Attaching cable to any T-bar support rods is not acceptable.

.3 Cable Tray/ Management System:
.1 Install cable management system at locations indicated on the drawings and in accordance with manufacturer’s instructions.
.2 Support system every 2.4 m (8’-0”) unless system is used within a telecommunication room. In that situation, support every 1.5 m (5-0”).
.3 Cut wires in accordance with manufacturer’s instructions.
.4 Cut wires with side action bolt cutters to ensure integrity of galvanic protective layer. Cut using side action bolt cutters (Cablofil Cat. #Coupfil).
.5 Cut each wire with 1 clean cut to eliminate grinding or tough-up.
.6 Install cable management system using hardware, splice connectors, support components, and accessories furnished by manufacturer.
.7 Suspend from structure or intermediate Unistrut channel spanning across the corridor where access to structure is not available due to the concentration of mechanical ductwork and/or piping.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Access panels for walls and ceiling shall be of the flush type with concealed flanges constructed from 12 gauge minimum bonderized steel and shall be complete with anchor straps, rust resistant concealed hinges and positive locking, self-opening screwdriver operated lock. Coordinate with Division 23.

.3 Access panels in tiled walls shall be stainless steel with recessed door panel to accept wall finish and shall be of a size to suit tile pattern.

.4 Access panels installed in fire rated walls, partitions or ceilings shall have a fire resistance rating equal to the materials in which they are installed.

.5 Access panels shall be as manufactured by LeHage, SMS, Pedlar or approved equal.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 All parts of the installation including, but not limited to, pull-in, junction and outlet boxes, cabinets, gutters, etc. shall be accessible.

.3 Supply access panels as required to provide complete access to all equipment and connections. The access panels shall be installed by other Sections of the specification.

.4 Provide drawings showing size, type and location of all access panels and submit for review by the Consultant.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

.3 Project specific design values shall be used for determining seismic and wind design forces based on the information on the structural drawings. The values below are provided for reference only for the purpose of coordinating with suppliers and other trades. If a conflict exists between these values and the structural drawings, the values on the structural drawings will prevail. Where project documents do not provide values necessary to determine design forces, the Delegated Design Engineer may use values substantiated through the governing building code(s) or the authority having jurisdiction and subject to review and approval by the Engineer of Record.
   .1 Risk Category: [I, II, III, or IV]
   .2 Seismic Design Category: [A, B, C, D, E, or F]
   .3 Short-period Spectral Response Acceleration parameter (SDS): [#.##g]
   .4 Basic wind speed: [###mph (###kph)]

.4 All vibration isolation and restraint products and associated engineering work shall be provided by one supplying manufacturer. Preferred manufacturer is Vibro-Acoustics. Alternate manufacturers must request and obtain written approval by the Engineer of Record for substitutions.

.5 Isolation and restraint products shall be tested or analysed for performance as appropriate and reports shall be made available to the Engineer of Record upon request.

.6 All work to determine seismic and wind restraints shall be done by or under the direct supervision of a qualified professional engineer in responsible charge of the work acting as the Delegated Design Engineer. This Delegated Design Engineer must hold an active license in the province of the project.

1.2 REFERENCES

.1 Ontario Building Code, latest edition

.2 CAN/CSA C22.2 NO.250.0, Luminaires, latest edition.

.3 CAN/CSA-G40.21, Structural Quality Steels, latest edition.

1.3 SUBMITTALS

.1 Submit shop drawings include:
   .1 Design load and calculation.
   .2 Details of design criteria
   .3 Identification of location where electrical equipment to be provided with seismic bracing.
   .4 Installation procedures.
   .5 Testing and certification

.2 Submittal shall be designed and stamped by a professional Engineer, licensed to practice specializing in design of seismic force restraint system.

2. Products

2.1 GENERAL

.1 The seismic restraint manufacturer shall be responsible for the selection of the attachment hardware as required to attach snubbers/restraints to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.

.2 The contractor shall furnish, to the seismic restraint manufacturer, a complete set of approved shop drawings of all equipment that is to be restrained, from which the selection and design of seismic restraint devices and/or attachment hardware will be completed. The shop drawings furnished shall include, at a minimum, basic equipment layout, length and width dimensions, and installed operating weights of the equipment to be restrained.

.3 All electrical equipment (lighting fixture, panel, transformer, conduits, cable trays, etc.) are to be restrained to meet code requirements. At a minimum, the seismic restraint manufacturer shall provide documentation on maximum restraint spacing for various restraint sizes and anchors, as well as “worst case” reaction loads for each restraint and/or anchor size

.4 The contractor shall ensure that all housekeeping pads used are adequately reinforced and are properly dowelled to the building structure, so as to withstand calculated seismic forces. In addition, the size & thickness of the housekeeping pad is to be coordinated with the seismic restraint manufacturer to ensure that adequate edge distances & embedment depths exist in order to obtain the desired equipment anchor capacities.

.5 Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting vibration/seismically rated equipment. Concrete shall have a minimum compressive strength of 3,000 psi.

.6 Coordinate with vibration/seismic restraint manufacturer and the structural engineer of record to locate and size structural supports underneath vibration/seismically restrained equipment (e.g. roof curbs, cooling towers and other similar equipment).

.7 The acceptable manufacture for Seismic Force Restraint System shall be:

.1 Kinetics noise Control Inc.
.2 Eaton
.3 Vibro-Acoustics
Or approved equal meets specification.

3. Execution

3.1 COORDINATION AND EXECUTION

.1 Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting vibration/seismically rated equipment. Concrete shall have a minimum compressive strength of 3,000 psi or as specified by the project engineer. Coordinate size, thickness, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space, embedment and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.

.2 Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer seismic restraint manufacturer’s written instructions.

.3 Coordinate with vibration/seismic restraint manufacturer and the structural engineer of record to locate and size structural supports underneath vibration/seismically restrained equipment (e.g. roof curbs, cooling towers and other similar equipment). Installation of all seismic restraint materials specified in this section shall be accomplished as per the manufacturer’s written instructions. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer’s written instructions.

.4 Isolated and restrained equipment and conduit located on roofs must be attached to the structure. Supports (e.g., sleepers) that are not attached to the structure will not be acceptable.

.5 Attach piping to the trapeze per seismic restraint manufacturer's design. Install cables so they do not bend across sharp edges of adjacent equipment or building structures

.6 Do not brace or support equipment to separate portions of the structure that may act differently in response to an earthquake. For example, do not connect a Transverse restraint to a wall and then a Longitudinal restraint to either a floor/ceiling/roof at the same braced location.

.7 Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer's design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to hanger rods.

3.2 SEISMIC RESTRAINT APPLICATION:

.1 General

.1 All equipment, conduits, cable trays shall be restrained to resist seismic forces per the applicable building code(s) as a minimum; listed herein. Additional requirements specified herein are included specifically for this project; as needed basis.
.2 Install seismic restraint devices per the manufacturer's submittals. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.
.3 Attachment to structure for suspended equipment, pipe and duct: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
.4 Provide hanger rod stiffeners where indicated or as required to prevent buckling of rods due to seismic forces.
.5 Where rigid restraints are used on equipment, cable tray, the support rods for the equipment, ductwork or piping at restraint locations must be supported by anchors rated for seismic use.
.6 Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices and shall also be large enough and thick enough to ensure adequate edge distance and embedment depth for restraint anchor bolts to avoid housekeeping pad breakout failure.

.2 Concrete Anchor Bolts:

.1 Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre- or post-tensioned tendons, electrical and telecommunications conduit.
.2 Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength
.3 Mechanical Anchors: Protect threads from damage during anchor installation.
.4 Adhesive Anchors: Clean holes to remove loose material and drilling dust per manufactures instructions prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
.5 Set anchors to manufacturer's recommended torque, using a torque wrench.

.3 Equipment Restraints:

.1 Install fasteners, straps and brackets as required to secure the equipment.
.2 Provide seismic restrains for all electrical equipment.
.3 The electrical contractor are to provide the weight per unit length for cable trays & conduits.
.4 Longitudinal restraints for single conduit supports shall be attached rigidly to the pipe, not to the pipe/conduit hanger.
.5 For supports with multiple conduits (trapezes), secure conduits to trapeze member with clamps approved for application.
.6 Where conduit, bus ducts, cable trays sizes reduce below required dimensions, the final restraint shall be installed at the transition location.
.7 Adjust restraint cables so that they are not visibly slack. Cable not to support weight during normal operation.
.8 Seismic systems are to be compatible with requirements for anchoring and guiding of systems.

3.3 INSPECTION & CERTIFICATION:

.1 The contractor shall notify the local representative of the seismic restraint materials manufacturer prior to installing any seismic restraint devices. The contractor shall seek the representative's guidance in any installation procedures with which he/she is unfamiliar.
.2 The contractor shall notify the local representative of the seismic restraint materials manufacturer mid-way through the listed project if they require an inspection of any and all vibration and seismic restraint devices already installed. A written report of any installation errors, improperly selected devices, or other fault in the system which could affect the performance of the system shall be documented and the contractor shall perform all steps that are required from this written report to properly complete the vibration and seismic restraint work as per the specifications.
.3 Upon completion of the installation, arrange for an independent 3rd party registered design professional, upon request, is to visit the site to verify the proper installation of all seismic restraint devices herein specified. The local representative of the vibration manufacturer shall, at the contractor's request, be present as well to support the independent professional in the inspection of the completed system. A written report citing any installation errors, improperly selected devices, or other fault in the system which could affect the performance of the system should be generated by the 3rd party professional. Also, the local representative shall verify that isolators are adjusted, with spring's perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.
.4 The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Electric supplementary heaters and controls shall, unless otherwise noted, be supplied by Division 23.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install all electric heaters and remote electric thermostats supplied by Division 23.

.3 Electric duct heaters shall be installed by another Division of Specification.

.4 Provide all conduit, wiring, etc. and connect to the electric heaters, electric duct heaters and remote electric thermostats to provide a complete Electric Heating System.

.5 Install filler pieces as shown on the drawings between baseboard heaters to form a continuous length.

.6 All L.V. control wiring shall be by Division 23.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The pipe tracing cables, and controls shall, unless otherwise noted, be provided by Division 23.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide all conduit, wiring, pipe tracing cables, etc., and connect to the pipe tracing cables and controls to provide a complete pipe tracing system.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 This Section is for provisions for Building Automation System only.

.3 Divisions 23 will supply and install a Computerized Building Automation System complete with the distribution boxes, control sequencing and all interfacing.

.4 Division 26 shall provide individual lighting relays and/or contactors for each individual circuit and associated relay boxes and connect to load side of relays, as shown on the drawings. All control wiring by Division 23.

.5 Contactors used in conjunction with building automation system shall be electrically operated, electrically held type. Refer to Section 26 29 01.

.6 Coordinate all work with Division 23.

Execution: NOT USED

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of disconnect switch, type, quantity, voltage, ampacity, and dimension etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The hand dryers shall be:
.1 Nova 4 by World Dryer or approved alternative by Bobrick or Saniflow. Surface mounted one-piece cast iron automatic hand dryer equipped with 15 air intake slots, fan protected by an aluminum die cast grating fixed into housing fitted with 360-degree revolving die cast aluminum nozzle, tamper resistant bolts and steel wall plates. Motor shall be 1/10hp, 3200rpm, thermally protected and 4400LFM of air volume. Nickel finish and 120v input voltage.
.2 Electrical supply: 110-120v, 15A, 1800watts.
.3 Finish: Cast iron finished in white acid-resistant porcelain enamel.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide backboxes complete with conduit and wiring and connect to circuits as shown on the drawings. Coordinate all associated work with Architectural drawings.

.3 Hand dryers shall be installed in accordance with manufacturer's recommendations.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit the following to the Consultant for review:
.1 Drawings to include electrical detail of lighting control devices including occupancy sensor complete with associated power pack etc., quantity, control schematic wiring diagram and coverage area etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Provide lighting control device(s) including occupancy sensors, room controllers, daylight sensors, dimmers, etc. as specified on the drawings:
.1 Provide associated power and relay packs.
.2 Provide all associated mounting accessories.

.3 Electrical Contractor shall include in tender price for installation, testing, time adjustment, functional testing and commissioning of occupancy sensors, room controllers, daylight sensors, and programming of Auto-On sequence of all lighting control devices for light fixtures on a room-by-room basis in entire building by manufacturer. Submit verification/commissioning report after completion of work.

.4 Lighting Control Devices Commissioning:
.1 Functional testing: Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. Where occupancy sensors, time switches, programmable schedule controls, or photo sensors are installed, the following procedures shall be performed.

Occupancy sensors:

.1 Certify that the sensor has been located and aimed in accordance with manufacturer recommendations.
.2 For each sensor to be tested, verify the following:

.1 Status indicator (as applicable) operates correctly.
.2 Controlled lights turn `off' or down to the permitted level within the required time.
.3 For auto-on occupancy sensors, the lights turn `on' to the permitted level when someone enters the space.
.4 For manual-on sensors, the lights turn `on' only when manually activated.
.5 The lights are not incorrectly turned `on' by movement in nearby areas or by HVAC operation.

.6 Simulate occupied condition. Verify and document the following:

.1 All lights can be turned `on' and `off' by their respective area control switch.
.2 The switch only operates lighting in the enclosed space in which the switch is located.

.7 Simulate unoccupied condition. Verify and document the following:

.1 All non-exempt lighting turns `off'.
.2 Manual override switch (where applicable) allows only the lights in enclosed space where the override switch is located to turn `on' or remain `on' until the next scheduled shut off occurs.

.8 Daylight controls

.1 All control devices (photocontrols) have been properly located, field-calibrated, and set for appropriate setpoints and threshold light levels.
.2 Daylight controlled lighting loads adjust to appropriate light levels in response to available daylight.
.3 The location where calibration adjustments are made is readily accessible only to authorized personnel.

.2 Functional testing report/documentation shall certify that the installed lighting control of each respective space in entire building meets all requirements as specified in the contract documents.

.5 All occupancy sensors must be installed as per manufacturer’s recommended location and wiring diagram.

.6 Occupancy sensors time delay settings must be adjusted and co-ordinated to suit the Owner requirements.

.7 Cooper lighting, Current lighting , Acuity and Watt-stopper shall be considered equivalent for lighting control system.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install all lighting control devices as shown on electrical drawings. Provide all components to suit.

.3 Exact location of occupancy sensors shall be co-ordinated on site and shall comply with the manufacturer’s recommendations.

.4 Occupancy sensors shall turn off the corresponding light fixture when light switches are in the “On” position and the space is not occupied.

.5 Adjust occupancy detection sensitivity to match the level of activity for each space.

.6 Install power packs and associated relays to suit the number of circuits in the respective spaces. Installation shall comply with the manufacturer’s recommendations. Coordinate all work with manufacturer.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 29, Panel boards and enclosed Panel boards.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of panel board, branch breaker type, quantity, ampacity, KAIC rating and enclosure dimensions etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Panel boards shall be of the size, capacity and type as shown on the drawings. Series or integrated ratings shall not be an acceptable method of achieving specified interrupting levels for breakers, panels, or electrical equipment in general. Where an interrupting rating is specified, it shall be on a breaker, panel, or switchboard. Each breaker associated shall be fully rated to interrupt that magnitude of current. If there is a conflict between drawings and specifications, the higher rated value associated with that equipment shall be deemed to be correct.

.3 Panel boards shall be of the sprinkler-proof, dead front type enclosed in code gauge steel equipped with door, gasket, lock, and directory and shall be suitable for surface or flush mounting as required.

.4 Bussing in each panel shall be copper and shall extend the full length of the panel. Multi-section panels shall have full capacity rated horizontal bussing between each section.

.5 Breakers shall be ambient compensated type, calibrated at 40 degrees C and be of the bolt-on type. Multi-pole breakers shall have common trip.

.6 Panel boards for use on 240-volt or 208-volt system shall, unless otherwise noted be of the "NQ" panel or I-line panel as indicated on drawings.

.7 Panel boards for use on 600-volt system shall, unless otherwise noted be of the "NF" panel as indicated on drawings.

.8 Panels, including tubs, shall have two coats of primer paint and two coats of ASA 61 grey paint.

.9 Panel boards shall be of the same manufacturer as the switchboard.

.10 All circuit breakers shall be installed in panel boards before shipment.

.11 Panel boards shall be provided with mains, number of circuits, KAIC rating and branch circuit breaker sizes as indicated in contract documents.

.12 Lock-on devices shall be provided for fire alarm, emergency and exit lighting circuits and other circuits as indicated in contract documents.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Locate panel boards where indicated; and mount securely and plumb true and square to adjoining surfaces.

.3 Panels are to be mounted so that the top of the panels are 1800mm above finished floor.

.4 Provide 2 - 32mm empty conduits from each flush mounted panel to the ceiling spaces above and below for future installation.

.5 Provide wire-ways above multi-section panels to avoid cross-wiring.

.6 Numbering of breakers in multi-panel assemblies shall be consecutive. If necessary, provide narrow Dymomite strips with the required numberings.

.7 Prior to energizing or commissioning the panels, they shall be fully inspected, tested, checked, and adjusted to include, but not limited to, the following:
.1 Grounding.
.2 Breaker settings.
.3 Breaker operation.
.4 Continuity of feeder cables.
.5 Phase resistance of feeder cables.
.6 Insulation resistance of feeder cables.
.7 Proper phasing of incoming and feeder cables.
.8 Equal division of load between parallel conductors.
.9 Bus torque, supports, clearance, general mechanical conditions, and insulation resistance.

.8 30% of all breakers in panels shall be equipped with locking devices. These locking devices shall be installed as directed by the Consultant on completion of work and the unused units shall be handed over to the Owners.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 29, Panel boards and enclosed Panel boards.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of power panel, branch breaker type, quantity, ampacity, KAIC rating and enclosure dimensions etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Power panels shall be factory assembled, sprinkler proof, free standing, dead front type, complete with door and gasket suitable for use on the system as specified and shown on the drawings.

.3 Power panels shall be of the size, capacity and type as shown on the drawings. Series or integrated ratings shall not be an acceptable method of achieving specified interrupting levels for breakers, panels, or electrical equipment in general. Where an interrupting rating is specified, it shall be on a breaker, panel, or switchboard. Each breaker associated shall be fully rated to interrupt that magnitude of current. If there is a conflict between drawings and specifications, the higher rated value associated with that equipment shall be deemed to be correct.

.4 Fusible panels shall be of the "QMQB" type consisting of a fully convertible chassis to permit assembly of units in any desired arrangement. The fusible units shall have visible blades, integral handle mechanism, cover interlock, quick-make, quick-break mechanism, front operation, high pressure fuse holders and recessed live parts. The units shall be floor mounted and shall, unless otherwise noted, be 92" in height.

.5 Breaker panels shall be switchboard QED distribution section type with the sizes and type of breakers as shown on the drawings. The branch devices/ breakers rated 400A and above shall be breaker(s) with electronic trip(s) (LSI).

.6 Splitter troughs shall be complete with copper bus bars the length of the trough. The covers shall be bottom hinged with retained securing screws at the top.

.7 Bussing in each panel shall be copper and shall extend the full length of the panel. Multi-section panels shall have full capacity rated horizontal bussing between each section.

.8 Panels shall be provided with the non-ferrous plates for aluminium sheathed cables.

.9 Panels, including tubs, shall have two coats of primer paint and two finish coats of ASA 61 grey paint.

.10 Power panels shall be of the same manufacturer as the main switchboard.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Locate panel boards where indicated; and mount securely and plumb true and square to adjoining surfaces.

.3 All panels less than 1520mm are to be wall mounted so that the top of the panel is 1980mm above finished floor.

.4 Connect loads to the circuits as shown on the drawings.

.5 Openings in panels shall be cut or punched. Burning of holes shall not be permitted.

.6 Each panel and switches or breakers mounted in them, shall be identified.

.7 Prior to energizing or commissioning the panels, they shall be fully inspected, tested, checked, and adjusted to include, but not limited to, the following:
.1 Grounding.
.2 Continuity of feeder cables.
.3 Breaker settings and fuses.
.4 Ground fault system operation.
.5 Breaker and switches operation.
.6 Phase resistance of feeder cables.
.7 Insulation resistance of feeder cables.
.8 Proper phasing of incoming and feeder cables.
.9 Equal division of load between parallel conductors.
.10 Trip units tested and calibrated to the settings provided by the Co-ordination Study.
.11 Bus torque, supports, clearance, general mechanical conditions, and insulation resistance.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA-C22.2 No.55, Special Use Switches.
.2 CSA-C22.2 No.111, General-Use Snap Switches.
.3 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices.
.4 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Supply and install classroom control panel modules as specified below for the locations as shown on drawings.

.3 Classroom control panel modules shall be wall mounted or otherwise supported as indicated.

.4 Classroom control panel module shall be as follows:
.1 Materials:

.1 Frame:

.1 Aluminum extrusions extruded shapes CSA HA.5, 6063 T5 alloy satin anodized aluminum frame.
.2 Sheet aluminum, plate sheet anodizing quality CSA HA.4 990C, Alcan D25, condition H14.

.2 Laminate Panel:

.1 0.08mm thick with high pressure plastic laminate faced panels of lightweight MDF core and a 0.5mm plastic laminate backing sheet. Plastic laminate–CAN3-A172.
.2 Allow minimum four (4) colours selections.
.3 Colours to be selected at later date by architect from Wilsonart, Arborite, Formica or Pionite.

.3 Finish: Clear anodized aluminum AA-M12.C32.M31.

.2 Manufacturer:

.1 Classroom control panel module shall be manufactured by:

.1 Swift Path Solutions
.2 Control Hub Solutions or approved equal.

.5 Receptacles shall be as specified in Section 26 27 26.

.6 Computer outlets/ jacks shall be as per specified Section 27 11 19.

.7 PA system outlets/jacks shall be as per specified Section 27 51 16.

.8 Devices shall be flush mounted inside the classroom control panel module.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Fabricate classroom control panel modules in accordance with reviewed shop drawings with extruded aluminum frames and solid plastic laminate face panels.

.3 Solid plastic laminate face panels shall be removable from aluminum frames and shall be vandal resistant.

.4 Classroom control panel modules shall have factory fabricated cutouts, mounting flanges, blank-off plates, etc. to mount all mechanical and electrical equipment and devices.

.5 Make, model and dimensions of switches, duplex and computer cable outlets, thermostats and temperature sensors, clocks, speakers, intercom devices, including switches, keypads and handsets will be supplied and installed by mechanical and electrical divisions.

.6 Classroom control panel modules shall be factory fabricated to include all drilled or cut holes and speaker mountings to allow installation of all devices by mechanical and electrical divisions.

.7 All cabling and wiring will be supplied and installed by mechanical and electrical divisions as indicated on drawings and specified in contract documents.

.8 Classroom control panel modules shall have all contacts for services as required for installation of mechanical and electrical services by mechanical and electrical divisions.

.9 Classroom control panel modules shall be full height from 6" (152mm) off floor to underside of ceiling panels.

.10 Install classroom control panel modules in accordance with manufacturers' recommendations and reviewed shop drawings complete with all frames, cutouts, face panels etc.

.11 Symbols on drawings shows approximate locations on classroom control panel module. Care shall be taken to locate each device to ensure that it is in the appropriate location to suit the classroom control panel module detail as shown on drawing.

.12 Mounting heights of equipment/devices are referred to finished floor or finished ceiling unless otherwise noted.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA-C22.2 No.55, Special Use Switches.
.2 CSA-C22.2 No.111, General-Use Snap Switches.
.3 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices.
.4 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Provide manufacturer’s printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Light switches on 120-volt circuits under 1200 watts shall be 15 amp. and above 1800 watts shall be 20 amp.

.3 Light switches shall be premium specification grade, A.C., Toggle type switches.

.4 Receptacles shall be of the type shown on the drawings with the standard C.S.A. configurations and shall be specification grade. Hubbell #5262.

.5 Light switches and receptacles on normal power shall be white unless noted otherwise.

.6 Isolated ground receptacles shall be orange. Hubbell #1G-5262.

.7 Wall plates for flush mounted devices shall be multiple gangs super stainless-steel type 302.

.8 Wall plates for surface mounted devices in unfinished areas shall be metal covers for F.S. type boxes.

.9 The weatherproof plates shall be cast aluminium with lift cover for F.S. type boxes.

.10 For T.V. and computer outlets provide blank cover plates unless work is complete.

.11 For telephone outlets provide blank cover plates unless work is complete.

.12 Receptacle mounted on the exterior walls of the building shall be with ground fault protection mounted in an F.S. type box with a Hubbell #5206WO and MX3200 weatherproof in-use cover plate.

.13 50A/208V 1 phase 3W receptacle, range receptacle Smith & Stone #1-8450 complete with plug and cord set.

.14 30A, 120/208V receptacle Smith & Stone #1-8430 dryer receptacle complete with plug and cord set.

.15 Wiring devices shall, unless otherwise noted, be of Pass & Seymour, Hubbell, Leviton, or Cooper manufacture.

.16 All service receptacles on roof shall be 15/20A combination GFI type receptacles complete with weatherproof in-use cover (Similar to Hubbell Cat. #MX3200).

.17 Receptacle controlled by occupancy sensor shall be Similar to Hubbell Cat. #BR15C2GRY.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Symbols on drawings show approximate locations. Care shall be taken to locate each device to ensure that it is in the appropriate location to suit the Architectural finishes.

.3 Mounting heights are referred to finished floor or finished ceiling unless related to benchmark elevations.

.4 Provide cover plates for flush mounted manual starters.

.5 Receptacle, telephone, etc. outlets shall, unless otherwise noted, be mounted vertically 400mm above finished floor in the finished areas and 1200mm in all unfinished areas. Thermostats shall be mounted 1400mm, unless otherwise noted.

.6 Telephone, P.A., etc. wall outlets shall be spaced 100mm from power outlet.

.7 All wiring devices cover plates shall be labelled using clear adhesive strips with black type identifying, panel and circuit number(s) for each device.

.8 Single throw switch(es) shall be installed with handle in "UP" position when switch closed.

.9 Switches shall be installed in gang type outlet box(es) when more than one switch is required in one location.

.10 Receptacles shall be installed in gang type outlet box(es) when more than one receptacle is required in one location.

.11 Suitable common cover plates shall be installed where wiring devices are grouped.

.12 Cover plates meant for flush mount outlet boxes shall not be use for surface mounted outlet boxes.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 248.12, Low Voltage Fuses

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of fuse type, quantity, ampacity, voltage rating and dimension etc.

.3 Submit fuse performance data characteristics for each fuse type and size. Performance data to include average melting time-current characteristics.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Fuses protecting motor circuits shall be Form I Class `J' time delay.

.3 Other fuses up to 600A shall be Form I Class `J'.

.4 Other fuses above 600A shall be Form I Class `L'.

.5 All fuses shall be of Ferraz, Shawmut or Bussman.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide fuses for the complete electrical installation.

.3 Supply six (6) spare fuses of each size and type installed.

.4 Provide in the main electrical room a wall mounted metal cabinet complete with doors and lock, and an adequate quantity of pigeonholes to accommodate the spare fuses.

.5 To avoid confusion and possible loss the fuses shall not be stored in the cabinets until they are physically counted by the Owner's representative and a written receipt obtained for them. A copy of the receipt shall be included in the manuals.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of disconnect switch, type, quantity, voltage, ampacity, and dimension etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Disconnect switch(es) shall have the operating handle interlocked with the switch cover so that it can only be opened when the switch is in the "Off" position, and the handle cannot be put in the "On" position unless the cover is closed.

.3 Fused disconnect switch(es) shall have steel reinforced clips and fuses shall be easily removable when the switch is in the "Off" position.

.4 Switches shall have ample gutter space for top or bottom wiring and shall have fully visible blades when in the "Off" position, quick-make, quick-break mechanism and be horsepower rated.

.5 Disconnect switch(es) shall be provided with ON-OFF switch position indication on switch enclosure cover.

.6 Switches used outdoors shall be in a weatherproof enclosure.

.7 Switches shall have provision for padlocking in the "Off" position and interlock defeat.

.8 All motors shall be provided with a disconnect switch by this Division unless otherwise noted.

.9 The disconnect switches shall be as manufactured by Eaton, Siemens, or Square `D’.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Disconnect switch(es) shall be installed complete with fuses as indicated on drawings and in contract documents.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No.14, Industrial Control Equipment.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of contactor, quantity, ampacity, voltage, control schematic wiring diagram and enclosure dimension etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Contactors controlling panel boards or branch circuits shall be tungsten rated, electrically operated, electrically held of the size and rating specified, complete with control transformer, control circuit fuses, pilot light warning label, NO/NC contacts and On/Off/Auto selector switch.

.3 Contactors shall be in sprinkler proof enclosure unless otherwise noted.

.4 The contactors ampere rating shown on the drawings is the minimum continuous enclosed de-rated rating of the contactors. Contactors shall be designed and manufactured in accordance with NEMA Standards.

.5 Contactors controlling branch circuits shall be mounted above the panel board from which they are fed, unless otherwise noted.

.6 Contactors shall be of Allen-Bradley, Eaton, Siemens or Square `D' manufacture.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Field designed and assembled contactor assemblies will not be acceptable.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC).
.1 IEC 947-4-1, Part 4: Contactors and Motor-Starters.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The motors shall be provided and adjusted by Division 23, Mechanical.

.3 The starters shall be supplied by Division 23, Mechanical.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide and connect conduit and power wiring to the motors.

.3 Conduit and wiring for low voltage thermostats shall, unless otherwise noted, be provided by another Division of the Specification.

.4 Wiring and conduit for line voltage thermostats shall be by this Division. Coordinate with Division 23, Mechanical drawings.

.5 Take delivery of and install the starters and provide and connect conduit and power wiring to the starters. Control wiring and conduit shall, unless otherwise noted, be provided by Division 23, Mechanical.

.6 Fuses for the fused combination magnetic starters shall be supplied and installed by Division 23, Mechanical.

.7 Prepare schedule of each motor connected which shall include the following:
.1 Phase
.2 Voltage
.3 Horsepower
.4 Full load current
.5 Motor Purpose
.6 Fuse size and type
.7 Overload heater size and type

.8 Submit the motor schedule for review by the Consultant and include the schedule in the manuals.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Light fixtures finish and construction shall meet ULC listings and CSA certifications related to intended installation.

.3 Light Emitting Diodes (LED) shall comply with the following:
.1 Light emitting diodes shall be manufactured by “Cree” or equal.
.2 Junction temperature at 25°C ambient shall not exceed 60°-70°C.
.3 LED light fixture(s) shall follow LM-79 and LM-80 Standards. Luminaire photometric shall be performed by an independent company.
.4 Lumens per watt output (LPW) shall be not less than 100 LPW.
.5 The lifetime rating of driver, LEDs and all electrical components of complete fixture shall be 60,000 hours (minimum) at full load.
.6 Colour temperature shall range from 3500K to 5100k as called for in the Lighting Fixtures Schedule.
.7 All electrical components shall have a 5-year replacement (parts and labour) warranty.
.8 LED light fixture(s) shall be DLC certified.
.9 LED light fixture(s) shall be complete with 0-10V dimming driver.

.4 The louvres for light coves in washrooms and display cases and where shown shall be 1/2"x1/2"x1/2" (13x13x13mm) continuous aluminium and shall be of American Louvre manufacture.

.5 Lenses shall be acrylic (minimum of 0.175mm) with a maximum flame spread rating of 250 and smoke development classification of 600 and shall be of KSH, American Louvre manufacture.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Remove from the site all empty cartons, crates, etc. in which the fixtures and associated components are delivered.

.3 Install lighting fixtures at locations as indicated on drawings and in contract documents.

.4 The chain supports required for mounting and installation of recessed lighting fixtures shall be supplied and installed by this Division. The supports shall be attached to the structure with minimum 2 supports per fixture. The ceiling system shall not be used as a supporting means. Prior to installation of lighting fixtures, Electrical Contractor shall coordinate with consultant and get approval.

.5 Surface mounted fixtures shall be independently supported from the structure above.

.6 Fixtures connected to the circuits exceeding 150 volts to ground shall be mounted at least 8 feet above floor level.

.7 Fixtures mounted in continuous rows shall be equipped with aligning clips to form straight uninterrupted line.

.8 Align light fixtures mounted individually parallel or perpendicular to building grid lines.

.9 The location of lighting fixtures in Service Areas, Electrical and Mechanical Rooms, etc. shall be determined after the equipment is installed.

.10 Refer to the Architectural reflected ceiling drawings for the exact location of the lighting fixtures.

.11 Cooperate with the other Divisions to establish proper clearances from sprinkler heads, diffusers, ducts, etc.

.12 Surface mounted fixtures shall have minimum clearance of 2'-0" (600mm) from adjacent sprinkler heads.

.13 Provide additional supports, hangers etc. required to support fixtures mounted under ductwork and the fixture supports shall not be attached to either the ductwork or the ductwork supports.

.14 Provide and connect all branch circuit conduit and wiring to the signs (if required).

.15 Angles required for support of 1/2"x1/2"x1/2" (13x13x13mm) louvre shall be by Ceiling Division.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 141 (latest edition), Unit Equipment for Emergency Lighting.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include electrical detail of system components, mounting method, source of power and special attachment etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Emergency Battery Unit:

Type "L" Shall be as manufactured by Lumacell and shall be CSA C22.2.141 performance approved and shall be connected to a 120volt A.C. 60 cycle, single phase power source and shall provide automatically and instantaneously emergency lighting upon failure or interruption of normal electric power. Batteries shall be sealed lead, 24volt, 550 watts complete with emergency heads as shown on drawings. Charger shall be completely automatic solid-state type, with inverse temperature compensation. The control panel shall contain the following:

.1 AC pilot light.
.2 Test switch.
.3 On-Off switch.
.4 Burn-out protection.
.5 Provision for conduit connection.

.3 The battery units shall be Lumacell "RG24S-550", Emergi-Lite, Beghelli or Aimlite.

.4 Battery Cabinet shall be suitable for direct or shelf mounting to wall and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.5 The complete system shall have a one-year unconditional guarantee, and a 5-year pro-rata guarantee on workmanship and parts and 10 years pro-rata on batteries.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install units where; shown on the drawings and provide all necessary mounting platforms and mounting hardware.

.3 Electrical Contractor shall provide report with on-site readings to show lighting levels in all areas with emergency lighting fixtures.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 141-02 (latest addition), Unit Equipment for Emergency Lighting.
.2 CSA C860, Performance of Internally Lighted Exit Signs.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations, mounting method, source of power and special attachment etc.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Exit Sign Schedule:

Type 'E' Shall be Beghelli Quadra series; Cat# QR-RM-L-XX, “Universal Mount” LED exit signs with “Running Man” pictogram, complete with left/right indicator(s) as shown on drawings, suitable for wall, ceiling and/or end to wall mounting, for 120volt operation and provisions for 24volt D.C. power supply. Fixture shall be of extruded aluminium housing. Emergi-Lite EA Series shall be considered equal.

Type 'EA' Shall be Beghelli Quadra series; Cat# QR-RM-SP-L-1-XX-M-2BTMR-AT, “Universal Mount” LED exit sign, self-powered with battery backup, combination with two emergency light heads, 120V input voltage complete with auto-test self diagnostics. The LED exit sign shall be complete with “Running Man” pictogram, Left/Right indicator(s) as shown on drawings. The fixture shall be suitable for wall, ceiling and/or end to wall mounting.The fixture shall be of extruded aluminum housing. Emergi-Lite EA Series shall be considered equal.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Install exit lights to manufacturer's recommendations, listing requirements and authority having jurisdiction regulatory requirements.

.3 Install units where shown; on the drawings and provide all necessary mounting platforms and mounting hardware.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 PURPOSE OF DOCUMENT

.1 This document is to provide a standard defining the structured communications cabling systems to be installed within Durham Catholic District School Board facilities. It is geared toward leveraging school board legacy cabling infrastructure while upgrading to more recent technologies in new installations. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards, and industry best practices.

.2 Within this document, the facilities owner is the ICT Services department, and shall be referred to as such, or as Durham Catholic District School Board. Bidding low-voltage installers shall be referred to as “Installer” or “Contractor”.

.3 It is the responsibility of the installing Contractor to evaluate these general recommendations and adapt them effectively to actual projects. Contractor is responsible for identifying and bringing to the attention of ICT Services any design directions that may be improved. All such changes shall be approved in writing from Durham Catholic District School Board.

.4 This specification defines quality standards and practices common to all School’s and network cabling upgrades and Greenfield (new), and Brownfield (existing) projects. The system offered and quoted, shall incorporate all features and facilities listed in this specification.

.5 In addition to this cabling standard, individual projects will also have associated documentation such Requests for Proposals (RFP), facility drawings, and project schedules pertaining to that job. Such collateral will be referred to in this document as “Project-specific Documentation”, “Project Documentation”, or simply “Construction Documents”. Many of the requirements described herein may be detailed or expanded upon by such project-specific documents.

.6 Any conflict between this general specification and any project-specific documentation shall be brought to the attention of ICT Services and will be resolved by ICT Services in writing.

.7 Note that while many portions of this specification are addressed to "The Contractor", these requirements apply equally to architects, engineers, project managers, planning, or anyone doing network cabling and infrastructure work within ICT Services facilities, whether those persons are outside contractors or persons directly employed by ICT Services.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Drawings to include equipment and material detail including dimensions.

.3 Submit drawings for jacks, cables, faceplates, patch panels, patch cords, wall brackets, etc.

1.4 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA-C22.2 No.214 (Latest Edition), Communication Cables.
.2 CSA-C22.2 No.232, (Latest Edition), Optical Fiber Cables.
.3 CSA-C22.1, (Latest Edition), Canadian Electric Code Part 1
.4 OESC – Latest Edition
.5 OBC – Latest Edition

.2 Telecommunications Industry Association (TIA)/ Electronic Industries Alliance (EIA)
.1 TIA/EIA-568-B.1 (latest edition), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
.2 TIA/EIA-568-B.2 (latest edition), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
.3 TIA/EIA-568-B.3 (latest edition), Optical Fiber Cabling Components Standard.
.4 ANSI/TIA-569: (latest edition), Telecommunications Pathways and Spaces.
.5 TIA/EIA-606-A: (latest edition), Administration Standard for the Commercial Telecommunications Infrastructure.
.6 ANSI/TIA-607: (latest edition), Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
.7 TIA-TSB-162: (latest edition), Telecommunications Cabling Guidelines for Wireless Access Points.
.8 ANSI/TIA-4966: (latest edition), Telecommunications Infrastructure Standard for Educational Facilities.
.9 ANSI/TIA/EIA-526-14 - Optical Power Loss Measurements.
.10 ISO-11801 - Generic Cabling for Customer Premises.
.11 BICSI – Building Industry Consultative Services International – Manuals

.1 Telecommunications Distribution Methods Manual, most recent edition.
.2 Information Transport Systems Installation Methods Manual (ITSIMM), most recent edition.

.12 Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the CEC and any applicable local codes or ordinances, or default to the most current and stringent requirements listed by either.
.13 Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense.

1.5 SUBMISSION POLICY

.1 This is a performance-based specification developed from the experience of the ICT Services, Durham Catholic District School Board in providing exceptional solutions for all SMCDSB facilities and departments. As such, substitution of specified products or systems named in this document is highly discouraged.

.2 Any Contractor wishing to offer substitutions for any part of the systems specified herein shall be responsible for proving equivalency and shall follow the procedure below:
.1 Contractor shall submit a request for product substitution to ICT Services of SCDSB in writing no less than one week in advance of bid.
.2 Contractor shall provide three (3) each sample of the product being offered for evaluation by ICT Services.
.3 Samples of products offered for substitution shall be accompanied by product drawings, specification sheets and engineering documents proving equivalency in transmission performance (where applicable) and mechanical function.
.4 Category Cat 6A cable and components offered in substitution to those specified shall be accompanied by third party test reports proving equal or better channel performance. Such test reports shall name exact products by part number and state channel results in worst-case connector links of maximum length that include both cross-connect and consolidation points.

.3 Equivalent product acceptance must be received from ICT Services in writing.

.4 Contractor shall be responsible for and assume all costs for removal and replacement of any substituted product installed without prior written approval from ICT Services. Such costs shall include but not be limited to labour, materials as well as any penalties, fees or costs incurred for late completion.

1.6 NETWORK INSTALLATIONS DESCRIPTION

.1 Reference the following documents detailing the completion of the network installation:
- .1 Attached drawings showing data drop locations.
- .2 Contractor will contact ICT Services to retrieve current matrix spreadsheet documenting the routing of all panel ports to switch ports in all LAN rooms.
- .3 Contractor will contact ICT Services to retrieve rack topology showing all inter-switch media, fibre trunk locations etc.

.2 In areas where data network is being upgraded, all existing cable is to be removed from existing infrastructure. This includes all cable found above and below ceiling, in cable tray, raceway, wiremold etc.

.3 Supply and install a complete end-to-end Category 6 and Category 6a structured data cabling system. Network cabling component manufacturer and the cable and patch cord manufacturer must have contractual relationships to ensure that the system warranty is a true “end to end” structured cabling system warranty.

.4 When installing & terminating copper cables, jacks shall follow colour designation below:
- .1 Data: Blue
- .2 Voice: Green
- .3 Cameras & security: Purple
- .4 WIFI: Yellow
- .5 Special: Black
- .6 Audio-Visual: Red

.5 WIFI structured cabling shall consist of minimum, two Category 6a cables per wireless access point (WAP), as per TIA-TSB-162 guidelines for WAP installations.

.6 Each classroom and/or office space will have the following volume of data drops:
- .1 Classroom: Two for a Wi-Fi access point. One for a Printer. One for a VOIP Phone.
- .2 Office: Two for a Wi-Fi access point. One for a Printer. One for a VOIP Phone. One for a Workstation.
- .3 Gym: Eight (2 X each WAP capacity of 4) for Wi-Fi access points. One for a phone. One for a Workstation.
- .4 Library: Four (2 for each WAP) for Wi-Fi access points. One for a Printer. One for a VOIP Phone, One for a Workstation.

.7 All work must be installed by system manufacturer’s certified system installers who are certified and experienced in implementing the selected data cabling system, and to perform relating testing programs.

.8 All cablings shall be installed in conduit or run-in cable tray.

.9 In locations without conduit and/or cable trays, cables must be supported to the building structure independent of other systems, using a wire management system. Board or Electrical Consultant must approve this type of installation.

.10 In LAN Rooms, where specified, supply and install EIA Standard 19" floor mount equipment racks in accordance with ANSI/TIA/EIA-607 (CSA T527), complete with patch panels, switches, bonding, and horizontal/vertical wire management.

.11 Data cabling shall be terminated in Category 6 or 6A where specified jacks at the workstation end and in Category 6 or 6A patch panels at the communication closet end.

.12 Data cabling contractor shall supply to the Owner, two (2) Category 6 or 6A where specified patch cables for every data drop installed. One from patch panel-to-switch, and another from the data jack faceplate. The lengths of the cables shall be as follows: 50 percent 4 feet and 50 percent 6 feet.

.13 All panel-to-switch patch cabling will be installed by the contractor as per details documented in the data cable matrix, provided by the ICT Services (detailed in section 1.5.1).

1.7 SPECIAL COORDINATION MEETINGS

.1 Attendance at the Division 25/26/27 Start-Up meeting is mandatory.

.2 M&E Rough-In Inspection:

.1 Inspect locations of all drops above and below ceiling, and placement of racks in LAN Rooms. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

.3 Above Ceiling Inspection:

.1 Verify placement of Wireless Access Point Drop and review installation of Access Point. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

.4 Cabling & LAN Room Inspection:

.1 Verify the installation and routing of cable, panel and cable management in racks, and review final cable matrix prior to installation of switches and patching down drops. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

.5 Final Installation Review:

.1 Prior to occupancy, review installation of switches, patch cables, and the functioning of wireless access points and data drops. Contractor to provide Board Staff with 48 hours' notice prior to scheduled inspections. ICT Services comments forwarded through Mgr. of ICT to the Capital Project Officer (CPO) and copied to the Mgr. of Capital Projects. CPO to distribute deficiencies to consultant. Consultant to distribute deficiencies to General Contractor.

1.8 PROJECT DOCUMENTATION

.1 Shop Drawings

.1 The contractor shall always maintain an updated copy of as-built drawings on site.

.2 Submit shop drawings in accordance with General Electrical Requirements or Submittals section as applicable.

.3 Shop drawings of this system must be submitted and reviewed prior to release of all orders.

.2 Cabling Matrix and Rack Topology

.1 Prior to shop drawing process, the data cabling Contractor to request from the Board a soft copy of up-to-date Data matrix. Contractor will update Matrix with new information prior to installation. The pre-installation matrix information will be used to provision and program network switches and finalize rack topology for the new data drops.

.2 During the project, this Data matrix document is to be kept up to date, with any changes made for the duration of the installation, by the contractor, including the length of all cables while also documenting the location of all racks, panels, and drops along with respective room locations.
.3 Rack topology provided by the ICT Services will be delivered to the contractor to ensure that all network equipment is mounted properly at time of installation.
.4 One week prior to occupancy, Data Cabling Contractor shall provide digital floor plans in PDF format indicating drop locations within the room with drop numbers indicated.
.5 One week prior to occupancy, Data Cabling Contractor shall provide digital up-to-date data matrix in Excel format indicating drop number (in A/1/2/03 format), drop room number, drop length, drop use, and any relevant drop notes. This information will be used to configure the network switches.
.6 One week prior to occupancy, Data Cabling Contractor shall perform testing on all data drops.

.3 Submittals (Prior to issuance of final payment by the Owner)
.1 Submit shop drawings in accordance with General Electrical Requirements. One digital AutoCAD copy, one PDF format and three sets of hard copy as-built drawings prior to final payment.
.2 Testing data and certificates per the “TESTING” section of this document, and all equipment manuals and warranty information.
.3 Final copy of included Data Matrix document, including all cable length and location information populated within.
.4 The following fields MUST be completed by the contractor for new drops:

.1 **Rack ID**: AAA-RX, where AAA is school code, and X is rack letter (if second rack in room, then AAA-RA2, otherwise "1" is assumed and AAA-RA is sufficient).
.2 **Panel ID**: AAA-X-PN, where AAA is school code, X is rack letter (add number if second rack in room), N is panel number from top of rack (verify numbering with ICT if installing a new patch panel).
.3 **Drop ID**: MUST follow A/1/2/03 format in spec (rack room/rack number/patch panel/drop number).
.4 **Alt Drop Nº**: (Deprecated) this is for existing drops only - all new drops should conform to A/1/2/03 format specified in spec, and this field should therefore be blank for new installs.
.5 **Length ft**: cable length in feet.
.6 **Cable:** CAT5e, CAT6, CAT6e, CAT7, etc.
.7 **Room Nº**: Room number on door, or generally accepted room number, or room number on floor plans.
.8 **Room Type**: (Optional, but helps to figure out obscure room numbers) Generic room description (classroom, gym, principal's office, etc.).
.9 **Drop Use**: Purpose for drop (student, teacher, admin, printer, projector, WAP, etc.).
.10 **Asset ID**: (Optional) ID from asset tag attached to drop.
.11 **Notes**: General notes if the above fields don't suffice.

.5 The following fields will be completed by ICT once contractor returns the final cable matrix showing newly installed drops. This can then be used by contractor to patch down the new drops to the switch:

.1 **Stack**: (ICT use) Switch stack name.
.2 **Rack U**: (ICT use) U where switch is installed.
.3 **Switch ID**: (ICT use) Asset ID of switch drop is patched to.
.4 **Port:** (ICT use) switch port where drop is patched to.
.5 ***:** (ICT use) Asterisk indicates non-contiguous patching where switch port number doesn't match patch panel drop number.
.6 **VLAN:** (ICT use) VLAN for switch port.

1.9 SYSTEM OPERATION

.1 The local area network system must be "protocol neutral". The wiring configuration is based on a "physical star" topology in which cabling and/or backbone runs emanate in a radial pattern from the main data communications closet. Six strand multimode fibre installations will connect all LAN Rooms, with the exception of the WAN fibre demarcation point which will be “extended” to uplink directly to the main data communications closet using single mode fibre. If a LAN Room exceeds 192 installed ports, an additional six strand fibre installation is required.

1.10 QUALITY ASSURANCE

.1 The Owner accepts products from the following manufacturers: ***COMMSCOPE,*** No alternatives will be accepted. If an installation involves moving, adding, or changing an existing install, the contractor will match the current product unless an alternate solution is proposed by the Owner.

.2 The data cabling contractor will have only tradesmen who are fully qualified and experienced in the installation of a certified communications cabling system and wireless network system.

.3 The successful data cabling contractor shall:
.1 Provide current training and certification status including certification number by the specified cabling system manufacturer.
.2 Have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.
.3 Have all necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Fibre Optic Cable
.1 The Fiber Structured Cabling System shall be capable of supporting and/or integrating the following:

.1 Data applications
.2 Local area network services
.3 Wide area network services
.4 Storage Network applications and services

.2 The applications that shall be supported include, but are not limited to:

.1 Data Communications

.1 Ethernet (10GBASE-SR/SW, 10GBASE-LRM, 10GBASE-LX4, 1000BASE-SX and 1000BASE-LX).
.2 Fibre Channel (100-M5E-SN-I thru 1600-M5F-SN-I).
.3 FCOE (ANSI T11 FC-BB-6 Fibre Channel Backbone 6).
.4 Any other application designed to run on a generic structured cabling system designed and installed to TIA or ISO structured cabling standards.

.2 Data Processing

.1 Mainframe access client server, enterprise server, messaging systems and electronic mail, client database, etc.

.3 Video

.1 Analogue video, digital video, and video conferencing.

.4 Multiple Services

.1 The structured cabling system shall also support backward and forward migration of applications with minimal disruption to existing services or personnel, allowing for quick moves, adds, and changes.

.3 Installation Guidelines (Applies to all Fiber Trunks)

.1 Fiber terminations shall be done according to recommendations of TIA, manufacturer's requirements, and accepted industry best practices.
.2 Fiber optic cabling system additions and upgrades to existing facilities (Brownfield) shall match the Fiber type (OM/OS designation) of the system to which it is being installed. Contractor shall under no circumstances mix different OM/OS classes of cable or termination devices (connectors) within the same channel unless specifically instructed to do so within the project specific documentation.
.3 When installing Fiber cable, Contractor shall maintain a minimum bend radius of 20 times the outer diameter of the cable when it is under load (being pulled).
.4 Fiber service loops shall be stored to maintain a minimum bend radius of 10 times the outer diameter of the cable.
.5 Optical Fiber shall only be pulled using its internal strength member in conjunction with a properly rated multi-weave mesh grip and swivel pulling eye.
.6 All unjacketed Fiber shall be contained within appropriate Fiber enclosures. Exposed tight-buffered, fan-out or loose-tube strands will not be tolerated and shall be remedied at Contractor's expense.
.7 Direct connection of terminated Fiber backbone links to equipment is not allowed. All Fiber connections shall go through a Fiber enclosure interconnect and connect to active equipment via Fiber jumpers.
.8 Contractor shall perform Fiber testing of all strands according to guidelines in the "Testing and Acceptance" section of this document.
.9 Service loop (slack) in telecommunications rooms shall be at least 3 meters. Consult project documentation for length of service loops and storage method within a specific telecom room or space.
.10 Slack shall be stored per manufacturer instructions inside the enclosure or stored outside the enclosure using appliances built for that purpose. Consult project documentation for details on storage of service loops.
.11 Fiber pulls using multiple pull points shall use the "figure-8" technique any time excess cabling is piled on the floor as slack to supply the next pull-point.
.12 Cable shall be rolled off the spinning cable reel, not pulled off the end.
.13 During all Fiber cable pulls Contractor shall have one person at each end of the pull to ensure proper cable pay out and pile up without damage to the Fiber.
.14 Fiber backbone cables shall be installed separately from horizontal distribution cables. Under no circumstances may copper and Fiber cables be pulled in common bundles.
.15 In pathways containing both Fiber and copper cables, the Fiber cable must either be of armoured construction or segregated in innerduct.
.16 Where cables are housed in sleeves or conduits, the backbone and horizontal cables shall be installed in separate conduits or the Fiber segregated in separate innerduct within the conduits.
.17 Fiber shall be segregated within racks and patching systems unless instructed otherwise in the project documentation.
.18 Where possible Fiber enclosures shall be mounted at the top of equipment racks and the Fiber cable kept separate from copper cable.

.19 Contractor shall inspect Fiber end faces with a Fiber scope and clean the connectors (if needed) whenever plugging in a Fiber connector.

.4 Fiber Optic Cable (Indoor Applications)

.1 The inter-LAN room fibre optic cable plant shall be type OM3 OR OM4 where required, 6 strand, 50 Micron Multi-Mode cabling, using laser optimized (OM3 or OM4) fibre in a cable with aqua coloured jacket, terminated with LC type connectors and mating adapters.
.2 The mechanical room to central LAN room fibre optic cable plant shall be 6 strand, 9/125 Micron Single-Mode cabling, with yellow coloured jacket, terminated with LC type connectors and mating adapters.
.3 The jacket shall be OFNP (FT6 / CMP) rated outer sheath.
.4 Shall be suitable for plenum and horizontal applications.
.5 Cable shall be part of the “end to end” structured cabling system warranty.
.6 Terminations and mating adapters shall be enclosed in a rack mount housing.
.7 Plenum rated 1” innerduct shall be supplied and installed by Data Network contractor if a dedicated conduit has not been provided.
.8 Fibre Optic patch cords, 50/125, shall be consistent with the grade and manufacturer of the fibre cable that is being warranted.
.9 Supply enough 6’ fibre optic patch cords to activate all strands. Confirm connector type with owner prior to ordering.

.5 Fiber Optic Cable (Indoor/ Outdoor Applications, including Portables)

.1 The inter-LAN room fibre optic cable plant shall be 6 strand, 50/125µm OM3 multi-Mode cabling with an attenuation of 3.5dB/km @ 850nm, an operating temperature of -40°C to 158°F (-40°C to 70°C), terminated with LC type connectors and mating adapters.
.2 The cable sheathing shall be UV resistant, meet light absorption requirement defined by standards and withstand harsh outdoor environmental demands.
.3 The cable sheathing shall provide superior crush resistance for aerial mounting applications.
.4 The cable sheathing shall be water resistant for underground conduit applications.
.5 The cable sheathing shall be rated OFNP (FT6 or CMP), and suitable for plenum and horizontal applications.
.6 The fibre used in the production of cords, cables and pigtails must be from the same source of manufacture (ex. - mixing of Bend Tolerant and Non-Bend intolerant fibres is not permitted).
.7 Bend radius should be maintained at 10x cable outside diameter, no less.
.8 Avoid excessive slack in the frames and cable tray, and abrupt bends.
.9 Dust plugs will be provided and should be maintained on all fibre outlets and patch panel ports to protect the connection from contamination when not in use.
.10 Mechanical splices and fibre adapter products shall not be used for joining fibres mid- span of any fibre link.
.11 Terminations and mating adapters shall be enclosed in a rack mount housing.
.12 Plenum rated 1” innerduct shall be supplied and installed by Data Network contractor if a dedicated conduit has not been provided.
.13 Fibre backbone should be the topmost cable in all cable routing solutions. Fibre should never be buried under any other cables.
.14 Fibre Optic patch cords, 50/125, shall be consistent with the grade and manufacturer of the fibre cable that is being warranted.
.15 Supply enough 6’ fibre optic patch cords to activate all strands. Confirm connector type with owner prior to ordering.
.16 Cable shall be part of the “end to end” structured cabling system warranty.

.3 Category 6 Cable

.1 Category 6 Cable (Indoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 The jacket shall be printed with sequential length markings1000' to 0' marking system, CMP (FT6) rated blue outer sheath.
.3 The category marking shall appear every foot.
.4 Shall be suitable for plenum and horizontal applications.
.5 Cable shall comply with TIA/EIA TSB-36 requirements for category 6 transmission.
.6 The cable shall be characterized to 300MHz and have a positive PSACR at 250MHz. It shall also be UL listed.
.7 CAT 6 cable is good for distances up to 90 meters / 295 feet. The horizontal cable from the patch panel to the RJ-45 jack in the faceplate shall not exceed a maximum of 90 meters / 295 feet.
.8 Cable shall support data rates up to 2.4 Gb/s, while surpassing Category 6 requirements as per the TIA/EIA-568-B.2-1 standard.

.2 Category 6 Cable (Indoor/ Outdoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 Cable sheath shall be CMX (outdoor) rated, for use where exposed to the elements.
.3 Cable sheath shall be CMR (riser) rated, suitable for vertical shaft applications.
.4 Cable sheath shall be UV rated, resistant to cracking after long-term UV exposure.
.5 Shall be suitable for plenum and horizontal applications.
.6 Cable shall comply with TIA/EIA TSB-36 requirements for category 6 transmission.
.7 The cable shall be characterized to 300MHz and have a positive PSACR at 250MHz. It shall also be UL listed.
.8 The horizontal cable from the patch panel to the RJ-45 jack in the termination box shall not exceed a maximum of 90 meters / 295 feet.
.9 Cable shall support data rates up to 2.4 Gb/s, while surpassing Category 6 requirements as per the TIA/EIA-568-B.2-1 standard.
.10 Bridged taps and splices are not permitted as part of the copper cabling.
.11 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.
.12 Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices.
.13 A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
.14 The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
.15 All horizontal cables shall be supported at a maximum of 48-to-60-inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
.16 Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities more than 25 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
.17 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

.3 Category 6A Cable (Indoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 The jacket shall be printed with sequential length markings 1000' to 0' marking system, CMP (FT6) rated blue outer sheath.
.3 The category marking shall appear every foot.

.4 Shall be suitable for plenum and horizontal applications.
.5 Certified channel performance to ANSI/TIA 568.2 D Category 6A and ISO 11801 Class EA in a four connector configuration up to 100 m.

.4 Category 6A Cable (Indoor/ Outdoor Applications)

.1 Cable shall be 4 pair 23 AWG solid copper conductors.
.2 Cable sheath shall be CMX (outdoor) rated, for use where exposed to the elements.
.3 Cable sheath shall be CMR (riser) rated, suitable for vertical shaft applications.
.4 Cable sheath shall be UV rated, resistant to cracking after long-term UV exposure.
.5 Shall be suitable for plenum and horizontal applications.
.6 Exceeds ISO 11801 Class Ea and ANSI/TIA568-C.2 Category 6A standards; Standards compliance: ISO 11801 Class Ea, IEC 61156-5 Category 6A, ANSI/TIA-568-C.2 Category 6A, IEC 60794-1-2F5 Method B Water Penetration Requirement Poe Compliance: Meets IEEE 802.3af, IEEE 802.3at, and IEEE 802.3bt for PoE applications; RoHS Compliant Cable.
.7 Bridged taps and splices are not permitted as part of the copper cabling.
.8 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.
.9 Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices.
.10 A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
.11 The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
.12 All horizontal cables shall be supported at a maximum of 48-to-60-inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
.13 Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities more than 25 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
.14 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

.4 Wireless Access Point Ceiling Drops
.1 All Wireless Access Point locations to be cabled with Category 6A cable, jacks, and patch cords or use of approved Field-terminable Plug. Cable to be CMP rated and terminated with colour jack in patch panel end to designate 6A. Contractor must have tester able to certify performance to 6A standards. You must install an additional 15 foot of "service loop" to ensure the cable can be placed optimally.

.5 Faceplates
.1 Faceplates shall be ULC Listed and CSA Certified.
.2 Faceplates shall be stainless steel, compatible with industry standard keystone modules.
.3 Faceplates shall be 2.75" W x 4.4" H (69.8mm x114.3 mm) for a single gang.
.4 Faceplates shall be available to mount one, two, three, four, or six jacks in a single gang.
.5 Two and three port faceplates shall have thermal ink transfer stencilled port indicators.
.6 All horizontal data cable installed in noted surface raceway shall be terminated with jacks as specified in a 3-port "furniture" faceplate on the raceway outlet location. Faceplates must be of the same manufacturer as the raceway. Surface faceplates on top of the raceway will not be permitted. Provide blank cover plates in ports not used. All faceplates to match raceway colour.

.6 Category 6 Modular Jacks

.1 Shall be 8 positions unkeyed.
.2 Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening.
.3 Jack Housing shall be constructed of high impact 94 V-0 rated thermoplastics.
.4 Modular jack contacts shall accept a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.
.5 Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in 2 staggered arrays of 4 to maximize contact spacing and minimize crosstalk.
.6 Modular jack shall be constructed of beryllium copper for maximum spring force and resilience.
.7 Contact plating shall be a minimum of 50 micro inches of gold in the contact area.
.8 Jack termination shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
.9 Jacks should be colour-coded as per their function:

.1 Wireless Access Points – Green
.2 CCTV Cameras – Purple
.3 Building Automation – Black
.4 Voice/Telephone - Red
.5 Main Office Data – White
.6 1st Floor Data – Blue
.7 2nd Floor Data – Orange
.8 3rd Floor Data - Yellow

.7 Category 6 Patch Panels
.1 Panels shall only be 48-port high density, 2U or 1U when required, and be made of black anodized aluminum in 2 rows of 24 ports. First row numbered 1-24 on upper portion of panel, and second row numbered 25-48 on lower portion of panel.
.2 Contractor to use existing empty ports on rack prior to adding additional ports.
.3 Contractor will populate, with modules, all ports of a newly installed patch panel frame.
.4 Panels shall be labelled on the front and rear of the panel to minimize obstruction by patch cables.
.5 Separate panels shall be used for data cable installations provisioned for voice and wireless access points. These panels shall be installed below other panels on the rack as the modules in these panels have to be connected to POE switches.
.6 One Rack Unit space should be maintained between Patch Panels of differing function (i.e., RU38 = Wireless Access Point Panel, RU37 empty, RU36 = CCTV Panel, RU35 empty, RU34 = 1st Floor Data, etc.)

.8 Racks
.1 Supply and install EIA Standard 19" floor mount equipment racks in accordance with ANSI/TIA/EIA-607 (CSA T527), complete with patch panels, switches, and horizontal/vertical wire management. Racks shall be bonded and bolted to the floor.
.2 All EIA Standard racks will be laid out to match Diagram 1-A. In addition, 4U must be made available for UPS, and another 3U made available for a rack mount server.
.3 Racks shall be securely attached to the concrete floor using appropriate mounting hardware.
.4 All racks shall be grounded to the telecommunications ground bus bar in accordance with cited standards the bonding and grounding section of this document.
.5 Rack mount screws (#12-24) not used for installing Fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation
.6 In telecommunications rooms with multi-bay rack rows, Contractor is responsible to include in design Interbay routing pathways at the top, middle, and bottom of each rack to provide efficient and neat patch routing between any two points within rack rows.

.9 Routers/ Switches/ Wireless Access Points/ UPS
.1 Supplied by Board with installation completed by the contractor. All Network Equipment software configuration will be completed by Board Staff.

.10 Portables
.1 The portable to LAN room fibre optic cable plant shall be 6 strand, 9/125 Micron Single-Mode cabling, with yellow coloured jacket, terminated in a 1U fibre patch panel (in LAN Room and portable) with LC type connectors and mating adapters.
.2 All fibre from the portables to the school shall be run within loom tubing in the cable support tray system, or in dedicated EMT conduit system, between the LAN Room and the point where it leaves the school building. All fibre shall be run in conduit and sealed when it runs through walls.
.3 A single wall mount 11U rack shall be securely installed in the Hub portable, with the bottom of the rack positioned at least 5 feet above the portable floor, and the rack located as close as possible to the point where the fibre enters the portable. The rack shall be configured as follows (top to bottom):

.1 1U Fibre Patch Panel
.2 2U 2-row 48-port patch panel
.3 2U Horizontal Management
.4 HPE Aruba Networking 2930F 12G PoE+ 2G/2SFP+ Switch (JL693A) and HPE Aruba Networking 10G SFP+ LC SR 300m OM3 MMF Transceiver (part number J9150D)

.4 All Ethernet cabling from the rack to a wireless access point drop located in the ceiling of each portable shall be CAT6 outdoor-rated and run-in conduit and sealed when it runs through portable walls.
.5 Supply one 3-foot CAT6 patch cable for each drop installed in the rack.
.6 Supply one 7-foot CAT6 patch cable for each wireless access point drop installed in the ceiling.
.7 Supply one 3 foot single-mode fibre patch cable with LC connectors for the portable rack.
.8 Supply one 6 foot single-mode fibre patch cable with LC connectors for the LAN Room rack.
.9 Patch down portable rack panel: drop 1 to port 1 on switch, drop 2 to port 2, etc.

.11 Patch Cables
.1 All LAN room Category 6 patch cables connecting panels to network equipment will be labelled at both ends of the cable following the naming convention detailed in the “LABELS” section of this document.
.2 All panel to switch patch cabling to be connected as per details provided in topology and matrix documents.

.12 Labels
.1 Supply and install the following mechanically printed labels:

.1 Face Plate Labels

.1 Labels shall adhere to the following convention:

.1 "LAN Closet<Letter>/Rack#/PATCH PANEL#/port#". ** Note that the LAN Closet Letter follows A, B, C...
.2 Labels shall be affixed to the faceplate on the space provided by the manufacturer.

.2 Cable Labels

.1 Shall be labelled in an identical manner as Faceplates.
.2 Supply and install self-laminated labels at both ends of each cable.

.1 End denotes 2-6” behind modular jack at both the faceplate and patch panel ends.
.2 All LAN Room panel-switch patch cables labelled within 3” of both ends of the cable.

.3 Rack Labels

.1 Labels shall adhere to the following convention:

.1 “LAN Closet<Letter>/Rack#”.

.2 Labels shall be affixed to the top centre of the rack.
.3 Shall be labelled consecutively from left to right.

.4 Patch Panel Labels

.1 Labels shall adhere to the following convention:

.1 ” Patch Panel#”.

.2 Labels shall be affixed to top left corner of patch panel.
.3 Shall be labelled consecutively from top to bottom.

.5 In-ceiling drops (access points, projectors, building equipment, etc.) shall have drop label (A/1/2/03 format) attached to the underside of the T-Bar below ceiling to indicate the location of the drop.

.13 Testing Copper
.1 The Data Cabling Contractor shall perform a full Category 6 or 6A test for every data drop installed in order to verify a 1000Mb/s solution or 10Gbs solution. Tester shall be a Level IIIe (or higher) field certification device capable of validating Category 6A channels per ANSI/TIA 1152 A.
.2 Upon completion of the testing, the Consultant or Owner may ask the contractor to perform random tests of up to 30% of the cables. This test will be completed with Consultant or Owner present. A penalty of $50.00 will be deducted from the contract amount for each cable that fails the test.
.3 All cables shall be tested in accordance with this document, the ANSI/TIA Standards, the manufacture warranty guidelines, and industry best practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
.4 All testers used must have been factory calibrated by the manufacturer within one year of use or according to factory calibration recommendations, whichever is more stringent.
.5 Contractor shall set references according to manufacturer’s recommendation prior to each day’s testing and reset references anytime the tester unit shuts down due to inactivity.
.6 Resetting references shall also be done whenever test results become sporadic, or the tester demonstrates a consistent deterioration of test measurement performance.
.7 Category 6 test parameters shall be:

.1 Wire map
.2 Insertion loss
.3 Equal-level far end crosstalk (ELFEXT)
.4 Power sum Equal level far end cross talk (PSELFEXT)
.5 Propagation delay
.6 Length
.7 Near end cross talk (NEXT)
.8 Power sum near end cross talk (PSNEXT)
.9 Return loss

.10 Delay Skew

.8 Jacks shall be tested as part of the horizontal cabling system.
.9 Category 6 or 6a jacks shall be tested as part of the channel Length, DC continuity, NEXT, PSNEXT, Attenuation, return loss, ELFEXT, and PSELFEXT using a level III tester for category 6 channel compliance.
.10 A "PASS" indication shall be obtained for all link or channel tests when tested using the appropriate level tester for the appropriate category.
.11 Testers shall be correctly set to test the type and manufacture of the horizontal cable used in the link or channel being tested, including the correct NVP.
.12 Link attenuation shall be calculated as: Link attenuation = cable attenuation + connection insertion loss + splice loss.
.13 Splicing of any cable shall not be permitted for any reason.
.14 Test results shall be submitted in hard and electronic format. Electronic reports shall be submitted in digital format in Microsoft Excel (.xls, .xlsx). All electronic reports must be accompanied by a certificate signed by the authorized representative of the Company warranting the truth and accuracy of the report. The hard copy of the report is to be submitted in triplicate in three individual binders.
.15 The test results documentation will reference each data outlet with the specified labelling scheme, while also appending the data outlet's room number location. This will provide the Board with a completed matrix that maps the data outlet's locations to the room numbers throughout the school. Each data outlet tested will appear as follows:

.1 "LAN Closet<Letter>/Rack#/PATCH PANEL#/Port#/Room#"

.16 Final room numbers should be used in this documentation.

.14 Final Inspection
.1 The cabling contractor, Consultant, and Owner must together perform a job walkthrough upon completion of testing, to verify that network cabling is properly installed and performs to acceptable Owner standards.

.15 Warranty
.1 The Contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-up support after the project for a period of one year. All costs for these warranties must be included in the tender/bid amount.
.2 The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance by the Owner. The warranty shall cover all labour and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after the repairs are accomplished. This warranty shall be provided at no cost to the Owner.
.3 The performance warranty shall warrant properly installed 250 MHz or 500 MHz horizontal copper portion of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA 568A and TSB-67.
.4 The Contractor shall provide a 24-hour response time to any warranty claim.
.5 The Data Cabling Contractor will be required to provide a minimum 15-year manufacturer's extended assurance warranty for the entire communications cabling system. Warranty shall be in effect from the date of substantial completion.
.6 The Data Cabling Contractor shall provide a letter of certification within two weeks of the substantial completion. This document will include:

.1 Verification number
.2 Manufacturer's certification number
.3 Identification of the installation by location and project number.

.7 The system manufacturer shall provide in writing to the Owner that in the event of the demise or failure of the installing certified system installer/Vendor, the manufacturer shall be responsible for providing another certified system installer/vendor to fulfil the remainder of the warranty conditions.

.8 Contractor must ensure that the selected network cabling components manufacturer and the wiring manufacturer have contractual relationships to ensure that the system warranty is a true "end to end" structured cabling system warranty.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 General

.1 Conform to the requirements of the authorities having jurisdiction.

.3 Cable Installation

.1 All cables shall be installed in the following manner:

.1 Cables shall be housed in conduit raceways or placed in the cable support tray system.

.2 All cables shall be plenum rated to provide fire protection to prevent smoke spread.

.3 Cable raceways shall not be filled greater than the Ontario Electrical Safety code maximum fill for the particular raceway type.

.4 Cables shall be installed in continuous lengths from origin to destination (no splices).

.5 The cable’s minimum bend radius and maximum pulling tension shall not be exceeded. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

.6 If a J-hook or Cable Tray support system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals - at no point shall cable(s) rest on acoustic ceiling grids or panels.

.7 Horizontal distribution cables shall be bundled in groups of not greater than 40 cables.

.8 The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

.9 Cables shall not be attached to ceiling grid or lighting support wires.

.10 Cables shall be identified by a self-adhesive label in accordance with the Section “Labels” of this specification.

.11 Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.

.12 Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.

.13 Where the cables in an air return plenum are not in conduit or placed in a wire management system, they shall be neatly installed following building lines and attached to the structure with Cable supports in plenums shall be UL listed, plenum rated, non metallic ties that maintain a minimum 1 inch bend radius, or metal clips mechanically fastened at maximum 1000mm centers. Do not attach to ductwork, piping, threaded rods, equipment, or other conduits.

.14 Backbone cables shall be installed separately from horizontal distribution cables.

.15 Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

.16 Backbone cables will be installed to a separate patch panel on each rack as per Diagram 1-A.
.17 The category marking shall appear every foot.
.18 Shall be suitable for plenum and horizontal applications.
.19 Cable shall comply with TIA/EIA TSB-36 requirements for category 6 transmission.
.20 The cable shall be characterized to 300MHz and have a positive PSACR at 250MHz. It shall also be UL listed.
.21 CAT 6 cable is good for distances up to 90 meters / 295 feet. The horizontal cable from the patch panel to the RJ-45 jack in the faceplate shall not exceed a maximum of 90 meters / 295 feet.
.22 Cable shall support data rates up to 2.4 Gb/s, while surpassing Category 6 or 6A requirements as per the TIA/EIA-568-B.2-1 standard.
.23 Cable shall include sequential length markings and be CMP (FT6) rated with blue outer sheath.
.24 Shall be suitable for plenum and horizontal applications.

.4 Outlet Installations
.1 All outlets shall be installed in the following manner:

.1 No more than appropriate lengths of slack shall be stored in an in-outlet box or modular furniture raceway.
.2 Each cable type shall be terminated as indicated below:

.1 Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.
.2 Pair untwist at the termination shall not exceed 0.5 inch for Enhanced Category 6 connecting hardware.
.3 Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
.4 The cable jacket shall be maintained as close as possible to the termination point.

.5 Horizontal Cross-Connect Installation
.1 Copper termination and management hardware shall be installed in the following manner:

.1 Cables shall be dressed and terminated in accordance with ANSI/TIA/EIA-568B, manufacturer's recommendations and best industry practices.
.2 Pair untwist at the termination shall not exceed 0.5 inches for Enhanced Category 6 or 6A connecting hardware.

.3 Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
.4 Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
.5 The cable jacket shall be maintained as close as possible to the termination point.
.6 Each cable shall be clearly labelled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.
.7 Cable labels shall not be obscured from view within bundles.

.6 Fibre Optic Termination Hardware Installation
.1 Fibre optic termination hardware shall be installed in the following manner:

.1 Fibre slack shall be neatly coiled within the fibre termination panel. No slack loops shall be allowed external to the fibre panel(s).

.2 Each cable shall be individually attached to the respective termination panel by mechanical means. The cables strength member(s) shall be securely attached the cable strain relief bracket in the panel.
.3 Each fibre cable shall be stripped upon entering the termination panel and the individual fibres routed in the termination panel.
.4 Each cable shall be clearly labelled at the entrance to the termination panel. Cables labelled within the bundle shall not be acceptable.
.5 Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

.7 Rack Installation
.1 The racks and cable routing hardware shall be in Local Area Network (LAN) closets. Racks shall be placed in a manner as follows; for the Central (Main) LAN closet allow a minimum of 5 feet clearance from the rear mounting surfaces and 3 feet of clearance from the front and on one side and for the racks in the Branch LAN closets allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6” to the wall to allow room for vertical management. The racks shall be equipped with perimeter horizontal and vertical management to provide Interbay management. Ganged rack frames will be placed in a manner that will allow a minimum of 5 feet of clearance from the rear and 3 feet from the mounting surfaces and on one side of the ganged assembly.
.2 Where racks and voice telecommunication networks are located in the same closet the racks shall be on the opposite side of the room from the voice termination fields. Conduits for data backbone shall be located adjacent to the racks and conduits for voice shall be located adjacent to the voice termination fields.
.3 Racks shall be installed in the following manner:

.1 Racks shall be securely attached to the concrete floor using 3/8” hardware anchor bolts.
.2 All racks shall be grounded in accordance with ANSI/TIA/EIA-607 “Grounding and Bonding Requirements”.
.3 Rack mount screws (#12-24) not used for installing fibre panels and other hardware shall be bagged and left with the rack upon completion of the installation.

.8 Fire and Smoke Stop Systems
.1 Must match General Contractor’s Specification for Firestop Systems.
.2 All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through wall penetrations and through floor penetrations. Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

.3 A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
.4 Firestop systems shall meet CAN4-S101M, Fire Tests of Building Construction & Materials, CAN4-S102M, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies and CAN4-S115M, Standard Method of Fire Tests of Fire Stopping Systems.

.9 Fibre Optic Testing
.1 Each fibre strand shall be tested for attenuation with an optical power meter and light source. Cable length and splice attenuation shall be verified using an OTDR.
.2 Attenuation:

.1 Horizontal distribution multimode optical fibre attenuation shall be measured in one direction at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. This measurement is consistent with the loss which network equipment will see under normal installation and use. Backbone multimode fibre shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14. Test results evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in ANSI/TIA/EIA-568-B.1.

.2 Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Maximum attenuation for installed cables shall be evaluated based on the following formula: manufacturer's maximum attenuation per kilometer divided by 1000 and then multiplied by the installed cable length in meters.

.3 The adjusted cable attenuation value shall be added to the manufacturers mean loss per mated pair of connectors multiplied by the number of mated pairs under test (the testing for this project measures the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors - subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test).

.4 The expected results for each cable (or group of cables of the same nominal length) shall be calculated before the start of testing and recorded in a space provided on the Contractor's test matrix. Each strand of fibre in the respective cable shall be evaluated against this target number. Any fibres that exceed this value shall be repaired or replaced at no cost to the Owner.

.5 Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.

.10 Cleaning

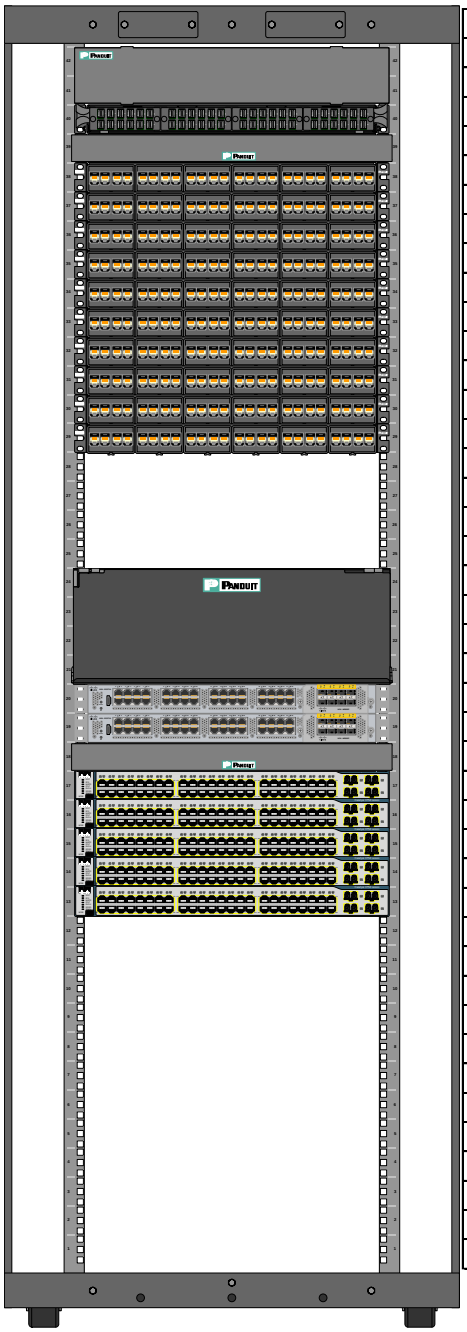
.1 The Owner's facilities shall be maintained in broom clean condition at the completion of work each day. At the completion of work in each area, the contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area.

.2 All Equipment will be stored appropriately at the end of each workday

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after fire stopping materials have set.

DIAGRAM 1-A



RU	DESCRIPTION
42	CBL MNGT
41	
40	FIBRE
39	CBL MNGT
38	PATCH PANEL COPPER
37	PATCH PANEL COPPER
36	PATCH PANEL COPPER
35	PATCH PANEL COPPER
34	PATCH PANEL COPPER
33	PATCH PANEL COPPER
32	PATCH PANEL COPPER
31	PATCH PANEL COPPER
30	PATCH PANEL COPPER
29	PATCH PANEL COPPER
28	OPEN
27	OPEN
26	OPEN
25	OPEN
24	CBL MNGT
23	
22	
21	
20	L3 SWITCH
19	L3 SWITCH
18	CBL MNGT
17	SWITCH
16	SWITCH
15	SWITCH
14	SWITCH
13	SWITCH
12	OPEN
11	OPEN
10	OPEN
9	OPEN
8	OPEN
7	OPEN
6	OPEN
5	OPEN
4	OPEN
3	OPEN
2	UPS
1	

END OF SECTION

APPENDIX A -MATERIALS LIST

Product Category	Part Description
Copper Cabling Products	
Category 6	Copper Cable, Cat6, 4-pair, 23AWG, U/UTP, CMP, Blue, 1000 feet in a carton
	Patch Panel ; 24 Port ; Angled ; Black
	Patch Panel ; 48 Port ; Angled ; Black
	Cat 6, UTP, 8 pos 8 wire, Universal, Blue, TG Style
	Stainless Steel Faceplate, 2 Port
	Faceplate that accepts two modular keystone-style Cat 6/6A jacks.
	Blank Module, 1 Port, Black
	The block-out device works with most standard RJ45 openings to prevent unauthorized access and to protect from dust and debris or foreign objects.
	Copper Patch Cord; Category 6 Performance 28 AWG ; UTP ; Blue CM/LSZH Cable ; 3 Ft
	Copper Patch Cord; Category 6 Performance 28 AWG ; UTP ; Blue CM/LSZH Cable ; 7 Ft
	Copper Patch Cord ; Category 6 Performance 28 AWG ; UTP ; Blue CM/LSZH Cable ; 10 Ft
	Standard RJ45 plug lock-in device with extended hood, 10 devices (black) and 1 key
Category 6a	Copper Cable, Cat 6A, 4-Pair, 23 AWG, UTP, CMP, Blue, 1000ft/305m
	Cat 6A, UTP, 8 pos 8 wire, Universal, Blue, TG Style
	Category 6A UTP Field Terminable RJ45 Plug
	Copper Patch Cord, Cat 6A (SD), Blue UTP Cable, 3ft
	Copper Patch Cord, Cat 6A (SD), Blue UTP Cable, 7ft
	Copper Patch Cord, Cat 6A (SD), Blue UTP Cable, 10ft
Fiber Cabling Products	
	50um OM4 6 Fiber Indoor Distribution Cable, Plenum (OFNP), 900um Buffered Fibers

Product Category	Part Description
	LC Fiber Optic Connector that is a multimode 50/125µm OM3/OM4/OM5 duplex fiber connector, intended for 900-micron tight-buffered fiber installation.
	Angled fiber tray that is designed to organize fiber distribution cabling. When used with the CFAPPBL1A patch panel, it accommodates up to 4 QuickNet cassettes or FAP adapter panels.
	Angled fiber patch panel is used with FMT1A and FMT2A trays and holds up to four Cassettes or FAP adapter panels. It is compatible with all 19" wide EIA rack mount installations, is black powder coated steel, and fits in a 1 RU footprint.
	Wall Mount Fiber Enclosure designed to manage and organize fiber distribution when space is limited.
Racks, Cabinets, and Cable Management	
	The 2-post rack that provides a reliable foundation for mounting telecommunications and data center equipment.
	Vertical Cable Manager that is a single-sided cable manager that provides a cost-effective solution to organize, manage, and protect network cabling in telecommunication rooms and data centers.
	Horizontal Cable Manager that provides a neat and efficient way to manage patch cables on any standard EIA 19 inch (483mm) rack or cabinet. It manages copper, fiber optic, and coax cables.
	Horizontal Cable Manager that provides a neat and efficient way to manage patch cables on any standard EIA 19 inch (483mm) rack or cabinet.
	The 2-post rack mount shelf mounts test gear, computer equipment, and small networking devices on 3 inch (76mm) or 6 inch (152mm) channel 2 post racks.
Bonding and Grounding	
	Grounding and labeling shall follow CSA T527 and ANSI/TIA-606-C; bidders may use any manufacturer's components that meet these standards.
Network Labeling	
	Labeling shall comply with ANSI/TIA-606-C and CSA T527; bidders may reference any publicly available documentation that demonstrates compliance with these standards.
Other Accessories	
	Provide basic 15 A, single-phase, 120 V rack-mount PDU with a minimum of twelve NEMA 5-20R outlets and 3 m cord.

Product Category	Part Description
	Hook and Loop Cable Roll is constructed of soft, premium material that is safe to use on high performance cables to protect against over-tensioning.
	J-Hook for wall mount application have a patented design, featuring complete horizontal and vertical 1" bend radius control, which prevents pinch points and degradation of cable performance.

END OF APPENDIX A

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The existing P.A. headend system shall be replaced with a new PA headend system compatible with existing PA system – Bogen/Telecor. Contractor shall site verify and provide suitable new headend system. include for rework of all existing PA wiring and re-terminate at the new PA headend system.

.3 Provide associated outlet boxes, back boxes, P.A. system wiring, P.A. system devices, testing, conduits terminated in corridor and provide extension to the existing system as shown on drawings and indicated in specification and in accordance with manufacturer recommendation. Provide all associated components to suit.

.4 New P.A. system speaker, VoIP phone handset (Mitel/ Shoretel) shall match existing unit.

.5 All new P.A. system devices i.e., P.A. system speaker(s), VoIP handset etc. shall match existing and shall be compatible with existing P.A. system panel.

.6 Provide VoIP-to-analog gateway that supports FXS ports complete with required conduit/wiring from new LAN room to existing PA rack located in existing electrical room. Provide all associated components for fully functional VoIP integration phone system to match existing to suit.

.7 Relocate existing P.A. system devices as shown on drawings. Extend associated conduit, wiring and adjust all components to suit.

.8 New P.A. system wiring shall be plenum rate FT-6 type, 24 AWG, two (2) twisted pair to match existing wiring. Install new wiring in new outlet/back boxes, conduits, and "free run" in corridor ceiling space. Provide associated "J-hooks" as required for proper support.

.9 Install wiring in new conduits/outlet boxes.

.10 Terminate new wiring in existing P.A. system panel.

.11 Terminate all conduits in corridor ceiling.

.12 The fish wire shall be installed in each conduit.

.13 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

.14 Installations of equipment and wiring shall be done in accordance with manufacturer’s recommendations and school board requirements.

.15 After completion of the system provides verification report by system manufacturer/installer.

.16 Pre-Qualified Contractor: Barrie Communications, High Tech Communications Inc.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide conduits, outlet boxes and other materials as required and/or shown on the drawings for installation of P.A. system devices and equipment.

.3 Conduits for P.A. devices shall be terminated as shown on the drawings. Coordinate all work with the P.A. system supplier/installer.

.4 The installation shall be in accordance with the Board's requirements.

.5 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The main existing telephone panel shall remain and shall be operational at all times.

.3 Provide associated outlet boxes, back boxes, jacks, cover plates, telephone system wiring, connection, conduits terminated in corridor and provide extension to the existing system as shown on drawings, indicated in specification and in accordance with manufacturer's recommendation. Provide all associated components to suit.

.4 Install wiring in new conduits/outlet boxes, and "free run" in corridor ceiling space. Provide associated "J-Hooks" (as required) for proper support.

.5 Terminate new wiring in existing telephone system BIXS panel.

.6 For each telephone outlet provide separate dedicated run of telephone system wiring and connect to existing telephone system BIXS panel/existing telephone system switch.

.7 New telephone system wiring shall be four (4) pair, solid copper, 22 AWG cable, unshielded twisted pair (U.T.P.), category 3, FT-6 rated and shall match existing wiring.

.8 Terminate all conduits in corridor ceiling. Provide J-Hook if required for proper support.

.9 The fish wire shall be installed in each conduit.

.10 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

.11 Installation shall be in accordance with manufacturer's recommendations and school board requirements.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide all conduits, outlets and other materials as required and/or shown on the drawings for a complete system.

.3 A fish wire shall be installed in each telephone conduit.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Clocks shall be surface mounted, battery operated, **Charles Leonard Wall Clock - 14" Thinline Quartz, Model: CHL76820** complete with batteries and hangers.

Charles Leonard Wall Clock - 14" Thinline Quartz | staples.ca

.3 Clocks in general purpose room shall be 14” diameter and shall be complete with wire guard.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide hangers for all clocks.

.3 Supply and install clock in each rom containing a classroom control panel and as shown on drawings. Include in contract 8-additional clocks which will be installed in rooms as designated by the school board representative and on site.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 The existing intrusion system shall remain and shall be operational at all times.

.3 Provide associated outlet boxes, back boxes, intrusion system wiring, intrusion system devices, testing, conduits terminated in corridor and provide extension to the existing system as shown on drawings and indicated in specification and in accordance with manufacturer recommendation. Provide all associated components to suit.

.4 Provide complete conduit system with proper support and required pull boxes for Intrusion detection system installation.

.5 The fish wire shall be installed in each conduit.

.6 All distribution conduits shall be complete with slip sleeves to permit the installation of the distribution cables.

.7 Conduit rough-in and installation shall be in accordance with the intrusion detection system installer and Owner’s requirements.

.8 Coordinate all work with the intrusion detection system installer/contractor on site.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Provide all conduits, outlets and other materials as required and/or shown on the drawings for installation of intrusion detection system devices and equipment.

.3 Conduits for intrusion detection system devices shall be terminated as shown on drawings. Coordinate all work with the intrusion detection system supplier/installer and on site.

.4 A fish wire shall be installed in each intrusion detection system conduit.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)
- .1 CAN/ULC-S524 - Standard for the Installation of Fire Alarm Systems.
- .2 CAN/ULC-S525 - Audible Signal Device for Fire Alarm Systems.
- .3 CAN/ULC-S526 - Visual Signal Devices for Fire Alarm Systems.
- .4 CAN/ULC-S527 - Control Units.
- .5 CAN/ULC-S528 - Manual Pull Stations for Fire Alarm Systems.
- .6 CAN/ULC-S529 - Smoke Detectors for Fire Alarm Systems.
- .7 CAN/ULC-S530 - Heat Actuated Fire Detectors for Fire Alarm Systems.
- .8 CAN/ULC-S531 - Standard for Smoke Alarms.
- .9 CAN/ULC-S536-S537 - Burglar and Fire Alarm Systems and Components.
- .10 CAN/ULC-S548 - Water flow Indicators for Fire Protective Signalling Systems.
- .11 CAN/ULC-S559 – Fire Signal Receiving Centres and Systems.

.2 National Fire Protection Agency (NFPA)
- .1 NFPA 72 - National Fire Alarm Code.
- .2 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

.1 Submit shop drawings for all products specified in Part 2.

.2 Submit manufacturer's printed product literature, specifications and data sheets as required and specified in specification.

.3 Submit equipment and zoning layout complete with wiring diagram.

2. Products

.1 The existing fire alarm system is manufactured by Edwards and must be operational at all times. <u>All new devices must match existing</u>.

.2 <u>Provide extension to the existing system (Edwards) as shown complete with F.A. devices and all necessary alarm, supervisory, and shut-down, modules as required for proper installation and operation. F.A. panel shall support existing and new zones. Adjust all components to suit.</u>

.3 <u>All new devices shall match existing F.A. manufacturer (F.A. pull stations, smoke and heat detectors, F.A. speakers, duct detectors, etc.).</u>

.4 Where indicated on the drawings; remove or relocate existing fire alarm speaker/strobe, F.A. pull stations, F.A. detectors etc. as shown.

.5 Before re-installation, the F.A. speakers, F.A. pull stations or F.A. detectors shall be cleaned, tested, and restored to a sound and operating condition. Coordinate with drawings.

.6 Provide new F.A. devices i.e.: F.A. speakers, pull stations, heat and smoke detectors, duct detectors, etc. as shown on the drawings.

.7 The existing fire alarm control panel shall be modified/expanded to suit F.A. zones as shown on the drawings. Adjust and add all components to suit.

.8 The existing F.A. graphic shall be replaced with new multi-colour passive graphic to suit existing and new F.A. zones.

.9 Existing F.A. annunciator(s) shall be modified to suit existing and new F.A. zones.

.10 Ensure the new fire alarm audible and visual devices are synchronized with the existing system. Include all associated costs in the contract.

.11 Combustion detectors shall operate on the ionization principle and shall be activated by the presence of combustion products. The detector shall be listed by Underwriters' Laboratories of Canada. The detector shall be a plug-in unit containing two ionization chambers, an amplifier-switching circuit and indicator lamp. The unit shall contain no moving parts. One chamber shall be for detection and the second chamber shall function as a reference, to stabilize the detector for changes in temperature, humidity, and pressure. It shall be possible to electrically check the detector's sensitivity and re-adjust the detector's sensitivity as required. The detector shall have incorporated a pilot light.

.12 The duct detectors shall be the same as the area detectors but shall include a duct mounting assembly, sampling tubes and remote indicating unit.

.13 End-of-line resistors shall be provided by this Division for the complete system.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 The equipment shall be installed strictly in accordance with the manufacturer's requirements and recommendations and the requirements of the Authorities having jurisdiction.
- .1 Canadian Electrical Code.
- .2 Canadian, Provincial and Local Building codes.
- .3 Local Authorities Having Jurisdiction.
- .4 Underwriters Laboratories Canada Inc.
- .5 ULC, BSA.

.3 Install wiring to conform with the requirements of the Canadian Electrical Code. Size wiring in accordance with Class 2 requirements, except for A.C. Signal Circuits where the wiring shall be sized in accordance with Class 1 requirements but be protected from mechanical injury or other injurious conditions such as moisture, excessive heat, or corrosive action in conduit. Connect wiring to the screw terminals in the devices.

.4 Install fire alarm systems in accordance with the latest Standards as identified in Section 1.2.1 above.

.5 Install end-of-line resistors in a separate outlet box with grille.

.6 Provide a complete system of relays for the auxiliary functions.

.7 Mechanical connectors are not acceptable. Solder and insulate all joints if wire cannot be continuous.

.8 Wire with colour coded conductors.

.9 Supervise all wiring.

.10 All wiring shall have copper conductors.

.11 Prior to energizing or commissioning the system, the F.A. system shall be fully inspected, tested, checked, and adjusted to include, but not limited to, the following:
- .1 That the type of equipment installed is that designated by the specifications.
- .2 That the wiring connections to all equipment components show that the installer has complied with ULC and CSA requirements.
- .3 That the equipment has been installed in accordance with the manufacturer's recommendations and that all devices have been operated and tested to verify their operation, and that the system operates in accordance with the requirements of the Specification.
- .4 That the supervisory wiring of those items of equipment connected to a supervisory circuit is operated as specified.
- .5 Those Governmental regulations will be met to the satisfaction of inspection office.

.12 The inspection and testing reports and certification of fire alarm system prepared by the fire alarm vendor shall be submitted for review by the Consultant. This work shall be complete 3 weeks prior to occupancy date.

.13 The "dB" readings shall be provided by the fire alarm system vendor in each area/room where audible devices are installed (part of this Contract). The testing report shall be prepared and submitted for review by the Consultant. This work shall be complete 3 weeks prior to occupancy.

.14 System changes shall be verified by the manufacturer's representative, and a verification certificate presented upon completion in accordance with CAN/ULC-S537 (Latest Edition) - Standard for Verification of Fire Alarm Systems.

.15 Warranties all materials, installation, and workmanship for one (1) year from date of acceptance, unless otherwise specified.

.16 System installation and operations shall be verified by the manufacturer's representative, and a verification certificate presented upon completion. The manufacturer's representative shall be responsible for an on-site demonstration of the system operation and initial staff training as required by the Owner and/or Consulting Engineer.

.17 When the fire alarm system has been commissioned and verified it shall be fully demonstrated by this Division to the authorities having jurisdiction.

END OF SECTION

1. General

1.1 APPLICATION

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

.2 Refer to section 26 05 01, Electrical Work General Instructions.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)
  .1 CAN/ULC-S524 - Standard for the Installation of Fire Alarm Systems.
  .2 CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.
  .3 CAN/ULC-S1001-11 – Integrated Systems Testing of Fire Protection and Life Systems.

.2 National Fire Protection Agency (NFPA)
  .1 NFPA 72 - National Fire Alarm Code.

1.3 SUBMITTALS

.1 Fire alarm verification report and verification certificate in accordance with CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.

.2 Integrated systems testing of fire protection and life systems report and certificate in accordance with CAN/ULC-S1001-11 – Standard for Integrated Systems Testing of Fire Protection and Life Systems.

2. Products

.1 Except for those items as may be specified in Part 3, of this Section, refer to Part 2 of the various Sections of Specification, Division 26 Electrical.

.2 Verify Fire Alarm System complete with all fire alarm zones in accordance with CAN/ULC-S537 (Latest Edition) - Standard for Verification of Fire Alarm Systems.

.3 Complete the installation, inspection, testing and verification of the fire alarm system as specified in Section 28 46 00, and perform "Integrated systems testing of fire protection and life systems" in accordance with CAN/ULC-S1001-11 with independent company and advise the Consultant and authority having jurisdiction in writing accordingly by providing all supporting documentation as required for CAN/ULC-S1001-11 inspection, testing and verification process three weeks prior to substantial completion of the contract.

.4 Provide all information, drawings, documents, shop drawings, and assistance to the independent company who will be performing inspection, testing and verification of integrated system testing of fire protection and life system in accordance with CAN/ULC-S1001-11.

.5 Coordinate with fire alarm system manufacturer, fire alarm system verification contractor and other trades and contractors for door hardware system, access control system, elevator system, mechanical systems, sprinkler and standpipe systems, building controls system, lighting control systems, security system etc. and facilitate to provide all required assistance necessary in order that the inspection, testing and verification in accordance with CAN/ULC-S1001-11 for Integrated systems testing of fire protection and life systems as specified herein can be successfully completed.

.6 Integrated Systems Testing of Fire Protection and Life Systems shall verify that the systems, their components including but not limited to Fire alarm systems, Sprinkler systems, Standpipe systems, Elevators, Hold-open devices, Cooking suppression system, Emergency generators, Fire pumps, Emergency Lighting systems, Electromagnetic locks, Smoke control systems, Ventilation (Pressurization) systems, Audio/Visual and/or Lighting controls, Notification systems, Water supplies, Water control valves, Freeze protection systems, Fixed fire suppression systems etc. and their interconnections with other building systems are functioning in accordance with the intent of their design.

.7 The independent company who will be performing inspection, testing and verification of integrated system testing of fire protection and life system in accordance with CAN/ULC-S1001-11 and acting as Integrated Testing Coordinator (ITC) shall include and perform all procedures as required by CAN/ULC-S1001-11 but not limited to:

.1 ITC shall develop and prepare an Integrated Testing Plan specific to the project, outlining the required tests and necessary functional results to conduct integrated fire protection and life systems testing.

.2 ITC shall attend construction meetings prior of integrated testing procedure; to review the integrated testing process with the architect, consultant, electrical contractor, mechanical contractor, general contractor, and owner's representative.

.3 ITC shall review all relevant shop drawings during construction.

.4 ITC shall attend site prior to day of testing to review testing process with project team/ electrical contractor and confirm all systems are ready for testing.

.5 ITC shall discuss with the project team/ electrical contractor, the testing process to ensure all trades are aware of their expectations on day of testing.

.6 ITC shall ensure that integrated testing (IT) Plan is reviewed by consultant team prior to testing.

.7 ITC shall ensure that all applicable system start-up reports are received prior to testing.

.8 ITC shall perform testing of integrated fire protection and life safety systems in accordance with CAN/ULC-S1001-11 and integrated testing plan.

.9 ITC shall submit an integrated testing report, specific to the project and documenting the implementation of the integrated testing plan. The report shall confirm and acceptable to the requirements of the authorities having jurisdiction.

.8 Refer to Architectural Division Section 01 91 29 – Integrated System Testing of Fire Protection and Life Safety Systems, and include in tender price cost for additional scope and details as described/identified.

3. Execution

.1 Except for those items as may be specified in Part 2 of this Section refer to Part 3 of the various sections of Specification Division 26 Electrical.

.2 Inspect and test the fire alarm system and auxiliary equipment in accordance with CAN/ULC-S537 and integrated testing in accordance with CAN/ULC-S1001-11 as specified in Section 28 46 00 and as described above and complete and sign all necessary forms.

.3 Provide a letter addressed to the Consultant confirming that the fire alarm system verification and integrated testing have been satisfactorily completed.

END OF SECTION

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 30 00 Cast-In-Place Concrete

.2 Section 07 21 13 Building Insulation

.3 Section 31 66 00 Helical Piles

.4 Section 32 92 23 Sodding

1.3 References

.1 ASTM International (ASTM)

.1 ASTM D698-12(2021) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

.2 ASTM D1557-12(2021) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

.2 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 805 Construction Specification for Temporary Erosion and Sediment Control Measures

.2 OPSS 180 General Specification for the Management of Excess Materials

.3 OPSS 206 Construction Specification for Grading

.4 OPSS 1010 Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material

.3 Ontario Provincial Standard Details (OPSD)

.1 OPSD 219.130 Heavy Duty Silt Fence Barrier

.2 OPSD 805 Temporary Erosion and Sediment Control Measures

.4 The Occupational Health and Safety Act.

.5 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings of shoring and bracing required in connection with excavation. Drawings to show clearly procedural sequence to be followed.

1.5 Definitions

.1 Earth: Site excavated material, including shale, rubble rock, building debris, shrub and tree roots and soil.

.2 Soil: Site excavated material, free from shale, rubble rock, building debris, shrub and tree roots.

.3 Fill: Approved materials, other than earth, clay and unapproved soil. Approved soil may be used only with approval of the Consultant in writing.

.4 Rock: All solid rock in ledges, stratified deposits, unstratified masses, and all conglomerate deposits or any other material so firmly cemented by process of nature as to present all the characteristics of solid rock, being so hard or firmly cemented that it cannot be excavated and removed with a power shovel except after thorough and continuous drilling and blasting.

.5 Backfilling: The operation of supplying and installing fill and approved soil materials.

.6 Engineered Fill: Approved material used to build-up to design elevations.

1.6 Examination

.1 Examine the building site and determine the nature and extent of the materials to be removed or the additional fill required to provide depths and levels indicated on drawings. Field check the site to review existing conditions. Verify locations of all existing utilities and services that will affect the work.

.2 Refer to drawings for all building and site development details.

1.7 Geotechnical Report

.1 Refer to “Geotechnical Investigation Report- St. Luke the Evangelist Catholic School” prepared by Cambium Inc. and dated July 31, 2026.

.2 Information provided in this report is based on field records and is therefore subject to the usual limitations and reservations associated with such work (stated in the conclusion of the report).

.3 The use of this information is entirely at the risk of the Contractor.

.4 During examination of the site, carry out such investigations as necessary to determine subsurface conditions to be encountered in constructing the Works.

.5 Notify the structural engineer and the inspection and testing company when excavation work commences for inspection and verification of soil conditions.

1.8 Setting Out Work

.1 The drawings indicate the building components location and proposed and final grades. Be responsible to construct the work according to levels and locations shown on the drawings. Report any errors or discrepancies to the Consultant before commencing work.

.2 Commencement of any part of the work shall constitute acceptance of drawings as being correct.

.3 Employ a competent instrument man and provide all lines and levels, limit lines and boundary stakes for the execution of the work as required. All benchmarks shall be carefully protected.

.4 Provide and be responsible for, all lines, levels and dimensions which trades require to relate their work to the work of other trades. All trades shall be notified that all such levels and dimensions must be obtained from the Contractor.

1.9 Existing Underground Utilities

.1 Arrange underground locates of all utility assets prior to excavating. Do not commence excavation in a location prior to utility members marking the location of their utilities or indicating that none exist within the outlined excavation limits. Where necessary, employ the services of a private utility locator to ensure that all utilities are located in a timely manner.

.2 Verify the location and elevation of all existing utilities within the limits of the Work. Observe the locations of the stake outs, prior to commencing the Work. In the event there is a discrepancy between the locations of the stake outs and the locations shown on the Contract Documents, that may affect the Work, immediately notify the Consultant and the affected utility companies, in order to resolve the conflict.

.3 All existing buried utilities located within the excavation zone and any other facilities adjacent to the excavation shall be carefully supported and protected from damage as a result of the Contractor’s operations. Be responsible for repairing any damaged underground utilities, as a result of actions during the course of the work at no extra cost to the Owner.

.4 All costs associated with this work shall be considered incidental to all related items of work in the Contract. No separate payment will be made for costs incurred in obtaining utility locates.

1.10 Protection of Existing Services

.1 Notify the Owner, Public Utility or Municipal authorities in advance of planned excavations adjacent to their services.

.2 Take care not to damage or displace encountered known and unknown services.

.3 When such services are encountered during the execution of work, immediately notify the Consultant and protect, brace and support active services. Where repairs to these services become necessary use the following procedure:

.1 Known services, repair at no expense to the Owner.

.2 Unknown services, forward to the Consultant a complete breakdown of the estimated cost of such work. Proceed only upon written authorization.

.4 In the case of damage to, or cutting off of an essential service, notify Consultant, the Owner, and Public Utility or Municipal authorities immediately and repair the service under the Consultant's direction.

1.11 Inspection and Testing

.1 Provide proper and sufficient samples, ample opportunity and access at all times for the Consultant or Testing Agency to inspect materials, operations and completed works carried out under this Section.

.2 Sample and test excavated material prior to shipping to landfill off the site in accordance with the requirements of O. Reg. 406/19. Samples shall be tested for compliance of acceptable material for landfill. Furnish to the Owner the results of all testing and location of landfill site used. This testing will not be undertaken by the Owner's Inspection and Testing Agency.

.3 Provide 24 hours notice to inspection laboratory and request tests as follows:

.1 Sieve Analysis: Proposed fill materials will be tested to confirm stability for intended use and conformity with specifications.

.2 Density Test: Tests will be conducted on compacted fill, to ASTM D698.

.3 Frequency Test: Excavated Surfaces: When existing compacted fill surface is being prepared, make a series of three tests of surface for each 500 m² area.

.4 Fills under Pavement or Slabs on Grade: Make three tests for every two lifts of compacted fill for each 500 m² area.

.5 Backfill Structural Walls: Test each different material for approximately each 30 metres of wall being backfilled at depth increments of 610 mm.

1.12 Standards

.1 Carry out all work in accordance with the applicable OPSS, OPSD and site drawings. The applicable Ontario Provincial Standard Specifications are listed hereafter.

.2 The following shall apply:

.1 OPS 180 Management and Disposal of Excess Material

.2 OPS 206 Grading, Nov. 2005

.3 OPS 314 Untreated Granular Subbase, Base, Surface, Shoulder and Stockpiling

.4 OPS 408 Adjusting or Rebuilding Maintenance Holes, Catch Basins Ditch Inlets and Valve Chambers

.5 OPS 805 Temporary Erosion and Sediment Control Measures

1.13 Shoring and Bracing

.1 Shoring and trench timbering, in addition to requirements of local authorities, shall be carried out in accordance with the requirements of The Occupational Health and Safety Act, "November 1992 Ontario Regulation 213/91" and Regulations for Construction Projects by Ontario Ministry of Labour and to Construction Safety Association brochure "Trenching Safety April 1994".

.2 Erect necessary shoring for excavations in such a manner that:

.1 Whenever a trench or excavated face is necessary, shore and brace to prevent failure. Engage a registered Professional Engineer fully qualified in this line of work to design, stamp shop drawings and assume responsibility for the shoring and bracing. Submit shop drawings to the Consultant.

.2 It will properly retain the banks of the excavations and prevent caving-in or displacement or damage to surrounding or adjacent buildings or other property.

.3 All other work in connection with this Contract, including the Mechanical and Electrical Trades, may be carried out while it is still in place if necessary.

.4 It will be entirely free of footings, foundation walls or other such work so that it may be removed entirely or in sections when it is no longer required or when directed, without causing any damage or injury to the structural work that has been completed.

1.14 Sedimentation Control

.1 Maintain and/or repair sedimentation control at all watercourses and catch basins to prevent contamination by excavated fill.

.2 Sedimentation control shall be in accordance with the Ontario Provincial Standard Specifications, OPSS 805 and local authorities.

.3 Refer to details and notes on site development drawings.

.4 Install additional sedimentation control as required and obtain Consultant's approval prior to commencement of site works.

1.15 Dewatering

.1 Keep excavations and backfill dry at all times.

PART 2 PRODUCTS

2.1 Materials

.1 Type A Fill: Class "A" material conforming to OPSS1010, latest edition.

.2 Type B Fill: Class "B" material conforming to OPSS 1010, latest edition.

.3 Sand Fill: Clean, well graded compactable sand to OPSS 1010, Granular "M" fill.

.4 Engineered Fill: fill placed below Type A and Type B fill to bring excavation to the design elevations. To be Type B fill or approved fill, approved in writing by the Consultant.

.5 Silt fence: heavy duty geotextile, Mirafi Envirofence or equivalent.

PART 3 EXECUTION

3.1 Preparation

.1 Lines and Levels: Refer to Section 01 71 00 - Examination and Preparation.

.2 Stock Piles: Materials shall not be stockpiled on the site except with the prior approval of the Consultant. Where permitted, stockpile materials in a manner to prevent segregation and contamination. Piles not to exceed 2000 mm in height. Stockpile materials in a location and manner not interfering with ongoing operation and use of the site and building by the Owner.

.3 Install silt fencing as detailed and in accordance with reference standards.

3.2 Excavation Work

.1 Excavate to elevations and dimensions indicated or required by the work, plus sufficient space to permit erection of forms, shoring and inspection. Excavation shall be made to clean lines to minimize quantity of fill material required.

.2 Remove large rocks, stumps and other obstructions of whatever nature encountered in the course of excavation and haul away off the site. Remove all concrete, masonry, rubble or other construction debris encountered during the work.

.3 Unauthorized Excavation - Excavation to greater than required depth shall be corrected by the Contractor at his own expense in a manner as directed by the Consultant. Fill over-excavated areas under structure bearing surfaces and footings with concrete as specified for foundations.

.4 Keep excavation free of water by bailing, pumping or a system of drainage as required and provide pumps, suction and discharge lines or well points of sufficient capacity and maintain until such time as the permanent drainage system is installed or until the Consultant's approval of removal of equipment is obtained. Take all necessary measures to prevent flow of water into the excavation.

.5 Protect the bottom and sides of excavated pits and trenches from freezing. Protect also from exposure to the sun and wet weather to prevent cave-ins and softening of the bed upon which concrete or drains rest.

.6 Excavations must not interfere with the normal 45 degree plane of bearing from the bottom of any footing.

.7 Keep bottoms of excavations clean and clear of loose materials levelled and stepped at changes of levels with exception of excavations made for drainage purposes and those to slope as required.

.8 If the excavations reveal seepage zones, springs or other unexpected sub-surface conditions which may necessitate revisions or additions to any drainage system, inform the Consultant immediately so that remedial action can be taken.

.9 If removal of earth causes displacement of adjacent earth, the earth so disturbed shall be removed at no additional cost to the Owner.

.10 Conditions of Excavated Surfaces

.1 Excavate to a depth sufficient to expose firm undisturbed subsoil, free of organic matter and to the Testing Agency's approval.

.2 Remove soft, wet or unconsolidated ground and organic material encountered in excavating.

.3 Should the nature of the sub-soil at the depths shown prove to be unsatisfactory to the Consultant for the placing of the concrete work, then upon the Consultant's written order, the Contractor shall excavate to greater depth until a satisfactory bottom is reached.

.11 Tolerances: General excavation shall be to the elevations shown on the drawings, plus or minus 25 mm.

3.3 Hydro Excavation

.1 Utilize hydro excavation services when working near and around known utilities to avoid

damage.

3.4 Backfilling

.1 Proceed promptly with backfilling as the building progresses, and as work to be backfilled has been inspected and approved by the Consultant. The backfill in areas where settlement cannot be tolerated, e.g. service and footing trenches under the floor slab, should be compacted to at least 100 per cent of its Standard Proctor Maximum Dry Density. The backfill should be placed in lifts not greater than 200 mm thick in the loose state, each lift being compacted with a suitable compactor to the specified density.

.2 Do not commence backfilling operations until mechanical and electrical services, site drainage systems, perimeter and underslab insulation has been inspected and approved by Consultant and authorities having jurisdiction. Existing floor subgrade must be proof rolled before backfilling.

.3 Withdraw shoring material during backfill. Lumber left in place without the Consultant's approval will not be paid for by the Owner.

.4 Backfill evenly on both sides of foundation walls to avoid unequal fill pressures on walls.

.5 Place fill around foundation walls and footings so that footings will have a minimum of 1200 mm coverage, measured at an angle of 45 degrees from bottom of footing to protect against frost until final grading is complete.

.6 Where fill is placed adjacent to structures or vulnerable building components or in restricted areas, the fill shall be compacted to the same degree as specified by suitable equipment approved by the Consultant. Avoid damage to or displacement of walls, columns, piers, underground services, and process/ production equipment.

.7 Add water in amounts required only to achieve the optimum moisture content, in accordance with ASTM D1557.

.8 Backfill shall be free of snow and ice, topsoil, construction debris and oversized boulders greater than 150 mm.

3.5 Rough Grading

.1 Preparation and Layout

.1 Establish extent of grading by area and elevation.

.2 Prior to commencement of grading work, establish location and extent of all underground utilities occurring in work areas. Maintain, reroute or extend as required. Pay all costs for this work, except costs borne by utilities companies.

.3 Slope grade away from building as indicated on drawings.

.4 Cut temporary drainage swales and create containment ponds and structures for temporary surface run-offs, until storm sewer system is installed.

.5 Regrade all areas that retain or pond water.

.6 Rough grade all areas to tolerance of plus or minus 50 mm.

3.6 Fills Under Concrete Slab

.1 The fill shall be deposited in layers of such thickness that the equipment being used for compacting can produce the specified density but in no cases, more than 200 mm thickness. If lumps are present in the material each layer shall be continuously disced in order to ensure proper compaction.

.2 The exposed subgrade shall be proof rolled to ensure its integrity. If the subgrade consists of engineered fill, the fill shall be compacted to at least 98% of its maximum Standard Proctor Dry Density for native materials or 100% compaction for Granular “A” and “B” materials, using equipment approved by the Consultant. Any loose, wet or deleterious material shall be sub-excavated and replaced by the Contractor with Type B Engineered fill which must be compacted to 98% Standard Proctor Maximum Density.

.3 Immediately after levelling, each layer of fill shall be thoroughly compacted by the use of approved mechanical equipment.

3.7 Compaction Density

.1 Use approved equipment for compaction. Maintain materials at optimum moisture content to obtain required compaction. Special care shall be taken to prevent disturbance of the existing subgrade and adjacent structures and equipment.

.2 Be responsible for damage to the subgrade and installed materials due to improper compaction methods. Make good to approval of the Consultant.

.3 The minimum density of fill in place shall be the following values of Standard proctor densities for corresponding locations in accordance with ASTM D698.

.1 Type A Fill: To 100% Standard Proctor Maximum Density.

.2 Type B Fill: To 100% Standard Proctor Maximum Density.

.3 Engineered Fill: To 98% Standard Proctor Maximum Density.

.4 If during progress of work, tests indicate that compacted materials do not meet specified requirements, remove defective work, replace and retest at own expense.

.5 Ensure compacted fills are tested and approved before proceeding with placement of surface materials.

3.8 Fill Locations

.1 Type A Fill:

.1 Under all interior and exterior concrete slabs 150 mm minimum thickness.

.2 Below all mechanical or electrical services, from 150 mm below invert, to springline.

.2 Type B Fill:

.1 Around all footings, foundations, grade beams and walls up to the underside of Type A fill.

.2 From top of approved compacted subgrade to underside of concrete slabs (interior or exterior) but not less than 200 mm thickness.

.3 At all areas on the site indicated to be paved with asphalt.

.3 Sand Fill:

.1 Below all mechanical or electrical services, minimum 150 mm deep.

.2 Above all mechanical or electrical pipes and trenches, from springline to 300 mm above pipe obvert.

.4 Engineered Fill: All fill locations up to the underside of Type B fill and where required to fill up to design elevations.

.5 Site excavated material: as backfill to exterior side of foundation walls only when permitted and approved by the Geotechnical engineer and below all sodded or seeded areas up to underside of topsoil, but not within 600 mm of foundation walls or structures.

3.9 Water on Prepared Surfaces

.1 Promptly remove, by approved methods, water rising from seeping of the soil or resulting from rainfall wherever such water is on the surface of sub-grade soil and compacted fill.

.2 Where proper drainage and pumping is not carried out as specified herein, and any prepared sub-grade soil for under structural work, and any compacted fill for under concrete slabs, is softened or disturbed by water due to improper drainage and pumping, the Contractor shall remove the unsatisfactory soil and fill, and bear all incidental costs in connection with additional excavation and placing and compacting of granular fill under floor slabs.

3.10 Adjustments

.1 All manhole frames and covers, catch basin frames and covers, drains and valves including those existing scheduled to remain, shall be adjusted and set flush with finished elevation.

.2 Adjustments to manholes and catch basins shall be done using concrete adjustment units

as per OPSS 408 and OPSD 704.010

3.11 Surplus Soil Disposal

.1 Surplus soil and excavated material shall be promptly removed and disposed of off the site at legal dump sites. Conform to local bylaw requirements for trucking and disposal.

.2 Comply with the requirements of Ontario Regulation O. REG 406/19, “On-Site and Excess Soil Management”, for the importation of new soils and fill materials and the exportation, removal and disposal off-site, of excavated materials. Complete testing of imported and exported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

3.12 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 As excavation proceeds, keep roads and aisles clean of dirt and excavated material.

.3 Clean up and wash down to remove all dirt and excavated materials caused by the work of this section daily.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 03 10 00 Concrete Forming and Accessories

.2 Section 03 20 00 Concrete Reinforcing

.3 Section 03 30 00 Cast-in-Place Concrete

.4 Section 31 23 10 Excavating, Trenching and Backfilling

1.3 References

.1 ASTM International (ASTM)

.1 ASTM A29/A29M-26 Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought

.2 ASTM A36/A36M-19 Standard Specification for Carbon Structural Steel

.3 ASTM A53/A53M-24 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.4 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.5 ASTM A193/A193M-26 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

.6 ASTM A252/A252M-26 Standard Specification for Welded and Seamless Steel Pipe Piles

.7 ASTM A320/A320M – 26 Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service

.8 ASTM A500/A500M-23 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

.9 ASTM A513/A513M-25 Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

.10 ASTM A536-26a Standard Specification for Ductile Iron Castings

.11 ASTM A572/A572M-25 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

.12 ASTM A618/A618M-21 Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing

.13 ASTM A656/A656M-24 Standard Specification for Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability

.14 ASTM A775/A775M-22 Standard Specification for Epoxy-Coated Steel Reinforcing Bars

.15 ASTM A958/A958M-24 Standard Specification for Steel Castings, Carbon and Alloy, with Tensile Requirements, Chemical Requirements Similar to Standard Wrought Grades

.16 ASTM A1018/A1018M-25 Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

.17 ASTM D1143/D1143M-26 Standard Test Methods for Deep Foundations Under Static Axial Compressive Load

.18 ASTM D3689/D3689M-25 Standard Test Methods for Deep Foundations Under Static Axial Tensile Load

.19 ASTM F3125/F3125M-26 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

.2 American Welding Society (AWS)

.1 AWS D1.1 Structural Welding Code – Steel

.2 AWS D1.2 Structural Welding Code – Reinforcing Steel

.3 ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations.

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit site specific shop drawings sealed by a registered professional engineer in the province of Ontario. Shop drawings to include:

.1 Helical Pier/Anchor number, location, and pattern by assigned identification number

.2 Helical Pier/Anchor design load

.3 Type and Size of Helical Pier/Anchor shaft

.4 Helical configuration (number and diameter of helical plates)

.5 Minimum effective torque requirement

.6 Inclination of helical pier/anchor

.7 Grout column diameter and length

.8 Connection details

.3 Submit certified mill test reports for the central steel shaft to the Owner for record purposes. The ultimate strength, yield strength, % elongation, and chemistry composition shall be provided.

.4 Submit Canadian Construction Materials Center (CCMC) evaluation report from manufacturer of helical materials.

.5 Calibration reports for installation equipment utilized on the project. The calibration tests shall have been completed within one year of the date submitted.

.6 Submit plans for pre-production and production tests for the helical piers/anchors to the Consultant for review and acceptance prior to beginning load tests. The purpose of the test is to determine the load versus displacement response of the helical pier/anchor and provide an estimation of ultimate capacity.

.7 After completion of the test piers/anchors (pre-production and production), submit the results to the Owner for approval to begin production pier/anchor installation.

.8 After completion of the installation of the helical piers/anchors, provide the Consultant with a report of all helical piers/anchors installed on the project certifying the ultimate load capacity of the piers/anchors installed sealed by a professional engineer registered in the province of Ontario.

1.5 Quality Assurance

.1 Helical Pier/Anchor Manufacturer Qualifications

.1 Helical pier/anchor components shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements.

.2 Helical pier/anchor manufacturer shall have had an Evaluation Report completed by Canadian Construction Materials Center.

.3 Design of helical piers/anchors shall be performed by a professional engineer licensed in the province of the project in accordance with existing local code requirements.

.2 Helical Pier/Anchor Installer Qualifications:

.1 Installation shall be completed by a contractor who is certified by the manufacturer to install the manufacturer's material. Installer shall provide proof of installations of similar nature, complexity or dollar cost.

1.6 Environmental Conditions

.1 Do not install helical piers/anchors during heavy rain or heavy snowfall.

.2 Do not place grout materials that are frozen or partially hydrated.

1.7 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

.3 Coordinate delivery and helical pier/anchor construction schedule to minimize interference with normal use of buildings adjacent to the project.

.4 Unload units at job site in such a manner that no damage occurs to the product

1.1 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Basis of Design Manufacturer

.1 Chance Civil Construction, 210 North Allen Street, Centralia MO, 65240

.1 Phone: 573-682-8414

.2 Email: civilconstruction@hps.hubbell.com

2.2 Helical Piers/Anchors

.1 The helical piers/anchors shall have a central shaft that is hot rolled Round-Corner-Square (RCS) solid steel bars meeting dimensional and workmanship requirements of ASTM A29 and have the following properties:

.1 SS5 – 38 mm Material:

.1 Torsional strength rating = 7457 Nm

.2 Ultimate Resistance Capacity = 240 kN

.2 SS175 – 45 mm Material:

.1 Torsional strength rating = 14915 Nm

.2 Ultimate Resistance Capacity = 480 kN

.3 SS200 – 51 mm Material:

.1 Torsional strength rating = 20337 Nm

.2 Ultimate Resistance Capacity = 660 kN

.4 SS225 – 57 mm Material:

.1 Torsional strength rating = 27116 Nm

.2 Ultimate Resistance Capacity = 890 kN

.2 The helical piers/anchors shall have helical bearing plates that are hot rolled carbon steel sheet, strip or plate formed on matching metal dies to true helix shape and uniform pitch and have the following properties:

.1 SS5 – 38 mm Material:

.1 Plate thickness = 9.5 mm

.2 Minimum yield strength = 345 MPa

.3 Per specification: ASTM A572, A1018 or A656

.2 SS175 – 45 mm Material:

.1 Plate thickness = 9.5 mm

.2 Minimum yield strength = 552 MPa

.3 Per specification: ASTM A1018 or A656

.3 SS200 – 51 mm Material:

.1 Plate thickness = 12.7 mm

.2 Minimum yield strength = 552 MPa

.3 Per specification: ASTM A1018 or A656

.4 SS225 – 57 mm Material:

.1 Plate thickness = 12.7 mm

.2 Minimum yield strength = 552 MPa

.3 Per specification: ASTM A1018 or A656

.3 The helical pier/anchor central shaft sections shall be bolted connections as follows:

.1 SS5 – 38 mm Material:

.1 Bolt Size = 19 mm

.2 Per specification: ASTM A320 Grade 7

.2 SS175 – 45 mm Material:

.1 Bolt Size = 22 mm

.2 Per specification: ASTM A193 Grade 7

.3 SS200 – 51 mm Material:

.1 Bolt Size = 28.6 mm

.2 Per specification: ASTM A193 Grade 7

.4 SS225 – 57 mm Material:

.1 Bolt Size = 32 mm

.2 Per specification: ASTM 1930 Grade 7

2.3 Grouting Materials

.1 Cement for Helical Pulldown Micropile grout shall be Type G Portland cement conforming to CSA A3000. Prepackaged, non-shrink cements grouts shall be subject to the review and acceptance of the Consultant.

.2 Water for mixing grout shall be potable, clean and free from impurities, which may be detrimental to grout or steel. Potable water shall be available in quantities sufficient to mix grout and for equipment clean-up.

.3 Sand fillers may be used in the grout mix as an extender with large diameter grout columns, subject to the approval of the engineer. Use fine sand only. Medium or coarse sand not be permitted. Small diameter grout columns shall not include aggregate.

2.4 Displacement Plates and Centralizers

.1 Displacement plates (lead or extension plates) shall be fabricated from steel or other material (not wood) that will not affect the structural integrity of the central steel shaft or grout column.

PART 3 EXECUTION

3.1 Acceptable Installers

.1 EBS Engineering and Construction Limited, 320 Woolwich Street, Breslau ON

.1 Phone: 1-866-649-3613

.2 Email: info@ebseng.com

.2 Desjardin House Movers Ltd., 267 East Pike Road, Windsor ON

.1 Phone: 519-979-0033

.2 Email: desjardinhousemovers@hotmail.com

.3 Jacques Belisle Construction Ltee, 1206 Theater Road, Casselmann ON

.1 Phone: 613-764-3018

.2 Email: info@jbcl.ca

3.2 Examination

.1 Acceptance of Site Verification of Conditions:

.1 Inspect, accept and certify in writing subcontractor that site conditions meet specifications for the following items prior to installation of the helical piers/anchors.

.1 Verify sub-grade preparation and elevations conform to the specified requirement.

.2 Verify location, alignment, and elevations of helical piers/anchors.

.3 Verify location, alignment, and elevations of any services within work area.

.4 Verify that all Helical pier/anchors may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.

.5 In the event of a discrepancy, notify the Consultant. Do not proceed with Helical pier/anchor installation in areas of discrepancies until said discrepancies have been resolved.

.6 Do not proceed with installation of helical piers/anchors until sub-grade soil conditions are corrected.

3.3 Preparation

.1 Retain a Geotechnical Engineer to oversee all aspects of installation of the helical piers/anchors. The items to inspect include, but are not limited to the following:

.1 Verify type of helical pier/anchor being installed is as specified on the Shop Drawings.

.2 Verify length of helical pier/anchor installed.

.3 Verify torque readings as specified on the Shop Drawings.

.2 Installation equipment shall be rotary type, hydraulic power driven torque motor with clockwise and counter-clockwise rotation capabilities. The torque motor shall be capable of continuous adjustment to revolutions per minute (RPM's) during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.

.3 Helical pier/anchors should be installed with high torque, low RPM torque motors, which allow the helical screw plates to advance with minimal soil disturbance.

.4 Installation tooling shall consist of a Kelly Bar Adapter (KBA) and Type SS or RS drive tools as manufactured by helical pier/anchor manufacturer and used in accordance with the manufacturers written installation instructions.

.5 Installation tooling should be maintained in good working order and safe to operate at all times. Flange bolts and nuts should be regularly inspected for proper tightening torque. Bolts, connecting pins, and retainers should be periodically inspected for wear and/or damage and replaced with identical items provided by the manufacturer. Heed all warning labels. Worn or damaged tooling should be replaced.

.6 A torque indicator shall be used during helical pier/anchor installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-

line with the installation tooling. Torque indicators shall meet requirements set forth by helical pier/anchor manufacturer.

3.4 Installation

.1 The helical pier/anchor installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

.2 The lead section shall be positioned at the location as shown on the working drawings. Battered helical piers/anchors can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle shall be established.

.3 The helical piers/anchor sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt(s) and nut torqued to 54 Nm.

.4 Sufficient down pressure shall be applied to uniformly advance the helical pier/anchor sections approximately 76 mm per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.

.5 Prepared grout shall be added immediately after lead displacement disk has started to penetrate the soil surface. A constant head of grout shall be maintained at all times during the installation of the helical pier.

.6 The torque as measured during the installation shall not exceed the torsional strength rating of the central steel shaft and shall be recorded at 300 mm increments.

.7 The minimum installation torque and minimum overall length criteria as shown on the working drawings shall be satisfied prior to terminating the helical pier/anchor installation.

.8 If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:

.1 Terminate the installation at the depth obtained subject to the review and acceptance of the Consultant, or:

.2 Remove the existing helical pier/anchor and install a new one with fewer and/or smaller diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new helical pier shall be terminated at least 1.0 metres beyond the terminating depth of the original helical pier/anchor.

.9 If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length, and there is no maximum length constraint, the Contractor shall have the following options:

.1 Install the helical pier/anchor deeper using additional extension sections, or:

.2 Remove the existing helical pier/anchor and install a new one with additional and/or larger diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new helical pier/anchor shall be terminated at least 1 .0 metres beyond the terminating depth of the original helical pier.

.3 De-rate the load capacity of the helical pier/anchor and install additional helical piers/anchors. The de-rated capacity and additional helical piers/anchors location shall be subject to the review and acceptance of the Owner.

.10 If the helical pier/anchor is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the helical pier/anchor re-installed. If the obstruction can't be removed, the helical pier/anchor shall be installed at an adjacent location, subject to review and acceptance of the Owner.

.11 If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to proper positioning of the last plain extension section relative to the final elevation, the Contractor may remove the last plain extension and replace it with a shorter length extension. If it is not feasible to remove the last plain extension, the Contractor may cut said extension shaft to the correct elevation. The Contractor shall not reverse (back-out) the helical pier/anchor to facilitate extension removal.

.12 The average torque for the last three feet of penetration shall be used as the basis of comparison with the minimum installation torque as shown on the working drawings for compression (pier) applications and average torque for the last five feet of penetration shall be used for tension (anchor) applications. The average torque shall be defined as the average of the last three readings recorded at one-foot intervals.

.13 The Contractor shall record the torque values for each individual helical pier/anchor at 300 mm increments during installation. These records shall be available to the Owner at their request.

.14 Perform load tests as stated in this specification. Tests shall be completed according to ASTM D1143 Quick Test Method.

3.5 Field Quality Control

.1 The tolerances quoted in this section are suggested maximums. The actual values established for a particular project will depend on the structural application.

.2 Centerline of helical pier/anchor shall not be more than 75 mm from indicated plan location.

.3 Helical pier/anchor plumbness shall be within 50 mm of design alignment.

.4 Top elevation of helical pier/anchor shall be within +25 mm to –50 mm of the design vertical elevation.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 References

.1 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 710 Construction Specification for Pavement Marking

.2 OPSS 1716 Water-Borne Traffic Paint

.3 OPSS 1750 Traffic Paint Reflectorizing Glass Beads

.2 United States Federal Standards

.1 Federal Standard 595B, Colors Used in Government Procurement

.3 The Accessibility for Ontarians with Disabilities Act, 2005 (AODA)

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer’s product data.

.3 Submit following material sample at least 4 weeks prior to commencing work.

.1 Paint colour selection.

.2 Mark samples with name of project and location, paint manufacturer's name and address, name of paint, reference specification number and formulation number and batch number.

1.4 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Deliver, handle and store materials in accordance with manufacturer’s printed instructions.

1.5 Waste Management and Disposal

.1 Refer to Section 01 74 19 – Construction Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Materials

.1 Paint:

.1 To OPSS 1716.

.2 Colour: Federal Standard FS Federal 595B, Yellow 33538.

.1 Provide H.C. Blue (Pantone 293 C) to OPSS standards for accessible parking spaces.

.3 Paint shall be non-slip.

.2 Glass beads: Overlay type: OPSS 1750 Traffic Paint Reflectorizing Glass Beads.

PART 3 EXECUTION

3.1 Equipment

.1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

.2 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

3.2 Condition of Surfaces

.1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.3 Application

.1 Lay out pavement markings.

.2 Apply paint only when air temperature is above 10° C, wind speed is less than 60km/h and no rain is forecast within next 4 hours.

.3 Apply traffic paint evenly at rate of 3m² /L.

.4 Do not thin paint unless approved by Consultant.

.5 Paint lines to be of uniform colour and density with sharp edges.

.6 Paint accessible parking spaces as detailed on the drawings. blue with a white or yellow border located in the centre of the space, 1525 x 1525 mm, with the International Symbol of Accessibility.

.7 Apply glass beads at rate of 200g/m² of painted area immediately after application of paint.

3.4 Tolerance

.1 Paint markings to be within plus or minus 12 mm of dimensions indicated.

.2 Remove and replace incorrect markings.

3.5 Protection

.1 Protect pavement markings until dry.

3.6 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

PART 1 GENERAL

1.1 General

.1 Conform to the requirements of Division 1.

1.2 Related Sections

.1 Section 31 23 10 Excavating, Trenching and Backfilling

1.3 References

.1 Nursery Sod Growers Association of Ontario (NSGA)

.2 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management

1.4 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit grass seed mix.

.3 Submit name and address of sod farm.

1.5 Quality Assurance

.1 Topsoil from each source, native and imported, shall be tested for N.P.K., altrazine, minor elements, as well as clay and organic matter contents and acidity (pH) range. Topsoil shall be tested, written test report submitted and approved by Consultant, prior to delivery to site.

1.6 Shipping, Handling and Storage

.1 Refer to Section 01 61 00 – Common Product Requirements.

.2 Protect sod during transportation, for delivery to the site in a fresh and healthy condition.

.3 Install sod immediately, no later than 48 hours after arrival on site. Keep moist and fresh until installation.

.4 Handle sod carefully to prevent breaking or tearing. Immediately remove damaged and dried-out sod from the site.

PART 2 PRODUCTS

2.1 Topsoil

.1 Clean topsoil imported material approved by the Consultant, and free from admixtures of subsoil, clay lumps, stones or roots over 25 mm diameter, free of toxic substances or any other foreign matter which would inhibit growth. Minimum 150 mm thickness.

.2 Comply with the requirements of Ontario Regulation O. REG 406/19, “On-Site and Excess Soil Management”, for the importation of new soils. Complete testing of imported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

2.2 Sod

.1 Sod shall be a Certified No. 1 sod, grown and sold in accordance with the latest specifications of the Nursery Sod Growers Association of Ontario (NSGA), composition of 50% Kentucky Blue Grass and 50% Merion Blue Grass.

.2 At the time of delivery, sod shall have a strong, fibrous root system, be free of disease, stones, burned or bare spots, with a healthy green colour and containing not more than 1% twitch grass and other weeds.

.3 Sod shall be cut and rolled in sections of max. 1.0 m² in area and approximately 30 mm thick as specified by the NSGA.

2.3 Wooden Pegs

.1 Hardwood pegs, 25 x 25 mm square and at least 250 mm long, or longer as required for satisfactory anchorage of sod.

2.4 Fertilizer

.1 Commercial type having a 10-10-10 ratio and shall be applied such that actual nitrogen is 9.0 kg/10 m².

PART 3 EXECUTION

3.1 Preparation

.1 Adjust subgrade to allow the placing of topsoil to minimum depths specified.

.2 Scarify subgrade to at least 75 mm deep and remove debris and all stones 50 mm in diameter and larger.

.3 Arrange for inspection of finished subgrade by Consultant.

.4 Spread and grade topsoil evenly over approved subgrade. Provide minimum 150 mm thick topsoil. No less will be accepted.

.5 Finished sodded area top surface shall be uniform and evenly graded between elevations indicated, free of bumps, ridges and depressions. Remove all stones and lumps over 25 mm in diameter and foreign materials.

.6 Unless recommended otherwise on soil analysis report, apply a 10-10-10 fertilizer at the rate of 9.0 kg/10 m².

.7 Work fertilizer well and uniformly into the topsoil within 48 hours before laying sod.

.8 Fine grade, rake and roll surface until smooth and firm against foot prints, and free of depressions, lumps and irregularities.

3.2 Installation

.1 Place sod closely knit together, so that no open joints are visible, and pieces are not overlapping.

.2 Install sod to blend tightly and uniformly with adjoining grass areas and, unless otherwise detailed, to be flush with paving, top of curbs.

.3 On slopes of 3:1 and steeper, place sod perpendicularly to the slope and stake every row with wooden pegs at maximum 600 mm intervals. Drive pegs flush with sod.

.4 Immediately after installation, water with sufficient amount to saturate sod and underlying topsoil.

.5 As soon as sod has dried sufficiently to prevent damage, roll with roller to ensure a good bond between sod and topsoil and to remove minor depressions and irregularities.

3.3 Maintenance

.1 Maintain all sodded areas, from date of installation and until one full growing season is complete (minimum 6 months). Obtain Consultant's approval at end of maintenance.

.2 Maintenance shall include all necessary measures to establish and maintain grass in a healthy, vigorous growing condition, for one full growing season.

.3 Maintenance shall include, but not be limited to the following work:

.1 Mow grass areas at regular intervals as required to maintain grass height between 50 mm and 60 mm. Not more than ⅓ of grass blade shall be cut during one mowing. Hand clip where necessary and keep edges neatly trimmed. Remove heavy clippings immediately after mowing and trimming.

.2 Control weeds by cutting. Use of chemicals is strictly prohibited.

.3 Fertilize not less than once per season (Spring, Summer, Fall).

.4 Water when necessary, with sufficient quantities of water to prevent sod and underlying soil from drying out.

.5 Roll all sodded areas to remove minor depressions and irregularities.

.6 Repair all erosion damage resulting from faulty workmanship and/or maintenance.

.7 Replace all grass which has deteriorated, or which shows bare spots.

.8 Protect all grass areas against damage, including erosion and trespassing, by providing and maintaining proper safeguards. Remove safeguards at end of maintenance period.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Clean up all areas and remove debris

End of Section