

**CONSEIL SCOLAIRE VIAMONDE**

**NRFP – 25-03**

**DAY CARE EXPANSION AT ÉCOLE ÉLÉMENTAIRE**

**PIERRE-ELLIOTT-TRUDEAU**

**65 Rue Grace, Toronto, Ontario**

**“ISSUED FOR TENDER”**

**Project 18113**

**DATE** September 11, 2024



**BARRY BRYAN ASSOCIATES**

*Architects, Engineers, Project Managers*

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End of Section

PART 1 GENERAL

1.1 General

- .1 The Agreement, Definition and General Conditions of this Contract shall be the Canadian Standard Construction Document CCDC-2, 2020, Stipulated Price Contract, except as amended by the Supplementary General Conditions, Section 00 54 00.

End of Section

LIST OF DRAWINGS

Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
000	OBC Matrix & Drawing List	3	-	May, 30, 2024
<b>CIVIL</b>				
CV-1	Erosion and Sediment Control Plan	9	-	Sep. 11, 2024
CV-2	Grading Plan	9	-	Sep. 11, 2024
CV-3	Site Servicing Plan	9	-	Sep. 11, 2024
<b>LANDSCAPE</b>				
L1	Landscape Layout Plan	7	-	Sept. 11, 2024
L2	Landscape Details	7	-	Sept. 11, 2024
<b>ARCHITECTURAL</b>				
A101	Site Plan	7	-	Sept. 11, 2024
A102	Part Site Plan	6	-	Sept. 11, 2024
A103	Site Details	6	-	Sept. 11, 2024
A104	Part Site Demolition Plan	6	-	Sept. 11, 2024
A105	Site Details	3	-	Sept. 11, 2024
A110	Renovation/ New Addition Life Safety Plan	2	-	Sept. 11, 2024
A200	Overall Floor Plans	5	-	Sept. 11, 2024
A201	Existing Ground & Second Floor/ Low Roof Demolition Plans	3	-	Sept. 11, 2024
A202	Washrooms, Gym & Corridor Demolition Plans	2	-	Sept. 11, 2024
A203	Ground Floor Plan, Wall Types Schedule & Floor Plan Notation	5	-	Sept. 11, 2024
A204	Part Ground Floor RCP	3	-	Sept. 11, 2024
A205	Part Second Floor/ Roof Plan	5	-	Sept. 11, 2024
A206	Enlarged Washroom Plans & Interior Elevations	3	-	Sept. 11, 2024
A207	Enlarged Washroom Plan & Interior Elevations	2	-	Sept. 11, 2024
A301	Elevations	5	-	Sept. 11, 2024
A302	Elevations & Sections	3	-	Sept. 11, 2024
A303	Interior Elevations	3	-	Sept. 11, 2024
A401	Building Sections	5	-	Sept. 11, 2024
A402	Building Sections	5	-	Sept. 11, 2024
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A601	Wall Sections	3	-	Sept. 11, 2024

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A603	Wall Sections	3	-	Sept. 11, 2024
A604	Section Details	3	-	Sept. 11, 2024
A605	Section Details	1	-	Sept. 11, 2024
A801	Millwork Details	3	-	Sept. 11, 2024
A901	Window, Screen, Room Finishes and Door & Frame Schedules and Details	3	-	Sept. 11, 2024
<b>STRUCTURAL</b>				
S101	General Notes	3	-	Sept. 11, 2024
S102	Typical Details	3	-	Sept. 11, 2024
S201	Foundation Plan and Schedules	3	-	Sept. 11, 2024
S202	Roof Framing Plan	3	-	Sept. 11, 2024
S301	Framing Elevations	3	-	Sept. 11, 2024
S501	Foundation Sections	3	-	Sept. 11, 2024
S502	Framing Sections	3	-	Sept. 11, 2024
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M-1.2	Mechanical Schedules I	04	-	24/10/01
M-1.3	Mechanical Schedules II	04	-	24/10/01
M-1.4	Mechanical Schedules II and Details	04	-	24/10/01
M-1.5	Mechanical Details	04	-	24/10/01
M-1.6	Kitchen Equipment Specifications I	04	-	24/10/01
M-1.7	Kitchen Equipment Specifications II	04	-	24/10/01
M-1.8	Kitchen Equipment Specifications III	04	-	24/10/01
M-2.1	Phase 1 Ground Floor New Plan - HVAC	04	-	24/10/01
M-2.2	Phase 1 Ground Floor New Plan – Hydronic Piping System	04	-	24/10/01
M-2.3	Phase 1 Roof New Plan - Mechanical	04	-	24/10/01
M-2.4	Phase 1 Basement New Plan - Mechanical	04	-	24/10/01
M-2.5	Phase 1 Ground Floor Washroom Plan - HVAC	04	-	24/10/01
M-2.6	Phase 2 Ground Floor Demolition Plan - HVAC	04	-	24/10/01
M-2.7	Phase 2 Roof Demolition Plan - Mechanical	04	-	24/10/01
M-2.8	Phase 2 Basement Demolition Plan - HVAC	04	-	24/10/01

Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
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M-2.10	Phase 2 Ground Floor New Plan - HVAC	04	-	24/10/01
M-2.11	Phase 2 Ground Floor New Plan Hydronic Piping System	04	-	24/10/01
M-2.12	Phase 2 Roof New Plan - Mechanical	04	-	24/10/01
M2.13	Phase 2 Basement New Plan – Hydronic Piping System	04	-	24/10/01
M-3.1	Phase 1 Ground Floor New Plan - Plumbing	04	-	24/10/01
M-3.2	Phase 1 Basement New Plan - Plumbing	04	-	24/10/01
M-3.3	Phase 1 Ground Floor Washroom Plan – Plumbing and Drainage	04	-	24/10/01
M-3.4	Phase 2 Ground Floor Demolition Plan – Plumbing	04	-	24/10/01
M-3.5	Phase 2 Basement Demolition Plan - Plumbing	04	-	24/10/01
M-3.6	Phase 2 Ground Floor New Plan - Plumbing	04	-	24/10/01
M-4.1	Phase 1 Ground Floor New Plan - Drainage	04	-	24/10/01
M-4.2	Phase 1 Basement New Plan - Drainage	04	-	24/10/01
M-4.3	Phase 2 Ground Floor Demolition Plan - Drainage	04	-	24/10/01
M-4.4	Phase 2 Basement Demolition Plan - Drainage	04	-	24/10/01
M-4.5	Phase 2 Ground Floor New Plan - Drainage	04	-	24/10/01
M-4.6	Phase 2 Basement New Plan - Drainage	04	-	24/10/01
M-5.1	Phase 1 Ground Floor Plan – Fire Protection	04	-	24/10/01
M-5.2	Phase 1 Basement Plan – Fire Protection	04	-	24/10/01
M-5.3	Phase 2 Ground Floor Plan – Fire Protection	04	-	24/10/01
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E-1.2	Electrical Details	5	-	Oct. 01/24
E-1.3	Electrical Details	5	-	Oct. 01/24
E-1.4	Electrical Details	5	-	Oct. 01/24
E-1.5	Electrical Details	5	-	Oct. 01/24
E-1.6	Electrical Details	5	-	Oct. 01/24
E-1.7	Electrical Details	5	-	Oct. 01/24
E-1.8	Electrical Details	5	-	Oct. 01/24
E-1.9	Electrical Details	5	-	Oct. 01/24



Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
E-1.10	Electrical Details	5	-	Oct. 01/24
E-2.0	Partial Electrical Facility Plan	5	-	Oct. 01/24
E-2.1	Electrical Plan	5	-	Oct. 01/24
E-2.2	Electrical Roof Plan	5	-	Oct. 01/24
E-3.1	Reflected Ceiling Plan	5	-	Oct. 01/24
E-4.1	Electrical Grounding System Details	5	-	Oct. 01/24
E-5.1	Electrical Demolition Plan	5	-	Oct. 01/24
E-5.2	Electrical Roof Demolition Plan	5	-	Oct. 01/24
E-6.1	Reflected Ceiling Demolition Plan	5	-	Oct. 01/24
E-7.1	Electrical Single Line Diagram	5	-	Oct. 01/24
E-8.1	Electrical Site Plan	5	-	Oct. 01/24
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E-9.1	Electrical Plans Corridor Washrooms	5	-	Oct. 01/24
E-9.2	Electrical Plans Corridor C101/C102	5	-	Oct. 01/24
<b>COMMUNICATIONS</b>				
C-1.1	Communications Legend and Details	3	-	Oct. 01/24
C-1.2	Communications Details	3	-	Oct. 01/24
C-2.0	Partial Communications Facility Plan	3	-	Oct. 01/24
C-2.1	Communications Plan	3	-	Oct. 01/24
C-5.1	Communications Demolition Plan	1	-	Oct. 01/24

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 Work covered by contract documents
- .2 Owner
- .3 Location of the site
- .4 Scheduling requirements
- .5 Site access
- .6 Work sequence
- .7 Contractor use of premises
- .8 Pre-ordered materials and equipment
- .9 Work by others
- .10 Engineer design
- .11 Hazardous material discovery
- .12 Building smoking environment
- .13 Special conditions
- .14 Site security
- .15 "By Others"
- .16 Protection of Drawings

### 1.2 Work Covered by Contract Documents

- .1 Work of this Contract comprises the construction of the Daycare Expansion to École élémentaire Pierre Elliott-Trudeau, as indicated on the drawings and specifications.

### 1.3 Owner

- .1 Conseil scolaire Viamonde

### 1.4 Location of Site

- .1 The Work of this Contract is located at 65 Rue Grace, Toronto, Ontario.

### 1.5 Scheduling Requirements

- .1 Refer to Instructions to Bidders

### 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.

1.9 Contractors Use of Premises

- .1 Contractor has restricted use of site until Substantial Performance.

1.10 Pre-ordered Materials and Equipment

- .1 The Owner will supply the following washroom accessories for contractor to install (soap dispensers, toilet paper dispensers).
- .2 It is the responsibility of the Contractor to manage, supervise and coordinate the supply and installation of this pre ordered.
- .3 The Contractor will schedule and coordinate the installation of pre ordered equipment and will assist and cooperate fully with installing Contractors.
- .4 The Contractor will supply and install all material, accessories, and equipment necessary to complete the installation of preordered equipment.

1.11 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.

1.12 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 constructor or General Contractor shall ensure that a copy of the ACM survey is provided to each contractor and subcontractor who will be working in the space.
- .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 and the Owner's Asbestos Management Program.
- .5 No asbestos-containing materials, as defined by O. Reg. 278/05, may be specified or used in any project.

1.13 Verification

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

1.14 Building Smoking Environment

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

1.15 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.

1.16 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.

1.17 "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. (Sample attached as Appendix 'A')
- .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 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

SAMPLE

[DATE]

[CONTRACTOR'S COMPANY

ADDRESS

CITY, PROVINCE, POSTAL CODE]

Attention: [INSERT CONTACT NAME]

At your request, BBA will provide electronic files for your convenience and use in the preparation of your shop drawings for Project Name, subject to the following terms and conditions:

Our electronic files are compatible with [AutoCAD 2018 (\*\*)]. We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications.

Data contained on these electronic files are part of our instruments of service, and at all times remain the exclusive property of Barry Bryan Associates and copyright is reserved. The electronic files shall not be used by you for any purpose other than as a convenience in the preparation of your shop drawings for the referenced project. You further agree not to transfer these electronic files to others without the prior written consent of Barry Bryan Associates. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or other project consultants that may arise out of or in connection with your use of the electronic files.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defence costs, arising out of or resulting from your use of these electronic files, or from the use by others, should they have obtained them from you.

These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the hard-copy construction documents prepared by us and the electronic files, the hard-copy construction documents shall govern. You are responsible for determining if any conflict exists.

Due to the nature of the design and construction process, the drawings on these electronic files may not be fully coordinated, may change, and may not incorporate revisions, change orders, or addenda. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.

Because information presented on the electronic files can be modified, unintentionally or otherwise, we require all indications of our ownership and/or involvement be removed from each electronic display.

We will furnish you electronic files upon your written request.

Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by us, and we make no warranties, either express or implied, of merchantability of fitness for any particular purpose. In no event shall we be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

---

Barry Bryan Associates

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[CONTRACTOR FIRM NAME]

## PART 1 GENERAL

### 1.1 Consultants

- .1 ARCHITECT:  
Barry Bryan Associates  
201 - 250 Water Street  
Whitby, Ontario L1N 0G5  
Tel: (905) 666-5252  
Fax: (905) 666-5256  
Attention: William Weima, OAA, MRAIC
  
- .2 STRUCTURAL ENGINEER:  
Barry Bryan Associates  
201 - 250 Water Street  
Whitby, Ontario L1N 0G5  
Tel: (905) 666-5252  
Fax: (905) 666-5256  
Attention: David Bovill, P.E., P. Eng.
  
- .3 MECHANICAL ENGINEER:  
Giallanardo Engineering Inc.  
220-4550 Highway #7  
Woodbridge, ON, L4L 4Y7  
Tel : (905) 265-1052  
Attention: Jeremy Hogan, P. Eng.
  
- .4 ELECTRICAL ENGINEER:  
HCC Engineering Limited (HCC)  
40 Eglinton Avenue East, Suite 600  
Toronto, Ontario M4P 3A2  
Tel: (416) 932-8393  
Attention: Howard Cohen, P.Eng.
  
- .5 CIVIL ENGINEER:  
MGM Consulting Inc.  
555 Industrial Drive, Suite 201  
Milton, Ontario, L9T 5E1  
Tel: (905) 567-8678  
Attention: Chenchen Shi, P.Eng.
  
- .6 LANDSCAPE ARCHITECT:  
LAUD Studios  
573 Daylight Court  
Pickering, Ontario L1V 6B1  
Tel: (647) 242-9278  
Attention: Sham Nankoosingh, OALA.



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 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 Refer to Instructions to Bidders, for list of Cash Allowances.

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 manufacturers products in the specification section are no longer manufactured.
- .2 Proprietary specification means 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 means 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 means 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 Subcontractor 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 will 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 order or 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
- .2 Submittal procedures
- .3 Screening of RFI's
- .4 Response to RFI's
- .5 Response Timing

### 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 and with each application for payment submission.
- .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 Related Requirements
- .2 Appointment and Payment
- .3 Contractor's Responsibilities

### 1.2 Related Requirements

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory are specified under various sections.

### 1.3 Appointment and Payment

- .1 The Owner will appoint an independent inspection and testing agency to provide Quality Assurance (QA) testing.
- .2 Contractor will pay the independent inspection/testing agency from the Cash Allowance, including costs for equipment, facilities, and labour, except as follows:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
  - .3 Mill tests and certificates of compliance.
  - .4 Tests specified to be carried out by Contractor under the supervision of Consultant.
  - .5 Additional tests specified in the following paragraph.
- .3 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Consultant or Owner to verify acceptability of corrected work.

### 1.4 Contractor's Responsibilities

- .1 The Contractor shall be responsible for his own Quality Control and shall appoint and pay for independent inspection/testing agency, equipment, facilities, and labour to provide Quality Control (QC) testing where necessary to satisfy the Contractor's quality control plan. Such inspection and testing services will not be paid out of the Cash Allowance.
- .2 Where independent inspection and testing has been appointed by the Consultant or Owner for Quality Assurance, the Contractor shall provide labour, equipment and facilities to assist in the independent inspection and testing agency and their representatives by:
  - .1 Providing access to Work to be inspected and tested.
  - .2 Facilitating inspections and tests.
  - .3 Making good Work disturbed by inspection and testing.
- .3 Notify Owner and Consultant sufficiently in advance of testing & inspection operations (24 hours minimum).
- .4 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

- .5 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed.

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 Closeout Procedures
- .5 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 Lines of communication and contact information
  - .2 Schedules
  - .3 Personnel and vehicle permit procedures
  - .4 Use of premises
  - .5 Location of any Contractor on-site facilities
  - .6 Security
  - .7 Housekeeping
  - .8 Submittal and RFI procedures
  - .9 Inspection and testing procedures, on-Site and off-Site
  - .10 Control and reference point survey procedures
  - .11 Health and Safety
  - .12 Contractor's Schedule of Values
  - .13 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 Contractor 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.
  - .5 Requests for Information (RFI's)
  - .6 Change orders.
  - .7 Other modifications to Contract.

- .8 Field test reports.
- .9 Geotechnical reports
- .10 DSS reports
- .11 Approved Work schedule.
- .12 Manufacturers' installation and application instructions.
- .13 Health and Safety Plan and Other Safety Related Documents.
- .14 Other documents as specified.

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 review copy within 10 days after receipt.
- .4 Resubmit finalized schedule within 7 days after return of review 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 (RFI's)
- .3 Shop Drawings and Product Data
- .4 Interference Drawings
- .5 Progress Photographs
- .6 Samples
- .7 Mock-Ups
- .8 Certificates and Transcripts

### 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 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Consultant in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant's review.
- .10 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.
  
- 1.6 Progress Photographs
  - .1 Progress photograph to be electronically formatted and labelled as to location and view.
  
- 1.7 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.

1.8 Mock-Ups

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

1.9 Certificates and Transcripts

- .1 Immediately after award of Contract, Submit Workplace Safety and Insurance Board Experience Report.

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".

### 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 Minimize stripping of topsoil and vegetation.
- .6 Prevent unnecessary disturbance of top soil and underlying soil from vehicles and heavy equipment.

#### 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.

### 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 Access for Inspection and Testing
- .10 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 C22.1-18, 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 Building Code or the Contract Documents 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, 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 your 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.

- .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 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 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.

1.11 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. Refer to Section 01 29 83.
- .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 Mock Ups

- .1 Prepare mock-ups for Work specifically requested in specifications.
- .2 Construct in locations acceptable to Consultant.
- .3 Prepare mock-ups for Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups 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

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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.

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, data hook up, lines and 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 CAN/CSA Z797-18 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.

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.
- .5 Relics and Antiquities

### 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 indicated on the drawings 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 Hoarding

- .1 Erect temporary site enclosure using modular freestanding fencing: galvanized, minimum 1.8 m high, chain link or welded steel mesh, pipe rail. Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys. Maintain fence in good repair.

### 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.
- .2 Provide as required by governing authorities.

### 1.6 Traffic Barriers

- .1 Where indicated, provide precast concrete barriers conforming to ASTM C825 - 19 Standard Specification for Precast Concrete Barriers.
- .2 Provide sufficient barriers as necessary to protect the public and Owner from construction traffic.
- .3 Remove barriers on completion.

### 1.7 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.

#### 1.8 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.

#### 1.9 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.

#### 1.14 Relics and Antiquities

- .1 Protect relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during course of Work.
- .2 Give immediate notice to Owner and await Owner's written instructions before proceeding with Work in this area.

.3 Relics, antiquities, and items of historical or scientific interest remain the Owner's property.

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 Existing Utilities

### 1.2 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 Should any dispute arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

### 1.3 Availability

- .1 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.
- .2 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 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 Consultant.

1.15 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.

1.16 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 Fire Commissioners of Canada, FC 301, Standard for Construction Operations.
- .2 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .3 Occupational Health and Safety Act.
- .4 R.R.O. 1990, Reg. 860: Workplace Hazardous Materials Information System (WHMIS)
- .5 National Fire Protection Agency (NFPA)
  - .1 NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations
- .6 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 Provincial Ministry of Labour or equivalent for Place of Work
  - .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 OHS Act 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 and Regulations for Construction Projects, August 1997, Ontario Regulation 213/91 including amendments.
  - .2 Hazardous Products Act and Canada Labour Code.
  - .3 The Workplace Safety and Insurance Board, O-Reg 454.
  - .4 Ontario Building Code Act, Ontario Regulation 332/12 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, 2013 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 Confined Space

- .1 Confined Space: Where applicable, provide the Consultant and all Regulatory Authorities with a copy of the Contractors' Confined Space Entry Procedure. In the event that defined procedures are not available, abide by the applicable requirements of the Occupational Health and Safety Act and all regulations made thereunder.
- .2 Persons intended to work in confined spaces, as defined by the Owner, must have formal training in performing work in confined spaces.
- .3 Provide proof of valid certificates of such training for all workers prior to entry of such workers into confined spaces.
- .4 Provide all necessary safety equipment for entry into confined spaces.
- .5 Where workers are required to enter a confined space, as defined by the OHS Act, O. Reg. 632/05 Section 221.2, ensure that workers of the Contractor and all Subcontractors follow the requirements of the above legislation, including but not limited to:
  - .1 Having a method for recognizing each confined space to which the program applies
  - .2 Having a method for assessing the hazards to which workers may be exposed
  - .3 Having a method for the development of confined space entry plans (which include on-site rescue procedures)
  - .4 Having a method for training workers
  - .5 Having an entry-permit system.
  - .6 Supply the necessary tools and equipment to perform the confined space entry. These items include, but are not limited to, required documentation, gas detectors, breathing equipment, fall protection and rescue equipment.

#### 1.8 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.

#### 1.9 Workplace Hazardous Materials Information System (WHMIS)

- .1 Be familiar with WHMIS 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.

#### 1.10 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.

#### 1.11 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.

#### 1.12 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.

#### 1.13 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 Recording of subsurface conditions found.

### 1.2 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.

### 1.3 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 Owner's representative 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.

### 1.4 Qualifications of Surveyor

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

### 1.5 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.



1.6 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.

1.7 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.

1.8 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.

1.9 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.

1.10 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 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 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 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 areas and other accessible concealed spaces.
- .17 Remove snow and ice from access to building.
- .18 Under direction of Consultant, aim adjustable luminaires.

End of Section



## PART 1 GENERAL

### 1.1 Section Includes

- .1 References.
- .2 Submittals.
- .3 Definitions.
- .4 Waste Management Goals for the Project.
- .5 Documents.
- .6 Waste Management Plan.
- .7 Waste Audit.
- .8 Waste Reduction Work Plan.
- .9 Materials Source Separation Program.
- .10 Disposal of Wastes.
- .11 Scheduling.
- .12 Storage, Handling and Protection.
- .13 Application.
- .14 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) including Waste Reduction Workplan (WRW) and Materials Source Separation Program description prior to project start-up.

### 1.4 Definitions

- .1 Waste Management Plan (WMP): Contractor's approved overall strategy for waste management including waste audit, waste reduction workplan and materials source separation program.
- .2 Waste Audit (WA): Relates to projected waste generation. Involves measuring and estimating quantity and composition of waste, reasons for waste generation, and operational factors which contribute to waste.
- .3 Waste Reduction Work Plan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .4 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.
- .5 Waste Management Coordinator (WMC): Designate individual who is in attendance on-site, full-time. Designate, or have designated, individuals from each Subcontractor to be responsible for waste management related to their trade and for coordinating activities with WMC.
- .6 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 Documents

- .1 Maintain at job site, one copy of following documents:
  - .1 Waste Audit
  - .2 Waste Reduction Workplan
  - .3 Material Source Separation Plan

1.7 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.

1.8 Waste Audit

- .1 Prepare Waste Audit prior to project start-up.
- .2 Record, on Waste Audit , extent to which materials or products used consist of recycled or reused materials or products

1.9 Waste Reduction Work Plan

- .1 Prepare WRW prior to project start-up.
- .2 Reduce construction and demolition waste in compliance with O. Reg. 102/94.
- .3 Reduction will involve action to minimize quantity of waste at source. Reuse products which would become waste where practical. Recycling will involve collection and source separation at the site, of materials for use as feedstock in manufacturing of new products.
- .4 Conform to local Municipal and Regional Landfill Solid waste management requirements. Consider reduction, reuse and recycling of waste generated during construction such as dimensional lumber, clean drywall, concrete, brick, scrap metal and corrugated cardboard.

1.10 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.

1.11 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.

1.12 Scheduling

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

1.13 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 Designated Substances

- .1 All designated substances abatement, removal and disposal shall be completed in accordance with O. Reg 278/05 and all other applicable legislation.

### 3.3 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. Provide instruction on disposal practices.
- .2 On-site sale of materials is not permitted.

End of Section

## 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 CCDC 2-2008, 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 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 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 the Construction Act 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 5.7 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 5.5

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.1 Not Used

- .1 Not used

End of Section

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## PART 1 GENERAL

### 1.1 Section Includes

- .1 As built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.
- .7 Final site survey.

### 1.2 Submittals

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

### 1.3 Submission

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 At least 2 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 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.
- .4 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.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

### 1.4 Format

- .1 Organize data in the form as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project

and identify subject matter of contents.

- .5 Arrange content by Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in .dwg format. Provide duplicate copies on memory stick

#### 1.5 Contents Each Volume

- .1 Table of Contents: provide title of project;
  - .1 Date of submission; names.
  - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 .For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

#### 1.6 Occupant Manual

- .1 Submit Occupant Manual to Consultant's requirements.
- .2 Occupant Manual to include:
  - .1 General building information.
  - .2 Building management.
  - .3 Building operations.
  - .4 Safety.
  - .5 Security.
  - .6 Environmental considerations.
  - .7 Communications.
  - .8 Contact List.
  - .9 Other/Miscellaneous.

#### 1.7 As Builts and Samples



- .1 In addition to requirements in General Conditions, maintain at the site for Consultant one record copy of:
    - .1 Contract Drawings.
    - .2 Specifications.
    - .3 Addenda.
    - .4 Change Orders and other modifications to Contract.
    - .5 Reviewed shop drawings, product data, and samples.
    - .6 Field test records.
    - .7 Inspection certificates.
    - .8 Manufacturer's certificates.
  - .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.
- 1.8 Recording Actual Site Conditions
- .1 Record information on set of drawings, provided by Consultant.
  - .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
  - .3 Contract Drawings and shop drawings: mark each item to record actual construction, including:
    - .1 Measured depths of elements of foundation in relation to finish first floor datum.
    - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
    - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
    - .4 Field changes of dimension and detail.
    - .5 Changes made by change orders.
    - .6 Details not on original Contract Drawings.
    - .7 References to related shop drawings and modifications.
  - .4 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 At least 2 weeks prior to commencement of scheduled commissioning activities, submit one copy of the draft "As-built" Project Record Documents for Consultants review and use during the commissioning activities. After the completion of the commissioning activities, the Consultant will return to the Contractor the draft copy, with review comments, for revision.

Prior to the Issuance of the Final Certificate of Completion, and within 10 working days after

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Substantial Performance, submit 2 copies of the final "As-built" Project Record Documents and disk of "as-built" record drawings.

- .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 and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections

1.9 Final Survey

- .1 Submit 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.

1.10 Equipment and Systems

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with Engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's 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.

1.11 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.

1.12 Spare Parts

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Spare parts as identified in individual sections are to be delivered to the Owner prior to the Contractor's application for Substantial Performance.
- .4 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.13 Maintenance Materials

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Maintenance materials are to be delivered to the Owner prior to the Contractor's application for Substantial Performance.
- .4 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.14 Special Tools

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Special tools are to be delivered to the Owner prior to the application for Substantial Performance.
- .4 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

1.15 Storage, Handling and Protection

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.16 Warranties and Guarantees

- .1 Separate each warranty or guarantee with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and guarantees, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and guarantees until time specified for submittal.

1.17 Independent Specialty Engineers Sign-Off

- .1 Prior to Substantial Performance, provide 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. Carry all costs associated with full compliance with this requirement.

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 Procedures for demonstration and instruction of equipment and systems to Owner's personnel.

### 1.2 Description

- .1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of Substantial Performance.
- .2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed-upon times.

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Owner's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.

### 1.4 Quality Control

- .1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

### 1.5 Conditions for Demonstrations

- .1 Equipment has been inspected and put into operation.
- .2 Testing, adjusting, and balancing have been performed and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions

### 1.6 Preparation

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present

### 1.7 Demonstrations and Instructions

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

- .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
- .3 Review contents of manual in detail to explain aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

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 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 The National Building Code of Canada, Part 8-Safety Measures on Construction and Demolition Sites.
- .2 ASTM International (ASTM)
  - .1 ASTM F710-19e1 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- .3 CSA Group (CSA)
  - .1 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans.
- .5 Ontario Regulation 103/94 Environmental Protection Act.
- .6 Ontario Regulation 213/07 The Fire Code.
- .7 Ontario Regulation 232/98 Landfilling Sites.
- .8 Ontario Regulation 278/05 Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.
- .9 Ontario Regulation 347 Environmental Protection Act, General — Waste Management.
- .10 Ontario Regulation 332/12 The Building Code.
- .11 The Workplace Health and Safety Act, and Regulations for Construction Projects.
- .12 The Contractors Health and Safety Policy.
- .13 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 Refer to Revised Pre-Renovation Designated Substances and Hazardous Materials Survey, École Élémentaire Pierre-Elliott-Trudeau, 65 Grace Street, Toronto dated June 25, 2024.
- .2 Should any other material not identified in the above referenced reports resembling asbestos or other hazardous substances be encountered in course of demolition work, immediately stop work and notify the Owner's Representative. Refer to Section 01 41 00.

- .3 All designated substances abatement, removal and disposal shall conform to the abatement plan prepared by Arcadis Canada Inc. All work shall be completed in accordance with O. Reg 278/05 and all other applicable legislation. Refer to Specifications included in the Designated Substance Survey for abatement requirements.

## 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.
- .5 Salvage existing Face Brick for use at openings to be infilled as indicated on the drawings.

### 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, appurtenances, and landscaping 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

**ASBESTOS ABATEMENT SPECIFICATIONS**  
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**At Rear:**

Drawing No. 30173487-1 - Locations of Work Areas – First Floor Plan

Drawing No. 30173487-2 - Locations of Work Areas – First Floor Plan

Drawing No. 30173487-3 - Locations of Work Areas – Basement Floor Plan

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Pre-Contamination Inspection Checklist

Daily Procedures Inspection Checklist

Final Visual Inspection Checklist

Final Air Clearance Test Checklist

Typical Decontamination Enclosures

Asbestos Abatement Electrician's Submittal Form

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**1.0 PART 1 – GENERAL****1.1 GENERAL**

- .1 The requirements as set out in these specifications may, at times, exceed the procedures detailed in the various applicable regulations. All work shall be done in compliance with the specifications AND the regulations. Should there be any discrepancy or conflict between the documents, the most stringent shall apply.

**1.2 ASBESTOS ABATEMENT OUTLINE OF WORK**

- .1 The intent of the work is to remove, and dispose accessible asbestos-containing materials, to the extent practicable, prior renovation work.
- .2 Replacement of the removed materials is not part of this contract unless otherwise noted.
- .3 Coordinate all work with the General Contractor and sub trades as required.
- .4 Refer to Architectural, Mechanical, Electrical and Structural drawings and project specifications for additional details and locations.
- .5 All mechanical, electrical and life systems isolations and disconnects will be performed by the General Contractor's sub trades prior to commencement of remedial work.
- .6 Removal of doors and associated hardware, radiator cabinets, mechanical systems, millwork, toilet partitions, toilets and sinks, washroom fixtures, and other attachments to allow for access to asbestos-containing building materials, will be performed by the General Contractor's sub trades prior to commencement of remedial work.
- .7 All florescent light tubes in light fixtures in ceiling assemblies slated for demolition by the Asbestos Contractor will be removed by the General Contractor's sub trades prior to commencement of remedial work.
- .8 Electrical hookups of GFI panels will be performed by the General Contractor's licensed electrician in compliance to all regulatory requirements and codes.
- .9 Each HEPA filtered negative pressure unit shall be integrity tested at the work site prior to commencement of asbestos removal operations.
- .10 Provide all supervision, labour, equipment, tools, materials, waste management, haulage and disposal, and other services, as required, for undertaking and completing all of the work, as detailed below.
- .11 **Work Area 1 – Rooms 119, 119A, 120, 121, 121A, 121B, 122, 123, 123A, 124, 125, 126, C103, C104 and C105**
- .1 Prepare the areas as indicated above and on the attached floor plans for a Type 2 Enclosure and Glovebag asbestos removal operation.
- .2 Refer to Architectural Demolition Drawings for additional details.

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- .3 Supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
- .4 Establish a measurable negative pressure differential in the enclosure work areas by using fan/filter units equipped with High Efficiency Particulate Air (HEPA) filters. Units must be integrity-tested on site and are to be exhausted directly outdoors.
- .5 Remove and dispose the following as clean demolition waste:
  - .1 All T-bar ceiling assemblies including, but not limited to, light fixtures and other attachments, acoustic lay-in ceiling tiles, underlying materials, and T-bar ceiling support systems.
  - .2 All non-gypsum board solid ceiling assemblies including, but not limited to, light fixtures and other attachments, acoustic ceiling tiles, substrate materials, underlying materials, and ceiling support systems.
  - .3 All baseboards not attached to gypsum board walls.
- .6 Remove and dispose the following as asbestos waste:
  - .1 All gypsum board ceiling assemblies including, but not limited to, gypsum board and associated asbestos-containing joint compounds, light fixtures and other attachments, and ceiling support systems. Light fixtures and ceiling support systems may be disposed a clean demolition waste provided, they are thoroughly cleaned of all dust and gypsum board debris.
  - .2 All baseboards attached to gypsum board walls.
  - .3 All gypsum board and associated asbestos containing joint compounds applied to wall sections, columns and bulkheads, associated framing materials and door frames. Framing materials and door frames may be disposed a clean demolition waste provided, they are thoroughly cleaned of all dust and gypsum board debris.
  - .4 All asbestos-containing vinyl floor tiles in Room 121A.
- .7 Remove and dispose as clean demolition waste, select partition wall sections, as required, to access piping supplying water to all heating systems, sinks and toilets.
- .8 Using glovebags inside the enclosure work areas, remove and dispose as asbestos waste, all asbestos-containing thermal insulation applied to pipe fittings. For costing purposes allow for the removal of asbestos-containing thermal insulation from one hundred (100) pipe fittings.
- .12 **Work Area 2 – Rooms 119, 121, 123, 123A, and 125**
  - .1 Prepare the areas as indicated above and on the attached floor plans for Type 1 asbestos removal operations.
  - .2 Refer to Architectural Demolition Drawings for additional details.
  - .3 Supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.

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- .4 Removal and dispose as asbestos waste, all asbestos-containing caulking applied to interior and exterior sides of window frames.
- .5 Remove and dispose as asbestos waste, entire window units as a whole, including window frames, glass and associated asbestos-containing glazing seal.

**.13 Work Area 3 – Room C102**

- .1 Prepare the areas as indicated above and on the attached floor plans for a Type 2 Enclosure and Glovebag asbestos removal operation.
- .2 Refer to Architectural Demolition Drawings for additional details.
- .3 Supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
- .4 Remove and dispose as clean demolition waste, entire solid ceiling assembly including, but not limited to, light fixtures and other attachments, acoustic ceiling tiles, substrate materials, underlying materials and ceiling support systems.
- .5 Using glovebags inside the enclosure work areas, remove and dispose as asbestos waste, all asbestos-containing thermal insulation applied to pipe fittings. For costing purposes allow for the removal of asbestos-containing thermal insulation from one hundred (100) pipe fittings.

**.14 Work Area 4 – Rooms 107, 107A, 107B, 107C, 108, 111, 112, 112A and 112B**

- .1 Prepare areas as indicated above and on the attached floor plans for a Type 3 asbestos removal operation.
- .2 Refer to Architectural Demolition Drawings for additional details.
- .3 Supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
- .4 Remove and dispose the following as asbestos waste:
  - .1 Entire solid ceiling assemblies including, but not limited to, light fixtures and other attachments, asbestos-containing plaster, plaster lath, underlying materials, ceiling support systems, and all plaster overspray on building materials inside ceiling cavities in Rooms 107, 107A, 107B, 108, 111, 112, 112A and 112B. Light fixtures and ceiling support systems may be disposed as clean demolition waste provided, they are thoroughly cleaned of all dust and plaster debris.
  - .2 All asbestos-containing thermal insulation applied to pipe fittings. For costing purposes allow for the removal of asbestos-containing thermal insulation from eighty (80) pipe fittings.

**.15 Work Area 5 – Room C101**

- .1 Prepare areas as indicated above and on the attached floor plans for a Type 3 asbestos removal operation.

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- .2 Refer to Architectural Demolition Drawings for additional details.
- .3 Supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
- .4 Remove and dispose the following as asbestos waste:
  - .1 Entire solid ceiling assembly including, but not limited to, light fixtures and other attachments, asbestos-containing plaster, plaster lath, underlying materials, ceiling support systems, and all plaster overspray on building materials inside ceiling cavity.
  - .2 All asbestos-containing thermal insulation applied to pipe fittings. For costing purposes allow for the removal of asbestos-containing thermal insulation from thirty (30) pipe fittings.
- .16 **Work Area 6 – Rooms 002, 003, 003B, 003C, 003D, 003E, 003F, 003G, and 003H**
  - .1 Prepare the areas as indicated above and on the attached floor plans for Type 1 asbestos removal operations.
  - .2 Refer to Architectural Demolition Drawings for additional details.
  - .3 Remove and dispose as clean demolition waste, all baseboards.
  - .4 Removal and dispose as asbestos waste, all asbestos-containing vinyl floor tiles.
- .17 **Work Area 7 – Areas To be Determined**
  - .1 Prepare locations pre-determined by the General Contractor for Type 2/Glovebag asbestos removal operations.
  - .2 If required, supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
  - .3 Using Glovebags, remove and dispose, as asbestos waste, accessible asbestos-containing thermal insulation from select piping to allow for removal of piping, modifications to mechanical systems and mechanical tie-ins. The General Contractor will clearly mark all locations for thermal insulation removals.
  - .4 For costing purposes, allow for two workers over a 10-hour shift including labour, travel time, equipment, tools, materials, waste management, haulage, and disposal per mobilization. Allow for one (1) separate mobilization.
- .18 **Work Area 8 – Areas To be Determined**
  - .1 Prepare locations pre-determined by the General Contractor for Type 2 asbestos removal operations.
  - .2 Assist General Contractor's sub trades in attaching items to asbestos-containing cement board.



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- .3 If required, supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
- .4 Using power tools attached to dust collecting devices equipped with HEPA filters, mechanically fasten items supplied by the General Contractor to asbestos-containing cement board. The General Contractor will supply mechanical fasteners and items to be fastened and will clearly identify locations where attachments are required.
- .5 For costing purposes, allow for two workers over a 10-hour shift including labour, travel time, equipment, tools, materials, waste management, haulage, and disposal per mobilization. Allow for one (1) separate mobilization.
- .19 Thermal insulation on pipe fittings contains 60% chrysotile asbestos. Plaster contains 2% chrysotile asbestos. Vinyl floor tiles contain 3% chrysotile asbestos. Joint compounds on gypsum board applications contain 1.5% chrysotile asbestos. Caulking contains 3.1% to 32.4% chrysotile asbestos. Glazing seal contains 1.2% chrysotile asbestos. Cement board contains 25% chrysotile asbestos.
- .20 All waste is to be removed from the site and disposed. Asbestos waste disposal bins are not to be left on School property unless fully enclosed with an integral metal roof system and a lockable metal door system which must be kept always locked. Disposal bins must be removed immediately on completion of work.
- .21 Schedule
- |    |                                  |   |
|----|----------------------------------|---|
| .1 | Mobilization                     | To be Coordinated with the General Contractor |
| .2 | Complete Work and Demobilization | To be Coordinated with the General Contractor |

**1.3 GENERAL REQUIREMENTS**

- .1 The location and availability of utilities including water, sewer and electrical power is to be determined on site. The Asbestos Contractor shall co-operate with all others on site. Should there be any disagreement, or should Contractors be unable to reach a satisfactory working arrangement, the Arcadis Canada Inc. Consultant shall determine the manner for proceeding. The Asbestos Contractor shall not be entitled to any additional payment.
- .2 The Asbestos Contractor is responsible for all electrical connects and disconnects. All work must be performed by a licensed electrician in compliance to all regulatory requirements and codes.
- .3 The Asbestos Contractor is responsible for making all arrangements, and for paying for the disposal of all waste materials in accordance to all applicable government laws and regulations including local, provincial and federal.
- .4 The Asbestos Contractor is advised that extended hours of work may be required to meet the schedules as detailed in the Scope of Work and shall allow for the cost thereof including

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shift premiums and overtime. The Arcadis Canada Inc. Consultant shall be advised in writing at least four days in advance of the proposed working hours.

- .5 The Asbestos Contractor shall furnish and post on site the name and current phone number of an authorized representative(s) who can be contacted on a 24-hour basis in case of an emergency.
- .6 All precautions will be taken to prevent the spread of contaminated material and to protect all parties including Asbestos Contractor's personnel, Owner's employees and the public from asbestos dust exposure during the course of the work. The documents outline the minimum levels of precaution to be taken.
- .7 All work in work areas that are confined spaces shall comply with all requirements respecting confined spaces specified in O. Reg. 632/05, as amended 346/15, November 26, 2015.
- .8 **All work shall be done in compliance with the specifications and the Ontario Regulation 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Occupational Health and Safety Act.** Should there be any discrepancy or conflict between the documents, the most stringent shall apply.
- .9 Contract conditions include, but are not limited to, complying with all Regulations, taking all precautions necessary to control the release of asbestos fibres within the work areas, preventing the release of asbestos fibres outside the work areas, and providing appropriate protection from exposure to asbestos fibres for all parties. Failure to meet any of these conditions will be considered a fundamental breach of the Contract.
- .10 The Arcadis Canada Inc. Consultant will visit the site at his/her discretion to familiarize himself/herself with the progress and quality of the Work and to determine if the Work is proceeding in accordance with the Contract Documents.
- .11 The Arcadis Canada Inc. Consultant shall have the authority to immediately stop the Work through a written instruction if, in his opinion, the Work does not conform to the requirements of the Contract Documents, or if continuance of the Work could subject the Owner, his employees or the public to a hazardous condition. The Work shall not recommence until such time as the deficiency or hazardous situation has been corrected and a written notice to proceed has been issued by the Arcadis Canada Inc. Consultant.
- .12 If the Asbestos Contractor fails to comply with requirements dealing with the control of asbestos fibres and the health and safety of Asbestos Contractor employees, Arcadis Canada Inc. Consultant and Owner personnel or the Public, the Owner, or the Owner's representative, may verbally instruct the Asbestos Contractor to cease work immediately with written confirmation to follow within two working days. If the Arcadis Canada Inc. Consultant gives a written statement to the Owner and the Asbestos Contractor that sufficient cause exists, the Owner may notify the Asbestos Contractor in writing that he is in default of his contractual obligations.

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- .13 Any employee shall be replaced, at the written request of the Arcadis Canada Inc. Consultant, if working, or causing others to work, in violation of O.Reg. 278/05.
- .14 The Asbestos Contractor's insurance coverage limits, per occurrence, shall equal or exceed the following and shall name the Owner, the Architect, the General Contractor and Arcadis Canada Inc. as additional insureds:
  - .1 General Liability \$5 million;
  - .2 Automotive Liability \$2 million;
  - .3 Pollution Liability \$5 million including asbestos operations.
- .15 The supervisor must have proven experience and proficiency in the type of Work being undertaken under this Contract.
- .16 The supervisor shall be replaced, at the written request of the Arcadis Canada Inc. Consultant, if found to be incompetent or inattentive to the needs of the project.
- .17 Where standards of performance are specified or implied and the Work does not comply with the performance specified or implied, such deficiencies shall be corrected as directed by the Arcadis Canada Inc. Consultant. Any subsequent testing shall be done at the Asbestos Contractor's expense.

**1.4 DEFINITIONS**

- .1 *HEPA Vacuum:*
  - .1 High Efficiency Particulate Aerosol (HEPA) filtered vacuum equipment acceptable to Health and Welfare Canada and meeting U.S. Military Standard 282. This vacuum equipment shall have a filtering system capable of collecting and retaining asbestos fibres to an efficiency of 99.97% for fibres of 0.3 micrometer or larger.
- .2 *Polyethylene sheeting sealed with tape:*
  - .1 Polyethylene sheeting of thickness specified sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through the sheeting into a clean area.

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**.3** *Inspector:*

- .1 Representative of Arcadis Canada Inc. designated by the owner to provide inspection and air monitoring of the Contractor's work.

**.4** *Authorized Visitor:*

- .1 Representative of the building owner, Arcadis Canada Inc., and/or persons representing regulatory agencies.

**.5** *Amended Water:*

- .1 Water with a non-ionic surfactant added to reduce water tension to allow thorough wetting of asbestos fibres.

**.6** *Airlock:*

- .1 A system for permitting ingress or egress without permitting air movement between a contaminated area and an uncontaminated area typically consisting of two curtained doorways at least 1.5 m apart.

**.7** *Curtained Doorways:*

- .1 An arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed by placing two overlapping sheets of polyethylene over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway.
- .2 All free edges of polyethylene shall be reinforced with duct tape and the bottom edge shall be weighted to ensure proper closing. Each polyethylene sheet shall overlap openings an additional 1/3 of the doorway width.

**.8** *Operating Area:*

- .1 Area where no removal or repair Work is underway.

**.9** *Clean Area:*

- .1 Either an operating area or an area in which removal Work has already been completed.

**.10** *Work Area:*

- .1 Where the actual removal of asbestos-containing materials take place.

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.11 *Negative Pressure:*

- .1 A system which extracts air from the work area and discharges this air directly outside the building, sufficient to maintain a minimum pressure differential of 0.5 mm (0.02 inch) of water column relative to adjacent areas outside of work areas. This air extraction system is to be equipped with a High Efficiency Particulate Aerosol filtering system before discharge.

.12 *Confined Space:*

- .1 A fully or partially enclosed space,
- .1 that is not both designed and constructed for continuous human occupancy, and
- .2 in which atmospheric hazards may occur because of its construction, location or contents or because of work that is done in it.

## **1.5 REGULATORY AGENCIES**

- .1 Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in any case of conflict among those requirements or with these Specifications the more stringent requirement shall apply. These include, but are not limited to, the following:
- .1 Ontario Ministry of Labour, Occupational Health and Safety Division, *Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations*, O. Reg. 278/05, as amended 62/18, March 2, 2018 – made under the *Occupational Health and Safety Act, R.S.O. 1990, c. E. 19, as amended*.
- .2 Ontario Ministry of the Environment *Regulation 347* under the Environmental Protection Act, 19 as amended by O. Reg. 509/21, June 30, 2021.
- .2 Government of Canada *Regulations Respecting the Handling, Offering for Transport and Transporting of Dangerous Goods*. (Extract from the Canada Gazette Part II, dated February 6, 1985.)
- .3 Government of Ontario *Occupational Health and Safety Act, -R.S.O. 1990, c. E. 19, as amended, and Regulations for Construction Projects* O. Reg. 213/91, as amended.
- .4 Office of the Fire Commissioner of Canada.
- .5 Ontario Electrical Safety Code.
- .6 Government of Ontario, Building Code O. Reg. 332/12, as amended 137/19, May 2, 2019.

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.2 *Patents:*

- .1 It shall be the Contractor's responsibility to ensure that all applicable patent laws are complied with.

**1.6 FIRE SAFETY PLAN**

- .1 Prior to initiating any work on the site, the Contractor shall prepare and submit in writing to the Arcadis Canada Inc. Consultant a Fire Safety Plan. The Plan shall be in accordance to the requirements set forth in Section 2.14, Construction and Demolition Sites, of the National Fire Code and shall include:

- .1 the designation and organization of site personnel to carry out fire safety duties, including fire water services if applicable;
- .2 the emergency procedures to be used in the case of fire, including:
- .1 sounding the fire alarm;
- .2 notifying the fire department;
- .3 instructing site personnel on procedures to be followed when the alarm sounds; and
- .4 firefighting procedures;
- .3 the control of fire hazards in and around the building;
- .4 maintenance of firefighting facilities; and
- .5 special requirements as may be identified by the building owner.

- .2 Implementation of the Fire Safety Plan shall be the sole responsibility of the Contractor, and the above shall, in no way, limit the Contractor's statutory and regulatory obligations. During the work, the Fire Safety Plan shall be prominently displayed at the site and its requirements included in site safety training and awareness programs.

**1.7 SUBMITTALS**

**1.7.1 Submittals Before Commencing Work**

- .1 The following documentation shall be submitted to the Inspector with a dated covering letter listing attachments a minimum 48 hours prior to commencement of the Work:

- .1 *Permits and Notifications:*

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- .1 All necessary permits for transporting and disposal of asbestos waste. Submit proof satisfactory to Inspector that suitable arrangements have been made to receive and properly dispose of asbestos waste. Copies of all Notifications required by Section 1.11.
  
- .2 *Safety Data Sheets:*
  - .1 Safety Data Sheets, or equivalent, for any sealant, surfactant or other material proposed for use. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.
  
- .3 *Supervisory Personnel:*
  - .1 Names of supervisory personnel who will be responsible for work area(s). **One of these supervisors must remain on site at all times asbestos removal or cleanup is occurring.** Submit proof that supervisory personnel have over 2000 hours experience on asbestos abatement projects, have performed supervisory functions on at least two other asbestos projects and have achieved the level of training as set out by the Regulation.
  
- .4 *Schedule:*
  - .1 Provide a bar chart indicating planned progress for critical activities as required under **Scope of Work** as well as additional information listed below a minimum of 48 hours prior to commencement of any preparatory work indicating:
    - .1 shifts to be worked;
    - .2 proposed workforce;
    - .3 starting date;
    - .4 estimated date of commencement of asbestos removal;
    - .5 estimated date of completion of asbestos removal;
    - .6 estimated completion date.
  
- .5 *Insurance:*
  - .1 Provide a Certificate signed by the insurance agency naming the Owner, the Architect, the General Contractor and Arcadis Canada Inc. as co-insureds.

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2. The Asbestos Contractor's insurance coverage limits, per occurrence, shall equal or exceed the following:
  - .1 General Liability \$5 million;
  - .2 Automotive Liability \$2 million;
  - .3 Pollution Liability \$5 million including asbestos operations.
- .3 The Asbestos Contractor must provide thirty (30) days' notice of cancellation or amendment of coverage.
- .6 *Fire Safety Plan:*
  - .1 In accordance to Article 1.6 above.
- .7 *Confined Space:*
  - .1 If a work area, or part thereof, is a confined space, the contractor shall submit:
    - .1 a co-ordination document (see Section 1.13.1.1);
    - .2 a written program (see Section 1.13.1.2);
    - .3 a written plan (see Section 1.13.1.4).
- .8 *Asbestos Training:*
  - .1 A letter certifying that:
    - (a) *every worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities; and*
    - (b) *every supervisor of a worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities. O.Reg. 278/05, s. 20(1).*



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**1.7.2 Submittals Before Commencing Asbestos Removal**

- .1 Results of negative pressure unit integrity tests.
- .2 Proposed Work Area emergency exit procedures.
- .3 Proposed locations of decontamination facilities and negative pressure units and exhaust routing.
- .4 Evidence (letter or other suitable documentation) of proper construction, inspection and installation of GFI panel by licensed electrician in compliance to all regulatory requirements and codes.

**1.7.3 Submittals Upon Completion of Work**

- .1 Asbestos waste haulage and disposal documentations including Bills of Lading, waste transfer documents and dump receipts.
- .2 All documentation as specified in the contract General Conditions including, but not limited to, Workplace Safety and Insurance Board Certificate, Statutory Declarations and Proof of Publication of Substantial Performance.

**1.8 EXISTING CONDITIONS**

- .1 Thermal insulation on pipe fittings contains 60% chrysotile asbestos. Plaster contains 2% chrysotile asbestos. Vinyl floor tiles contain 3% chrysotile asbestos. Joint compounds on gypsum board applications contain 1.5% chrysotile asbestos. Caulking contains 3.1% to 32.4% chrysotile asbestos. Glazing seal contains 1.2% chrysotile asbestos. Cement board contains 25% chrysotile asbestos.
- .2 Existing conditions are documented in a report prepared by Arcadis Canada Inc. for the Conseil scolaire Viamonde titled "*Revised Pre-Renovation Designated Substances Survey, École élémentaire Pierre-Elliott-Trudeau, 65 Grace Street, Toronto, Ontario*" dated June 25, 2024, which is included with the tender documents.
- .3 Masonry applications may contain silica. Paint applications contain lead and may contain mercury. Appropriate dust control procedures and respiratory protective equipment are to be used if disturbing these materials.

**1.9 RESTRICTIONS**

- .1 Do not allow smoking, eating or drinking in the work area.
- .2 Do not allow entry to work area by unauthorized persons.
- .3 Compressed air shall not be used in the work area.

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- .4 Open flames will not be permitted in the work area (including but not limited to torches and propane-fired heaters).

**1.10 WORKER PROTECTION****.1 Instructions:**

- .1 Before commencing Work, instruct workers in all aspects of work procedures and protective measures.

**.2 Respiratory Protection:**

- .1 Provide workers with personally issued and marked respiratory equipment acceptable to the Occupational Health and Safety Division of the Ontario Ministry of Labour, suitable for the asbestos exposure in the work area.

- .2 Ensure that suitable respiratory protective equipment is worn by every worker who enters the work area. A respirator provided by an employer and used by a worker:

- .1 shall be in accordance to O.Reg. 278/05, Section 13, respirators;
- .2 shall be fitted so that there is an effective seal between the respirator and the worker's face;
- .3 shall be assigned to a worker for the worker's exclusive use;
- .4 shall be used and maintained in accordance with the procedures specified by the equipment manufacturer;
- .5 shall be cleaned, disinfected and inspected after use on each shift, or more often if necessary;
- .6 shall have damaged or deteriorated parts replaced prior to being used by a worker; and
- .7 when not in use, shall be stored in a convenient, clean and sanitary location.

**.3 Protective Clothing:**

- .1 Provide workers with protective clothing which shall:

- .1 be worn by every worker who enters the work area;
- .2 be made of a material which does not readily retain nor permit penetration of asbestos fibres;

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- .3 consist of full body covering including head covering with snug fitting cuffs at the wrists, ankles and neck;
- .4 include suitable footwear; and
- .5 be repaired or replaced if torn.

**1.11 NOTIFICATIONS**

- .1 Notify, in writing, the local Fire Department of the extent of the work, including a copy of the Fire Safety Plan detailed in Article 1.6 above.
- .2 Notify, orally and in writing, an inspector at the office of the Ministry of Labour nearest the work place of the operation. O.Reg. 278/05, Section 11.
  - .1 The written notice required by subsection (1) shall set out:
    - .1 the name and address of the person giving the notice;
    - .2 the name and address of the owner of the place where the work will be carried out;
    - .3 the municipal address or other description of the place where the work will be carried out sufficient to permit the inspector to locate the place, including the location with respect to the nearest public highway;
    - .4 a description of the work that will be carried out;
    - .5 the starting date and expected duration of the work; and
    - .6 the name and address of the supervisor in charge of the work.
- .3 Notify the Inspector a minimum of eight hours prior to initiation of the following phases of the project:
  - .1 commencement of asbestos removal;
  - .2 commencement of sealant application;
  - .3 dismantling of the enclosure; and
  - .4 removing asbestos waste from the work area.

**1.12 PROTECTION, REPAIR AND REPLACEMENT OF EQUIPMENT AND MATERIALS**

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- .1 All equipment within and surrounding the work area shall be suitably protected by the Contractor during the work periods.
  
- .2 All equipment damaged by the Contractor shall be replaced by the Contractor at no additional cost to the Owner.

**1.13 CONFINED SPACES**

Not Applicable.

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**2.0 PART 2 – PRODUCTS****2.1 MATERIALS****.1 Polyethylene:**

- .1 In 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.

**.2 Tape:**

- .1 Reinforced duct tape suitable for sealing polyethylene under both wet conditions using amended water, and dry conditions.

**.3 Wetting Agent:**

- .1 50% polyoxethylene ester and 50% polyglycol or polyxyethylene ether, or equivalent approved product, and shall be mixed with water to a concentration to provide adequate penetration and wetting of asbestos-containing material.

**.4 Asbestos Waste Receptors:**

- .1 0.15 mm (6 mil) minimum thickness appropriately labelled, sealable polyethylene bags and 0.15 mm (6 mil) minimum thickness sealable clear polyethylene bags.

**.5 Rip-Proof Polyethylene:**

- .1 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil) weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.

**.6 Sealant:**

- .1 Slow-drying sealant which remains tacky on surface for a minimum of 8 hours for purpose of trapping residual airborne fibre during settling period. Product must have flame spread and smoke development ratings both less than 50. **Product shall leave a clear finish when dry. Acceptable products “Childers Chil-Lock CP-240” or equivalent.**

**2.2 EQUIPMENT**

- .1 All equipment brought on site must be thoroughly clean and free of all fibre, asbestos or otherwise, to the satisfaction of the Field Inspector. The Contractor will be fully responsible for the replacement of equipment rejected by the Inspector and for all costs resulting from site contamination due to dirty or faulty equipment.

**.2 Airless Sprayer:**

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- .1 Spray equipment for the application of amended water and sealant such as Graco Hydrospray or equivalent:
  - .1 Fine atomizing spray nozzle: Nozzle for airless sprayer capable of delivering not less than 4.5 L per minute of fine particle spray of amended water.
  
- .3 *Garden Sprayer:*
  - .1 Hand pump-type pressure-can garden sprayer fabricated out of either metal or plastic equipped with a wand at the end of a hose that can deliver a stream or spray of liquid under pressure. **Only to be used on small removal and repair projects with the approval of the site inspector.**
  
- .4 *HEPA Vacuum:*
  - .1 High Efficiency Particulate Aerosol filtered vacuum equipment. Must have a filtering system capable of collecting and retaining asbestos fibres to an efficiency of 99.97% for fibres of 0.3 um or larger. HEPA filters must have been individually tested and certified by the manufacturer.
  - .2 All HEPA vacuums brought onto the job site shall be visibly clean, shall be in a good state of repair and shall be maintained in such state through completion of the project.
  
- .5 *Glovebag:*
  - .1 Prefabricated, purposely made, 0.20 mm minimum thickness, polyvinyl chloride bag with integral 0.25 mm thick polyvinyl chloride gloves.
  - .2 Bag equipped with reversible double-pull, double-throw zipper on top to facilitate installation on pipe and progressive movement along pipe, with straps for sealing ends of bag around pipe, and with plastic flap under zipper for strength on pipe and to provide effective seal and with “ziploc” feature. Bags shall be secured using manufacturer’s prescribed securing devices. Approval must be obtained from the Inspector for use of Glovebags. Bag must be acceptable to the Inspector for use.
  - .3 Bag must have valves to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
  
- .6 *Negative Pressure Units:*
  - .1 Exhaust units fitted with High Efficiency Particulate Aerosol (HEPA) filters used to effect a negative pressure differential in the work area as compared to the immediate surrounding or clean area. The filtering system must be capable of collecting and retaining asbestos fibres to an efficiency of 99.97% for fibres of

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0.3 um or larger. The HEPA filters must have been individually tested and certified by the manufacturer and bear a label certifying performance. The unit is to be fitted with instrumentation to indicate pressure differential across the HEPA filter with an audible alarm to sound at a preset low differential pressure.

- .2 Construction of HEPA filter/fan cabinet units shall be airtight, and all joints shall be caulked. The gasket seal between the filter housing and the retaining frame inside the cabinet shall provide a zero-leakage seal to avoid filter bypassing.
- .3 **Each negative pressure unit shall be integrity tested at the work site prior to commencement of asbestos removal.** The procedure must include the testing of the integrity of the entire cabinet. Written confirmation of the test results are to be provided to the Inspector. Retesting may be requested by the Inspector and performed by the Contractor should the unit be damaged or modified during the work.

.7 *Differential Pressure Recorder:*

- .1 Instrument to monitor and record the differential pressure between the Work Area and Clean Area.
  - .1 sensitivity: 0.025 mm (0.001 inches) WC increments between +0.25 mm to -2.5 mm (+0.010 to -0.100 inches) WC
  - .2 accuracy: +/- 1 %
  - .3 pressure alarms: audible high and low level alarm programmable within operating range
  - .4 printout: minimum 24 hr period at 15-minute intervals

.8 *Ground Fault Panel:*

- .1 Electrical Panel equipped with ground fault circuit breakers of sufficient capacity to power all electrical equipment and lights in work area. All breakers shall have 5 mA ground fault protection. Panel should be complete with all necessary accessories including ground fault interrupter lights, test switch to ensure unit is working, and reset switch. Ground fault receptacles on extension cords shall not be used without written authorization by the Arcadis Canada Inc. Consultant.
- .2 The GFI Panel must be constructed under the direction of a licensed Electrician and inspected by a licensed Electrician on a regular basis. Evidence of such construction and inspection shall be submitted to the Arcadis Canada Inc. Consultant prior to installation of the Panel on site.

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**3.0 PART 3 – EXECUTION****3.1 MAJOR ASBESTOS WORK (TYPE 3 OPERATIONS)****3.1.1 Plumbing and Drainage**

- .1 Provide a constant supply of water by means of copper or PVC pipe, fittings and valves to the worker area, equipment decontamination room and the shower facility. High pressure hose with appropriate connections may be used with the approval of the Inspector. A master shut-off valve shall be installed adjacent to, and on the clean side, of the decontamination facility. Any hose and hose connections must have a high-pressure rating and be limited to downstream of the master shut-off valve and are not to be left under pressure unattended.
- .2 The Contractor is responsible for the supply of a potable water source. There is no water in the building.
- .3 The effluent from the shower may be disposed of, through a filter, to the sanitary sewer, location to be determined during the pre-tender site visit. Only shower water may be disposed in this fashion, no asbestos-containing debris, cleaning solutions, encapsulants, sealants, body wastes, etc., may be disposed in the shower. The Contractor is responsible for all tie-ins to the existing systems and making good on completion. Free flowing shower effluent on to the floor or ground is not acceptable.
- .4 **All Work shall be carried out in accordance to the Ontario Plumbing Code.**

**3.1.2 Electrical**

- .1 The Contractor shall become completely familiar with the existing electrical installation during the site visit and pre-tender period.
- .2 The Contractor is responsible to provide and install all electrical requirements for the project including but not limited to:
  - .1 de-energize and lockout all electrical circuits in the work area wherever practicable;
  - .2 identify all systems that cannot be de-energized, and all low voltage systems such as controls and alarms;
  - .3 identify any electrical conditions which need special protection or consideration during the work;
  - .4 disconnect, if practicable, or provide suitable protection for, smoke and heat detectors, if any, and advise the authorities;
  - .5 protect existing electrical equipment including but not limited to: transformers, circuit breakers, switch gear, panels, buss ducts, fixtures, conduits, etc, within the work



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area, de-energized or not. Cover with a minimum of two independently sealed layers of poly, at least one of the layers to be of reinforced poly;

- .6 provide all additional transformers, circuit breakers, switch gear, panels, ground fault protection and temporary lighting required for the project. The ground fault panel is to have sufficient capacity to service the project needs and have two spare circuits to serve as backup. The work area lighting is to provide appropriate levels of illumination for the work, with a minimum of two separate circuits. Bulbs are to be fitted with cages or other suitable protection against breakage and/or direct contact with insulation materials (wood, plastic, etc.).
- .7 All electrical power within the work area must be ground fault protected. Refer to Section 2.2.8, *Ground Fault Panel*.
  - .1 The power cable to the Ground Fault Panel and the panel itself is not protected by interruptor and as such it must be located outside the work area or suitably protected from water and physical damage.
  - .2 All Work shall be performed by a licensed electrician and comply with the latest edition of the Ontario Electrical Safety Code and any other local codes and requirements which may govern the installation. The Contractor is responsible for, and shall arrange for, all inspections and approvals which may be required by government regulations, Electrical Safety Authority (ESA) or any other authorities having jurisdiction. The Client is to receive copies of all inspection reports.

### **3.1.3 Fire Prevention / Site Security**

- .1 Contact and co-operate with Owner's fire/security monitoring agency to identify impact of project on existing system with the intent of maintaining existing protection. The Owner will assume service costs for the monitoring agency.
- .2 Advise local fire department of the nature and extent of the work.
- .3 Heat Detectors:
  - .1 Protect and seal heat detectors with 0.04 mm (1.5 mil) polyethylene, sealed with tape. Tape is not to interfere with function of the unit.
  - .2 System is to be activated and deactivated as arranged with monitoring agency and Owner's Representative with the intent of leaving the entire system active when the Contractor is not on site.
  - .3 Provide an emergency name and contact number to the monitoring agency.

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**3.1.4 Decontamination Facilities**

- .1 Proposed locations of Decontamination Enclosure Systems are to be determined during the prestart site review. The facility must be of adequate size and construction to suit the requirements of the project. The owner may have restrictions on the location of the facilities. The worker decontamination enclosure system shall be kept separate from the waste and equipment transfer system.
- .2 Workers' Decontamination Enclosure System:
  - .1 The Worker Decontamination Enclosure System shall comprise of a serial arrangement of three separate compartments including a Clean Change Room, a Shower Room and a Contaminated Change Room with an air lock separating each area. The purpose of this system is to provide a means of entry into the work area and allow decontamination of personnel and small tools on exit.
    - .1 *Clean Change Room:* Build a clean room between the shower room and clean areas outside of enclosures, with one airlock to the shower room. Provide lockers for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install a mirror to permit workers to fit respiratory equipment properly; provide sufficient hangers and hooks; provide a bench or chairs. Install a lockable door and lock at the entrance to the clean room and provide a key to the Inspector.
    - .2 *Shower Room:* Build a shower room between the Equipment and Access Room, with two airlocks, one to the clean room and one to the Equipment and Access Room. Provide one shower for every five workers. **Only 'walk through' shower units are acceptable.**
    - .3 Provide a constant supply of hot and cold water. The shower room shall have individual controls inside the room to regulate water flow and temperature.
    - .4 Provide piping and connect to water sources and drains. Provide soap and appropriate containers for disposal of used respirator filters. Note that workers may provide their own towels as these are not contaminated and may be removed from the site for cleaning.
    - .5 *Contaminated Change Room:* Build an Equipment and Access Room between the shower room and the work areas, with one airlock to the shower room. Install storage facilities for workers' shoes and any protective clothing to be reworn in work areas. Provide for disposal of used coveralls.

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- .6 The Contaminated Change Room shall be large enough to accommodate specified facilities, any other equipment needed, and at least one worker allowing him sufficient space to undress comfortably.
- .3 Waste and Equipment Decontamination Enclosure System (Waste Load-Out).
  - .1 The drum and equipment decontamination enclosure system shall comprise of a serial arrangement of three separate compartments including a Clean Room, a Central Handling Area and a Washing area with an air lock between each area. The purpose of this system is to provide a means to decontaminate and remove waste from the work area. Large equipment is to remain in the work area for the duration.
    - .1 *Clean Room:* Build a clean room between the Central Handling Area and the clean area with a plastic double airlock separating the two areas. The clean room shall be of sufficient size to accommodate at least ten waste receptors and the largest item of equipment used. Install a lockable door and lock at the entrance to the clean room and provide a key to the Inspector.
    - .2 *Central Handling Area:* Build a handling room between the Clean Room and the Washing Area with a plastic double airlock separating the two areas. The handling room shall be of sufficient size to accommodate at least ten waste receptors and the largest item of equipment used.
    - .3 *Washing Area:* Build a washroom between the Central Handling Area and the work area with one airlock to the Central Handling Area. Provide water for cleaning which is to be disposed as asbestos waste.
- .4 Construction of Decontamination Enclosures:
  - .1 Build suitable framing for enclosures or use existing rooms, where convenient and permitted, and line with polyethylene sheeting sealed with tape. Use minimum of one layer of clear, rip-proof polyethylene on floors and two layers (one on each side of the framing) of dark 0.15 mm (6 mil) polyethylene on walls and ceiling.

Temporary framing shall be constructed of 50 mm x 100 mm studs at 600 mm centres.
  - .2 Construct airlocks between rooms.
  - .3 Clearly mark the exits from the work area.
  - .4 Post warning signs at all entrances to the work area and on the outside of all walls enclosing each work area. Submit proposed emergency exit procedures for review and approval by the Inspector prior to contamination of the work area.

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- .5 Separation of Work Areas with **Temporary Partitions**:
  - .1 Separate parts of the building not included in the asbestos abatement program from parts of the building used for asbestos abatement by means of an airtight and tamper resistant barrier constructed from floor to ceiling as follows:
    - .1 Build suitable temporary lumber stud framing constructed of 50 mm x 100 mm Spruce studs at 600 mm centres.
    - .2 Caulk edges of partition both sides at floor, ceiling, walls and fixtures to form an air tight and watertight seal. Duct tape is a suitable alternative.
    - .3 Cover framing with two layers of 0.15 mm (6 mil) polyethylene, one on each side of studs. Apply new 12 mm (1/2 inch) gypsum board or 6 mm (1/4 inch) plywood from top to bottom of the barrier on the occupied (clean) side secured with screws and nails.

**3.1.5 Work Area Preparation**

- .1 Remove moveable objects to a designated temporary location in the building unless the Scope of Work specifies this work to be done by others.
- .2 Isolate air handling and ventilation systems to prevent contamination and fibre dispersal to other areas of the building during the work phase.
  - .1 There may be ventilation ducts above the ceiling assembly which must be accessed, visually inspected for openings and sealed prior to contaminating the work area. If, in the opinion of the Inspector, there is a significant amount of asbestos material on the ceiling assembly, access is to be restricted until all other preparations are complete.
  - .2 The mechanical ventilation system serving the work area shall be disabled and locked out and all openings, diffusers, grills or voids in the work area shall be sealed with rip proof polyethylene and tape independent of wall polyethylene.
- .3 Protect all existing electrical equipment to be left in place during the work including fixtures, panels, transformers, switch gear, motors and boxes located within the work area: Cover with a minimum of 2 independently sealed layers of polyethylene sealed with duct tape. At least one of the layers shall be rip proof polyethylene.
- .4 Protect all wall hangings, fixtures, equipment, and other items which could not be relocated from the work area with 0.15 mm (6 mil) polyethylene sealed with tape independent of wall or floor polyethylene.
- .5 Secure from the inside and seal independently, prior to applying the wall polyethylene, all openings including doors, windows, hatches, etc., leading into the work area from an

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- occupied area or from outside. Polyethylene used to seal windows to public or occupied areas is to be opaque.
- .6 Seal all penetrations including pipe, conduit and duct openings, drains, etc., with polyethylene and duct tape independent of floor or wall polyethylene.
- .1 There may be penetrations or equipment requiring protection above the ceiling assembly which must be accessed, visually inspected and sealed prior to contaminating the work area. If, in the opinion of the Inspector, there is a significant amount of asbestos material on the ceiling assembly, access is to be restricted until all other preparations are complete.
- .7 Protect floors with rip proof polyethylene sheeting sealed with tape except areas requiring floor tile removal. Extend polyethylene at least 300 mm (12 inches) up the walls. Overlap adjoining sheets of polyethylene by at least one foot.
- .1 Protect any floor rugs which are to remain in place from damage by using a minimum second layer of rip-proof poly taped and sealed independently.
- .2 Water leakage during the removal operation may not be confirmed until the work is complete and can result in contamination of the rug with asbestos fibres carried in the water as well as permanent staining or damage of the material. Should a rug be left in place during the work it must be thoroughly vacuumed with HEPA equipment and steam cleaned at the completion of the project. The Contractor is responsible for cleaning, repair or replacement of floor covering to the satisfaction of the Inspector. The Contractor may elect to provide additional protection.
- .8 Protect walls and all other internal surfaces not specifically mentioned earlier with one layer of 0.15 mm (6 mil) clear polyethylene. The polyethylene shall extend to within six inches of ceiling height and shall be attached carefully to avoid disturbing asbestos-containing material. Overlap adjoining sheets of polyethylene by at least 300 mm.
- .9 Polyethylene sheeting shall be suitably braced and/or restrained so that subsequent application of a negative pressure differential in the work area does not cause excessive billowing or failure of the polyethylene or taped joints. Walls with masonry finish (brick or block) may require 25 mm x 50 mm (1" x 2") straps as bracing for the wall protection.
- .10 Ensure that polyethylene near a heat source is a flame-resistant type.
- .11 Spray adhesive is not to be applied directly on to floor or wall finishes.
- .12 Install the negative air pressure system, which includes a minimum of 1 backup unit for every 4 units installed. Exhaust air to the outside of the building. Submit proposed locations of negative pressure units and exhaust routing to the Inspector for review and approval.

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- .1 The exhaust from the unit to the outside of the building is to be airtight and constructed of wire-reinforced flexible or rigid duct. Each end, at the unit and at the outlet, and the penetration through the isolation barrier or enclosure, is to be mechanically secured (duct tape is not considered adequate). The outlet is to be shielded from the weather and have a mesh to prevent introduction of foreign objects. The Contractor is to ensure that the building remains secure from intrusion by others.
- .2 Each unit is to be integrity tested at the work site prior to commencing asbestos removal. The procedure is to include the testing of the integrity of the entire cabinet. Retesting is required if the unit is damaged or modified during the work.
- .3 Switch the negative air pressure system to the "ON" mode and operate continuously until completion of the work, including final cleanup. Provide continuous monitoring of pressure difference using an automatic instrument. The monitor gauge shall be located outside the work area enclosure. A minimum air pressure of 0.5 mm (0.02 inches) water gauge is to be achieved and maintained within the work enclosure relative to the adjacent uncontaminated areas at all times.

**3.1.6 Worker Protection**

- .1 Instructions:
  - .1 Before commencing Work, instruct workers in all aspects of work procedures and protective measures.
- .2 Respiratory Protection: (refer to Section 1.10.2).
- .3 Protective Clothing: (refer to Section 1.10.3).
- .4 Entering the Work Area:
  - .1 Remove all street clothing in the Clean Room.
  - .2 Put on clean disposable coveralls.
  - .3 Inspect and put on respiratory protection. Note that respirator head straps are to be under the head covering as the respirator is removed last.
  - .4 Enter work area through Shower Room and Equipment and Access Room. Put on work boots and other items left in contamination.
- .5 Leaving the Work Area:
  - .1 Before exiting the work area, remove visible debris from clothing, footwear, hard hats and the outside of respirators by using a HEPA vacuum or wet wiping.

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- .2 Proceed to the Equipment and Access Room and remove boots and other items to be left in contamination, remove disposable coverall and place in container for disposal. Respirator is not to be disturbed during this operation.
- .3 Wearing only the respirator, enter the Shower Room, wet the respirator in the shower before removing by facing the shower nozzle and remove. If applicable, remove the filters and dispose in container. If filters are to be reused, seal openings with provided plugs or duct tape to prevent release of fibre and hand out respirator to the Clean Room. Proceed to wash thoroughly with soap and shampoo prior to entering the Clean Room.
- .4 Items left in the Equipment and Access Area may be removed by cleaning at completion of the project, disposed as waste, or sealed in plastic and taken to another contaminated area.
  - .1 At no time is more than one airlock in the three room serial arrangement to be opened during the passage of workers.
  - .2 Once in the contaminated work area, leaving the area must include full procedures as listed above.

**3.1.7 Pre-contamination Inspection**

- .1 Asbestos Abatement Work shall not commence until:
  - .1 The Ministry of Labour, Construction Health and Safety Branch has been notified through a Notice of Project and a copy of the Notice of Project is posted on the site.
  - .2 Arrangements have been made for disposal of waste.
  - .3 All documentation is in place.
  - .4 Work areas and decontamination enclosures and parts of the building required to remain in use are effectively segregated.
  - .5 Tools, equipment, materials, and waste receptors are on hand.
  - .6 Warning signs have been posted as specified.
  - .7 Negative air pressure differential [minimum 0.5 mm (0.02 inches) water gauge] has been established in the work area with monometer in place and operational.
  - .8 All workers have been made familiar with the use of respirators, procedures for entering and leaving the contaminated area and emergency evacuation routes.

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- .9 Written **authorization to proceed** has been obtained from the Inspector based on a visual inspection of the site.
- .10 A Pre-contamination Inspection Checklist is provided at the end of this document for the Contractor's reference.

**3.1.8 Asbestos Remedial Work**

- .1 Maintenance of Enclosures:
  - .1 Maintain enclosures in tidy condition.
  - .2 Ensure that barriers and polyethylene linings are effectively sealed and taped.
  - .3 Repair damaged barriers and remedy defects immediately upon discovery.
  - .4 Visually inspect enclosures at the beginning and end of each working period **and at least once each day on days when there are no shifts. This includes weekends and holidays.**
  - .5 Ensure that a **minimum** air pressure differential of **0.5 mm (0.02 inches)** water gauge is maintained within the work enclosure relative to the adjacent uncontaminated areas at all times.
  - .6 Ensure that the work area is secure during periods of no activity.
- .2 Upper Seals: (where applicable)
  - .1 There may be ventilation ducts, penetrations and equipment requiring protection above the ceiling assembly which must be accessed, visually inspected and sealed.
  - .2 Open Plenum and/or upper wall penetrations: while operating under contaminated procedures and ensuring adequate negative pressure within the work area, systematically access the ceiling along the perimeter of the project site and seal all openings with framing, polyethylene and duct tape. Adjacent areas are not to be occupied during this operation.
  - .3 Ventilation ducts, openings, etc.: while operating under contaminated procedures and ensuring adequate negative pressure within the work area, systematically access the ceiling as required to access the openings and seal with framing, polyethylene and duct tape. The ventilation systems serving the work area are to be turned off or locked-out during this procedure and remain off until completion of the work.
  - .4 Equipment requiring protection: while operating under contaminated procedures and ensuring adequate negative pressure within the work area, systematically access



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the ceiling as required to access the equipment and seal with polyethylene and duct tape.

.3 Asbestos Encapsulation

Not Applicable.

.4 Asbestos Removal (Wet Method)

.1 *Paints and coatings:* Apply amended water to the surface of the material using an airless sprayer. Allow the water to soak through to the surface. Application of a fine mist at low volumes will avoid excessive water dripping to the floor. Ensure that all asbestos-containing paint is completely removed from substrate materials.

.2 *Mortar:* Apply amended water to the surface of the material using an airless sprayer. Ensure that all asbestos-containing mortar is completely removed from substrate materials. Spray the asbestos material repeatedly during the work process to maintain saturation and to minimize asbestos fibre dispersion.

.3 *Vinyl baseboards and associated mastics:* Apply amended water to the surface of the material using an airless sprayer. Allow the water to soak through to the surface. Application of a fine mist at low volumes will avoid excessive water dripping to the floor. Remove mastic to an extent that only a thin layer of mastic remains on substrate materials.

.4 Remove the saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed, pack the material into a waste receptor (polyethylene bag).

.1 Spray the asbestos material repeatedly during the work process to maintain saturation and to minimize asbestos fibre dispersion.

.2 Mist the air periodically with water.

.3 Excess water is to be treated as asbestos waste and is to be placed into a waste receptor (polyethylene bag). Refer to Waste Handling for cleaning and removal of bagged asbestos waste.

.6 After completion of asbestos removal, all surfaces from which asbestos has been removed shall be brushed and wet-sponged to remove all visible material and residues. During this work the surfaces shall be kept wet.

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.5 Asbestos Removal (Dry Method)

Not Applicable.

.6 Initial Cleaning

.1 Wet clean (other than dry removal areas) and HEPA vacuum the entire work area, including all Decontamination Enclosure Systems and equipment used in the process. Prefilters on HEPA fan/filter units shall be replaced and disposed of as contaminated waste.

.1 For floors covered by rugs, remove the top layer of polyethylene at this stage.

.2 HEPA vacuum cleaners shall be emptied of their contents which shall be disposed of as contaminated waste.

.3 All equipment shall also be thoroughly clean including but not limited to HEPA vacuum cleaners, vacuum hoses, sprayers, scaffolding and other equipment. Dismantle scaffolding and clean components.

### **3.1.9 Waste Handling**

.1 Three workers with personal protection equipment for a Type 3 operation, respirators and disposable coveralls, enter the Waste Load-out facility from the clean side, one (A) stays in the Clean Area, the second (B) proceeds to the Central Handling Area, and the third (C) proceeds to the Washing Area. A fourth worker (D) may enter the work area in the usual fashion.

.2 Worker D cleans all bulk debris from the waste receptors (polyethylene bag) containing asbestos waste by wet wiping. The bag is then passed in to worker C in the Washing Area of the Waste Load-out facility. Worker C washes the bag (water must be made available) and passes it to worker B in the Central Handling Area where it is placed into a second waste receptor (clear bag) and wet wiped. Worker B passes the bag to worker A in the Clean Area where it is stored for future disposal or passed outside the facility to another worker for placement into the disposal bin.

.1 At no time is more than one air lock in the three-room serial arrangement to be opened for transfer of material. The workers are not to pass from one room to another during the waste handling operation.

.3 On completion, all surfaces in the three material handling areas are to be wet washed and cleaned of all debris. The three workers are then to proceed into the contaminated work area each sealing or closing the airlock behind him.

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- .4 Contaminated equipment being removed from the work area may be handled similarly to waste but instead of bagging it may be completely washed or vacuumed.

**3.1.10 Final Seal and Cleaning**

- .1 After completion of the asbestos removal and initial cleaning a visual inspection will be performed by the Inspector to confirm that all visible debris has been removed from the work surfaces.
- .2 Surfaces shall be accepted as clean when there is no visible residue, dirt, dust, film, stain or discolouration on all surfaces within the work area including but not limited to piping, tanks, ducts, conduits, mechanical and electrical items, wiring, cracks, crevices, joints, etc., resulting either from prior contamination, asbestos removal procedures or from cleaning procedures.
- .3 Cleaning and inspection shall be repeated at the Contractor's cost if the area does not meet the above criteria and is declared unclean.
- .4 The application of sealant is not to commence until all visible asbestos fibre has been removed from all surfaces and a written *authorization to proceed* has been obtained based on a visual inspection of the work area.
- .5 Architectural finishes, including ceiling components, various fixtures and other surfaces which may be damaged or stained by the sealant are to be suitably protected with polyethylene and duct tape. **Any damage resulting from the Contractor's work shall be made good to the satisfaction of the Inspector.**
- .6 Sealant shall be sprayed to all surfaces in the work area. The spray is to be directed from the top down to ensure that the higher horizontal surfaces are covered. Spraying from the floor only is not acceptable. Apply sealant using an airless high pressure paint sprayer.
- .7 The nature of the sealant may affect the requirement for respiratory protection. Vapours that may be released during sealant application must be taken into account when selecting respirators.
- .8 In dry removal areas, it may be possible to apply the sealant with a rag or sponge. If this is not practicable, the surfaces are to remain unsealed.
- .9 After the sealant has dried, allow a 12-hour period for dust settling. During this settling period, no entry or activity will be permitted in the work area.
- .10 After the work area is dry and a visual inspection by the Inspector confirms the area is satisfactorily clean, clearance air samples shall be taken in the work area by the Inspector. The work area is declared clean by the Inspector when the air monitoring results conform to the pre-established levels.

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- .11 Cleaning, inspection and air sampling shall be repeated at the Contractor's expense if the area does not meet visual inspection and air monitoring criteria and is declared unclean.

**3.1.11 Final Tear Down and Demobilization**

- .1 The final tear down is not to commence until a written *authorization to proceed* has been obtained based on a visual inspection of the work area and the results of the air monitoring.
- .2 Dismantle the remainder of the enclosure and dispose of all polyethylene sheeting as asbestos waste.
- .3 Vacuum and/or wet wipe all surfaces previously inaccessible due to temporary construction.
- .4 Seal the outside of the negative pressure exhaust units with polyethylene and tape before removing from work area.

**3.1.12 Re-establishment of Objects and Systems**

- .1 Re-establish thermal insulation, fireproofing, acoustic applications, ceiling systems, etc., removed during the course of the project in accordance with the standard specification when specified in the Scope of Work.
- .2 Reinstall objects, moved to temporary locations in the course of the Work, in their proper positions.
- .3 Resecure mounted objects removed in the course of the Work in their former positions.
- .4 Re-establish mechanical and electrical systems in proper working order.
- .5 Repair or replace objects damaged in the course of the Work.

**3.2 ASBESTOS REMOVAL (GLOVEBAG METHOD)**

- .1 Before performing work:
  - .1 Prepare site by placing new 0.15 mm (6 mil) polyethylene plastic drop sheets on all surfaces immediately below and within 3.0 m of the work area.
  - .2 Remove all obstructions from around pipes to allow access for repair work.
  - .3 Inspect all glovebags for defects before using. A defective bag shall not be used.
  - .4 Ensure that any knife to be used inside the glovebag has a retractable blade and that any saw used inside the glovebag is of the flexible wire type; and brush used inside a glovebag shall not have metal bristles.

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- .2 Perform removal operations using the following procedures (in accordance to the manufacturer's instructions):
  - .1 Place any tools necessary to remove insulation in bottom of the containment bag.
  - .2 Install the bag on the pipe or fitting using shoulder straps and zipper provided. **Duct tape is not to be substituted for shoulder straps.** Support bag as necessary to avoid damage to the piping system or the bag itself.
  - .3 Insert nozzle of spray pump prefilled and primed with water and surfactant mixture (amended water) into the bag through the valve provided. Place hands in gloves and relocate the tools to the tool pouch.
  - .4 Cut or remove exterior insulation jacket, where applicable, to expose asbestos pipe covering. Wet exposed pipe covering with sufficient amended water to suppress any dust. Remove insulation and arrange in bottom of bag to obtain maximum capacity for the bag. Wash down exposed portion of pipe and top section of bag ensuring that insulation in lower portion of bag as well as any exposed end of insulation is thoroughly saturated. Use one hand and a cloth or sponge to aid in washing process.
  - .5 Ensure that pipe and other surfaces are clean of visual residue, dirt or dust prior to removal of the containment bag and seal all surfaces with encapsulant. Seal exposed ends of remaining asbestos insulation with encapsulant.
  - .6 If the glovebag is ripped, cut or opened in any way, work that may disturb friable material shall cease immediately. If the rip, cut or opening is small and easy to repair then the glovebag shall be repaired immediately with tape. Work may continue once the repairs are complete. If the rip, cut or opening is not small and cannot be easily repaired, place the glovebag immediately within a suitable asbestos waste container. Any spilled material containing asbestos shall be cleaned up and removed by using a vacuum equipped with a HEPA filter.
  - .7 To remove bag after completion of stripping, wash top section and tools thoroughly. Put all tools in one hand (glove), pull hand out inverted, twist to create a separate pouch, double tape to seal ends, cut and place in the next glovebag or into a water bucket, open pouch under water and clean and then allow to dry. Tools may also be cleaned and handed out during the dismantling of the bag while taking all precautions to prevent release of asbestos.
  - .8 Remove all air inside the glovebag by means of a vacuum equipped with a HEPA filter. Seal lower portion of bag and place bag into appropriate waste container.
  - .9 After removal of bag, ensure pipe is clean of all residue. If necessary after removal of each section of asbestos, vacuum all surfaces of pipe, using HEPA Filtered Vacuum equipment.

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- .10 Welds and folds of glovebags are to remain intact without modification to manufacturer's design.
- .11 Glovebags, disposal bags, cloth rags and any porous materials are to be handled and disposed as hazardous waste.
- .12 Frequently, and at regular intervals during the work and immediately upon completion of the work, glovebags containing asbestos-contaminated dust and waste shall be placed in a suitable waste container and shall be removed from the workplace.
- .13 Immediately after removal of asbestos, clean all surfaces and equipment within the work area using a HEPA vacuum and damp wiping.
- .14 Remove polyethylene floor covering, fold inward, and place in 6-mil polyethylene waste bags. Seal bags tightly.
- .15 Place sponges, brushes, etc., in double polyethylene bags and seal tightly.
- .16 Make arrangements for disposal of all asbestos-containing waste material.

**3.3 TYPE 2 ENCLOSURE METHOD**

- .1 Preparation
  - .1 Separate the work area from the rest of the building using rope barriers, signage and other appropriate means. The extent of the work area will depend on the amount of work to be done, potential for fibre release and the height of the work above floor level.
  - .2 Identify the work area with clearly visible warning signs.
  - .3 Construct a frame for the enclosure from 50 mm x 100 mm (2" x 4") studs or other suitable material (scaffolding, for example); if the potential exists for the disturbance of asbestos-containing material during the construction of the enclosure, wear a respirator and suitable protective clothing; ensure that the enclosure is of adequate size to permit the storage of equipment and waste.
  - .4 If the room where the work is to take place is small, the room itself may serve as an enclosure, provided that all openings are sealed, the mechanical ventilation system servicing the room is disabled and the ventilation ducts to and from the work area are sealed.
  - .5 Shut off the source of heat for piping systems (i.e., boiler or steam line header), where possible.

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- .6 Cover the walls, floor and ceiling of the enclosure with clear 0.15 mm polyethylene sheeting sealed with duct tape. Curtains of polyethylene sheeting must be fitted on each side of the entrance to the enclosure (curtain flaps may require weights at the bottoms to ensure proper closing).
- .7 Disable the ventilation system servicing the enclosure; seal ventilation ducts to and from the work area.
- .8 Shut off and lock out electrical power within the enclosure.
- .9 Wear an appropriate respirator approved for use with asbestos and suitable protective equipment. Only persons wearing protective clothing and equipment shall be allowed to enter the work area. If the type of asbestos is other than chrysotile, a powered air purifying respirator shall be used.
- .10 Do not use compressed air.
- .11 Do not eat, drink, smoke or chew in the work area.
- .12 Vacuum surfaces of insulated material in the work area using a HEPA vacuum.
- .2 Asbestos Removal and Cleanup
  - .1 Only non-powered hand-tools, or power tools **FITTED WITH A DUST COLLECTION DEVICE AND HEPA FILTER** are permitted to be used.
  - .2 Do not eat, drink, chew or smoke within the work area.
  - .3 Apply amended water to the surface of the asbestos-containing material using an airless sprayer.
  - .4 Remove the saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed, pack the material into a waste receptor (polyethylene bag).
    - .1 Spray the asbestos material repeatedly during the work process to maintain saturation and to minimize asbestos fibre dispersion.
    - .2 Mist the air periodically with water.
    - .3 Excess water is to be treated as asbestos waste and is to be placed into a waste receptor (polyethylene bag). Refer to Waste Handling for cleaning and removal of bagged asbestos waste.

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- .5 After completion of asbestos removal, all surfaces from which asbestos has been removed shall be brushed and wet-sponged to remove all visible material and residues. During this Work the surfaces shall be kept wet.
- .6 Clean all surfaces and equipment within the work area, including polyethylene sheeting, using a HEPA vacuum or by damp wiping.
- .7 Seal all surfaces of pipe or other equipment, enclosure, and ends of exposed insulation with a suitable encapsulant.
- .8 After satisfactory completion of cleaning and before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
- .9 Dismantle the enclosure and wet and dispose of all polyethylene sheeting, brushes and sponges as asbestos waste.
- .10 Dispose of protective clothing as asbestos waste.
- .11 Wash hands and face at the completion of the work (before leaving the work area); damp wipe the respirator and store in a proper place.
- .12 Make arrangements for disposal of all asbestos-containing waste material.

**3.4 TYPE 2 NON-ENCLOSURE METHOD**

- .1 Preparation
  - .1 Control the spread of dust from the work being performed by use of drop sheets, keeping doors closed, providing signage, etc. Ensure that appropriate equipment and materials are at hand.
  - .2 Restrict access to the work area using rope barriers, barricades, and other appropriate measures.
  - .3 Disable ventilation systems servicing the work area.
  - .4 Provide and wear a non-powered air purifying respirator with high efficiency cartridges approved for use with asbestos and disposable coveralls including hood, elasticized cuffs and zipper over work clothes.



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- .2 Asbestos Removal and Cleanup
  - .1 Only non-powered hand-tools, or power tools **FITTED WITH A DUST COLLECTION DEVICE AND HEPA FILTER** are permitted to be used.
  - .2 Do not eat, drink, chew or smoke within the work area.
  - .3 *Asbestos Cement Board*: Apply amended water to the surface of the material using an airless sprayer. Using hand tools or power tools fitted with HEPA filtered dust collection devices, remove asbestos-containing cement board and/or using power tools drill into asbestos cement board as required to make attachments. Spray the asbestos material repeatedly during the work process to maintain saturation and to minimize asbestos fibre dispersion.
  - .4 Do not allow waste to accumulate.
  - .5 Clean dust and debris at regular intervals and at the end of each shift with a damp cloth or HEPA vacuum.
  - .6 Ensure that there is no visible airborne dust in the work area during the removal and cleanup operation.
  - .7 All duct tape, polyethylene sheets, disposable clothing and other consumables used for, and during the removal of asbestos shall be contained and disposed as asbestos waste.
  - .8 After satisfactory completion of cleaning and before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
  - .9 Dispose of protective clothing as asbestos waste.
  - .10 Wash hands and face prior to taking breaks and at completion of the work before leaving the work area. Damp-wipe the respirator after use and store in an appropriate place.
  - .11 Make arrangements for disposal of all asbestos-containing waste material.

**3.5 TYPE 1 OPERATION**

- .1 *Preparation*
  - .1 Control the spread of dust from the work being performed by use of drop sheets, keeping doors closed, providing signage, etc. Ensure that appropriate equipment and materials are at hand.

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- .2 Restrict access to the work area using rope barriers, barricades, and other appropriate measures.
  - .3 Disable ventilation systems servicing the work area.
  - .4 Provide and wear a non-powered air purifying respirator with high efficiency cartridges approved for use with asbestos and disposable coveralls including hood, elasticized cuffs and zipper over work clothes.
- .2 *Asbestos Removal and Cleanup*
- .1 Do not use any power tools. All work is to be completed by non-powered hand tools only.
  - .2 Do not eat, drink, chew or smoke within the work area.
  - .3 *Vinyl Floor Tile/Vinyl Floor Sheeting (without asbestos-containing paper backing):* Disconnect all floor-mounted electrical fixtures and outlets and seal with duct tape. Seal other floor penetrations as required. Spray amended water on tiles to be removed to reduce dust. Remove tiles and immediately place into waste receptor. Double bag when removing debris from work area.
  - .4 *Drywall with Asbestos-Containing Joint Compound:* Apply amended water to the surface of the material using an airless sprayer. Application of a fine mist at low volumes will avoid excessive water dripping. Remove gypsum board by hand and place directly into waste receptor. Do not throw or allow waste to fall to the floor from the work area. Ensure that all asbestos debris is removed from the ceiling/wall assembly. Ensure that all asbestos debris is removed including that on fasteners. Double bag when removing debris from work area.
  - .5 *Caulking:* Apply amended water as required to reduce dust. Remove material by hand and place immediately into waste receptor. Do not throw asbestos waste. Double bag when removing debris from work area.
  - .6 Do not allow waste to accumulate.
  - .7 Clean dust and debris at regular intervals and at the end of each shift with a damp cloth or HEPA vacuum.
  - .8 Ensure that there is no visible airborne dust in the work area during the removal and cleanup operation.
  - .9 All duct tape, polyethylene sheets, disposable clothing and other consumables used for, and during the removal of asbestos shall be contained and disposed as asbestos waste.

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- .10 After satisfactory completion of cleaning and before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
- .11 Dispose of protective clothing (where applicable) as asbestos waste.
- .12 Wash hands and face prior to taking breaks and at completion of the work before leaving the work area. Damp-wipe the respirator (where applicable) after use and store in an appropriate place.
- .13 Make arrangements for disposal of all asbestos-containing waste material.

**3.6 WASTE DISPOSAL**

- .1 Asbestos-containing wastes shall be disposed of in accordance with procedures established by the Ontario Ministry of the Environment *Regulation 347 (as amended) under the Environmental Protection Act* and the Government of Canada *Transportation of Dangerous Goods Regulations*.
- .2 All waste is to be removed from the site and disposed. Disposal containers are not to be left on the property unattended unless fully enclosed and locked. Bins must be removed immediately on completion of work.
- .3 Both sides of every vehicle used for the transportation of asbestos and every waste container must display in large easily legible letters that contrast in colour with the background the word "CAUTION" in letters not less than 10 cm in height and the words:

**CONTAINS ASBESTOS FIBRES**

Avoid Creating Dust and Spillage

Asbestos May Be Harmful To Your Health

Wear Approved Protective Equipment

- .4 Both sides of every waste container must display in large easily legible letters the words '**ASBESTOS, WHITE, PRODUCT IDENTIFICATION NUMBER 2590**' or '**ASBESTOS, BLUE, PRODUCT IDENTIFICATION NUMBER 2212**' in accordance with the type of asbestos being transported.
- .5 Every vehicle used for the transportation of asbestos waste shall display a Class 9 placard on the front, back and two sides of the vehicle.
- .6 The waste must be transported in a fully-enclosed truck, or alternatively, in a waste disposal skip. The driver must be familiar with cleanup and handling procedures and be trained to deal with spills or container breakage.

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- .7 The truck must be equipped with a shovel and broom, wetting agent, protective clothing, respiratory protective equipment, polyethylene bags of at least 0.15 mm (6 mil) thickness, and bag closures and duct tape.
- .8 All waste must be transported with a **Bill of Lading** directly from the work area to the waste disposal site. The Bill of Lading is to indicate the source and type of asbestos, the Carrier, the amount, the destination (disposal site) and date all in accordance to applicable regulations. A copy of the Bill of Lading and disposal site receipt is to be provided to the Inspector.

**3.7 AIR MONITORING**

- .1 Air tests will be taken at the discretion of the Asbestos Consultant using the Phase Contrast Microscopy (PCM) method from the time asbestos-containing materials may be disturbed until the final visual inspection of the work area(s). PCM will be used for final clearance air monitoring analysis.

- .1 *Outside Asbestos Removal Work Areas:*

- .1 The maximum allowable fibre concentration outside the Work Areas during asbestos removal or cleanup shall be 0.05 f/cc. Should readings exceed this value, the work shall stop at the discretion of the inspector and proceed only after the cause of the high fibre counts has been remedied.
- .2 All costs associated with the cleaning, monitoring, and disruption caused by excessive fibre levels outside the Work Area and related to the work, are to be borne by the Asbestos Contractor including but not limited to:
  - .1 thorough cleaning with wet wiping and HEPA vacuuming by the Asbestos Contractor to the extent and satisfaction of the Inspector,
  - .2 all activities deemed necessary by the Inspector including area isolation, personnel relocation, additional visual inspections and air monitoring to confirm that the area has been adequately cleaned,
  - .3 disruption of plant production, office routine, and delays.

- .2 *Final Clearance Test:*

- .1 Air samples will be taken in each Type 3 asbestos removal work area using the PCM (NIOSH 7400) method.
  - .1 Air sampling will not be performed in crawl space work areas.
- .2 Final clearance tests will be performed following aggressive sampling procedures:

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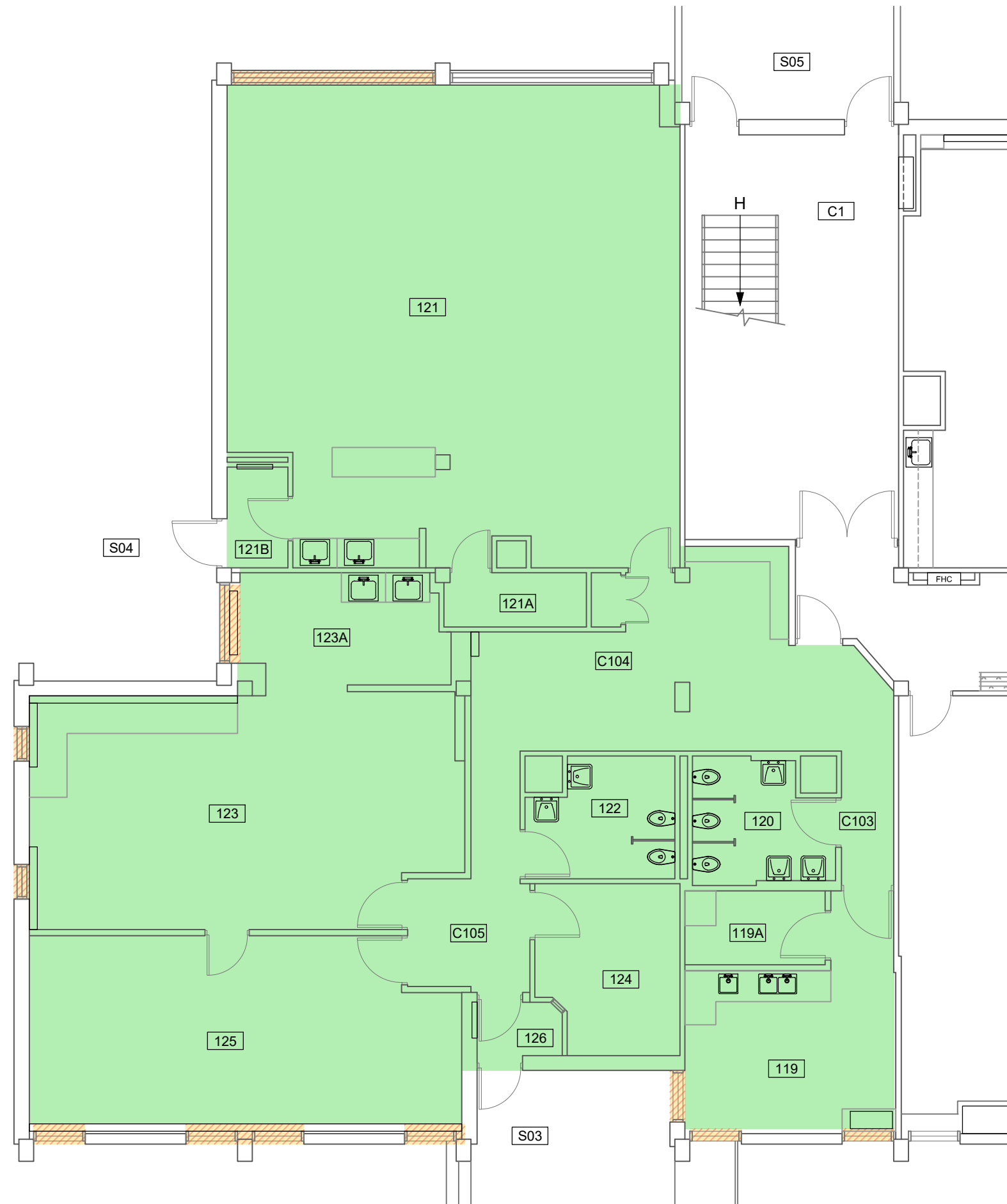
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- .1 Before starting the sampling pumps and during sampling, the exhaust from forced air equipment (1 horsepower) leaf blower) is directed against walls, ceilings, floors, ledges, and other surfaces in the area. The Contractor shall supply the leaf blower.
- .2 Prior to commencement of final air clearance testing, the contractor shall install 20-inch fans in the centre of the work area (minimum of one fan per 10,000 cubic foot of work area space). The fans shall be operated on slow speed and pointed toward the ceiling. The fans will run for the duration of the air sampling period and will be shut off when sampling is complete.
- .3 Asbestos work areas shall be declared clean only if the laboratory results show concentrations of 0.01 f/cc or less for all samples.
- .4 All costs associated with additional cleaning, monitoring, and disruption as the result of failure to pass final clearance due to visual inspection and/or air monitoring are to be borne by the Contractor including but not limited to:
  - .1 thorough cleaning with wet wiping and HEPA vacuuming by the Asbestos Contractor to the extent and satisfaction of the Inspector,
  - .2 further visual inspections and air monitoring to confirm that the area has been adequately cleaned,
  - .3 disruption of plant production, office routine, and delays.

**END OF SECTION**

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**LEGEND:**

- 121 FUNCTIONAL SPACE
- WORK AREA 1
- WORK AREA 2

**NOTES:**

**REVISIONS:**

No.	Date:	By:	Revisions

**REFERENCE:**

- 1.



Conseil Scolaire Viamonde

**ASBESTOS ABATEMENT SPECIFICATIONS**

LOCATIONS OF WORK AREAS

ÉCOLE ÉLÉMENTAIRE  
PIERRE ELLIOTT TRUDEAU

65 GRACE STREET, TORONTO, ONTARIO

FIRST FLOOR PLAN

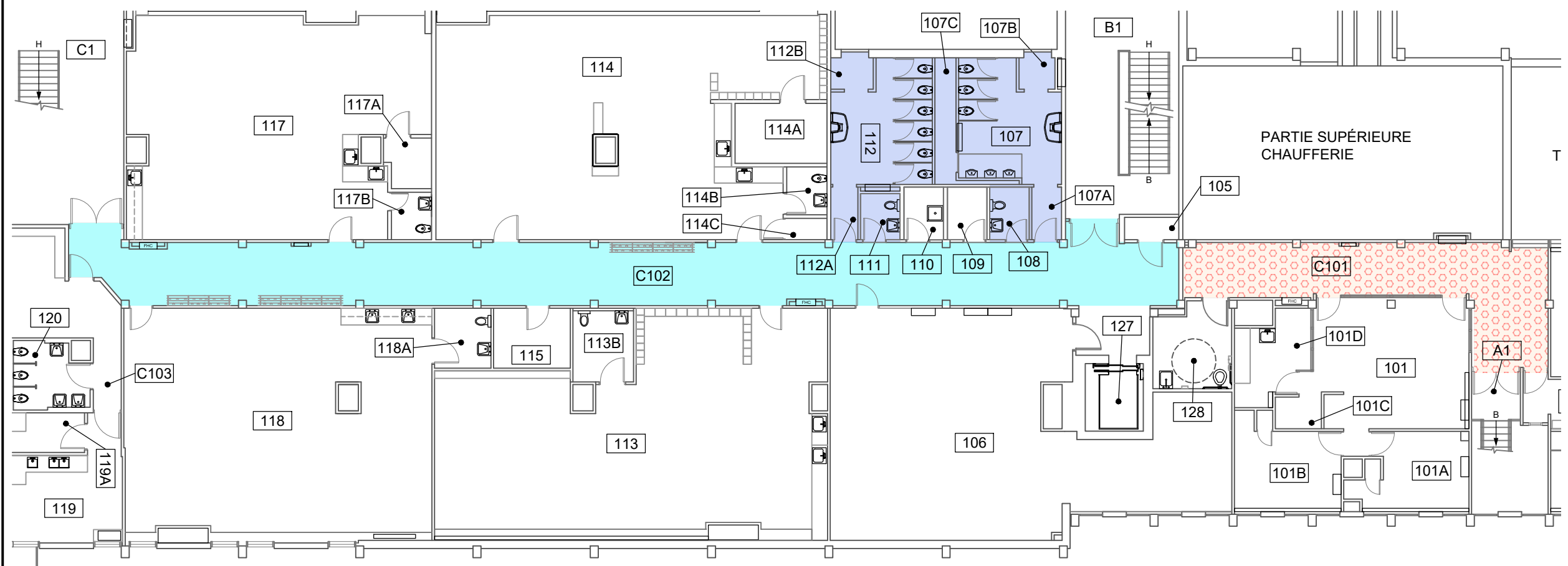
Drawn By: M K	Approved By: J.D	Project No: 30173487
Date: JULY 2024	Scale: N.T.S	Drawing No: 30173487-1

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**LEGEND:**

- 105 FUNCTIONAL SPACE
- WORK AREA 3
- WORK AREA 4
- WORK AREA 5



**NOTES:**

**REVISIONS:**

No.	Date:	By:	Revisions

**REFERENCE:**

1.



Conseil Scolaire Viamonde

**ASBESTOS ABATEMENT SPECIFICATIONS**

LOCATIONS OF WORK AREAS

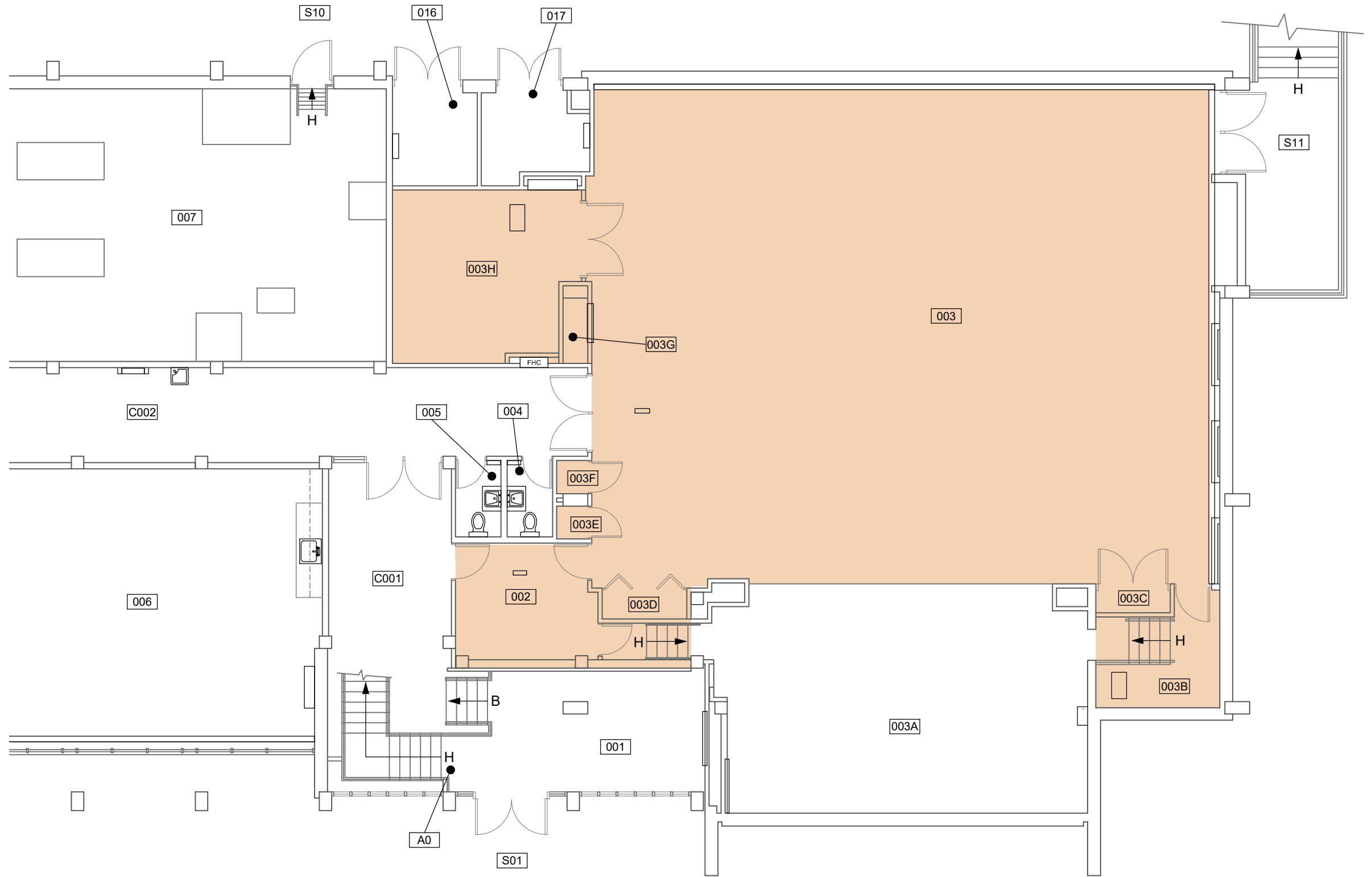
ÉCOLE ÉLÉMENTAIRE  
PIERRE ELLIOTT TRUDEAU

65 GRACE STREET, TORONTO, ONTARIO

**FIRST FLOOR PLAN**

Drawn By: M K	Approved By: J.D	Project No: 30173487
Date: JULY 2024	Scale: N.T.S	Drawing No: 30173487-2

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**LEGEND:**

- 017 FUNCTIONAL SPACE
- WORK AREA 6

**NOTES:**

**REVISIONS:**

No.	Date:	By:	Revisions

**REFERENCE:**

- 1.



Conseil Scolaire Viamonde

**ASBESTOS ABATEMENT SPECIFICATIONS**

LOCATIONS OF WORK AREAS

ÉCOLE ÉLÉMENTAIRE  
PIERRE ELLIOTT TRUDEAU

65 GRACE STREET, TORONTO, ONTARIO

**BASEMENT FLOOR PLAN**

Drawn By: M K	Approved By: J.D	Project No: 30173487
Date: JULY 2024	Scale: N.T.S	Drawing No: 30173487-3



# ARCADIS CANADA INC.

Client: \_\_\_\_\_ Project No.: \_\_\_\_\_  
Project Site: \_\_\_\_\_ Foreman: \_\_\_\_\_  
Contractor: \_\_\_\_\_ Work Area: \_\_\_\_\_

## TYPE 3 (FULL ENCLOSURE) ASBESTOS ABATEMENT PRE-CONTAMINATION INSPECTION CHECKLIST

### Type 3 Asbestos Abatement Classifications:

- Removing/disturbing of more than 1 m<sup>2</sup> of friable asbestos-containing materials
- Spray application of sealant to friable asbestos-containing materials
- Removing/cleaning air handling equipment in a building with sprayed fireproofing
- Removing/disturbing kiln, metallurgical furnace or similar structure with refractory materials
- Removing non-friable asbestos materials using power tools not equipped with HEPA filters
- Repair/alter/demolish a building which asbestos was used in the manufacture of products

### Before Beginning Asbestos Abatement Work:

- All documentation and pre-work submittals in place
  - Bonding (if applicable)
  - Insurance documentation (naming ARCADIS and Owner as co-insured)
  - Names/Phone numbers of Contractor Representatives for emergencies
  - Permits for transport and disposal of asbestos waste
  - Material Safety Data Sheets
  - Names and statement of experience for supervisory personnel
  - Contractor schedule
  - Notice of Project (NOP)
  - Confirmation of electrical lock-out in work area and of any electrical inspections
  - Evidence of proper construction and inspection of GFI panel by a licensed electrician.
  - Written *Fire Safety Plan*.
  - Documentation of pre-construction site condition (if required)
  - Proof of asbestos abatement training
- Notice of Project (NOP) posted
- Warning signs posted
- Work area and decontamination enclosures segregated from rest of building
- Points of entry secure including neg-air exhaust location(s)
- Independent isolation of all electrical equipment and openings including windows, doors, temporary partitions, etc.
- Adequate protection applied to all equipment and other components within work area
- Mechanical ventilation systems locked out and isolated
- Adequate neg-air units, including back-ups installed, and Integrity-tested on site
- Negative air units exhausting outside of building
- Negative air pressure differential in place (minimum 0.02 inch water gauge)
- Manometer in place, alarm and recorder functioning
- Emergency lighting in place and plugged into electrical outlets
- Work area lighting adequate
- All electrical equipment, including shower sump pump inside work area ground fault protected
- Tools, equipment, materials and waste receptors on hand
- All workers familiar with PPE, decontamination procedures, equipment and evacuation routes
- Airless sprayer functioning, and tested with approved amended water in-line
- Shower functioning and tested for pressure, filtered drainage, separate hot/cold water, or mixed water (40°C to 50°C)
- All shower accessories (soap, shampoo, mirrors etc.) in place
- Upper seals complete (if required)
- HEPA vacuums - Integrity-tested within last 3 months

**Note:** All above items must be checked off or marked n/a (not applicable)

### COMMENTS / AUTHORIZATION

This authorization does not in any way replace the contract requirements as detailed in the Specifications, Scope of Work, Regulations, or on-site direction given by the Arcadis Inspector.

DATE: \_\_\_\_\_ ARCADIS INSPECTOR SIGNATURE: \_\_\_\_\_

# ARCADIS CANADA INC.

Client: \_\_\_\_\_ Project No.: \_\_\_\_\_  
Project Site: \_\_\_\_\_ Foreman: \_\_\_\_\_  
Contractor: \_\_\_\_\_ Work Area: \_\_\_\_\_

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## TYPE 3 (FULL ENCLOSURE) ASBESTOS ABATEMENT DAILY PROCEDURES CHECKLIST

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- All warning signs posted
- Decontamination and work area enclosures kept in tidy condition
- Shower unit properly drained and clean
- Adequate hot water for shower
- Adequate shower accessories
- All polyethylene barriers and linings sealed and taped
- Minimum negative pressure maintained
- Neg-air primary filters replaced regularly
- Neg-air exhausts to each side secure
- Manometer alarm and tape read-out functioning
- ACM applications wet and promptly bagged into labelled containers
- Personal Protective Equipment being used properly
- Decontamination of personnel and equipment executed properly
- Perimeter inspections being carried out
- Adequate labour, supervisors, materials and equipment available on site
- Access to work area secure
- Adequate lighting maintained
- Emergency lighting operational

### Waste Disposal

- Proper signage applied to truck/waste skip
- Waste bin secured/locked

**Note:** All above items must be checked off or marked n/a (not applicable)

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### COMMENTS / AUTHORIZATION

This authorization does not in any way replace the contract requirements as detailed in the Specifications, Scope of Work, Regulations, or on-site direction given by the Arcadis Inspector.

DATE: \_\_\_\_\_ ARCADIS INSPECTOR SIGNATURE: \_\_\_\_\_

# ARCADIS CANADA INC.

Client: \_\_\_\_\_ Project No.: \_\_\_\_\_  
Project Site: \_\_\_\_\_ Foreman: \_\_\_\_\_  
Contractor: \_\_\_\_\_ Work Area: \_\_\_\_\_

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## TYPE 3 (FULL ENCLOSURE) ASBESTOS ABATEMENT FINAL VISUAL INSPECTION CHECKLIST

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**Final Visual Inspection Checklist**

Surfaces shall be accepted as clean when there is no visible residue, dirt, dust, film, stain or discolouration on all surfaces within the work area including but not limited to piping, tanks, ducts, conduits, mechanical and electrical items, wiring, cracks, crevices, joints, etc., resulting either from asbestos removal procedures or from cleaning procedures.

Cleaning and inspection shall be repeated at the Contractor's expense if the area does not meet the above criteria and is declared unclean.

- All waste bags removed from area
- All surfaces and equipment clean including neg-air units, scaffolding, ladders, vacuum attachments, etc.
- All tools bagged or decontaminated and removed from area
- Glue and application equipment available and operational
- Remaining non-acm thermal insulation applications protected and clean (if present)

**Note:** All above items must be checked off or marked n/a (not applicable)

---

### COMMENTS / AUTHORIZATION

**This authorization does not in any way replace the contract requirements as detailed in the Specifications, Scope of Work, Regulations, or on-site direction given by the Arcadis Inspector.**

**DATE:** \_\_\_\_\_ **ARCADIS INSPECTOR SIGNATURE:** \_\_\_\_\_

# ARCADIS CANADA INC.

Client: \_\_\_\_\_ Project No.: \_\_\_\_\_  
Project Site: \_\_\_\_\_ Foreman: \_\_\_\_\_  
Contractor: \_\_\_\_\_ Work Area: \_\_\_\_\_

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## TYPE 3 (FULL ENCLOSURE) ASBESTOS ABATEMENT FINAL CLEARANCE TEST CHECKLIST

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### Post-Sealant Application Inspection Checklist

- Sealant application visually confirmed (surfaces tacky)
  - Polyethylene from walls and floors (not forming part of seal) removed and disposed
  - All surfaces and equipment clean
  - Minimum sealant settling time elapsed
- 

### PCM Final Clearance Test

- Two air samples taken inside the enclosure of an area of 10 m<sup>2</sup> (108 ft<sup>2</sup>) or less
- Three air samples taken inside the enclosure of an area of 10 m<sup>2</sup> (108 ft<sup>2</sup>) to 500 m<sup>2</sup> (5382 ft<sup>2</sup>)
- Five air samples taken inside the enclosure of an area of 500 m<sup>2</sup> (5382 ft<sup>2</sup>) or more
- Forced air used inside enclosure before and during air sampling
- Fan (20") in the centre of the enclosure pointed upwards towards the ceiling on low (1 fan for every 20,000 ft<sup>3</sup> of room space required.)
- Each air sample collected for a volume of at least 2400 L
- Final air sample analysis pass pre-determined criteria
- Final air sample analysis failed pre-determined criteria
- Air sampling results posted following receipt of the results.

### TEM Final Clearance Test

- Five air samples taken inside of the enclosure
- Five air samples taken outside of the enclosure
- Forced air used inside enclosure before and during air sampling
- Fan (20") in the centre of the enclosure pointed upwards towards the ceiling on low (1 fan for every 20,000 ft<sup>3</sup> of room space required.)
- Each air sample collected for a volume of at least 2400 L
- Final air sample analysis pass pre-determined criteria
- Final air sample analysis failed pre-determined criteria
- Air sampling results posted following receipt of the results.

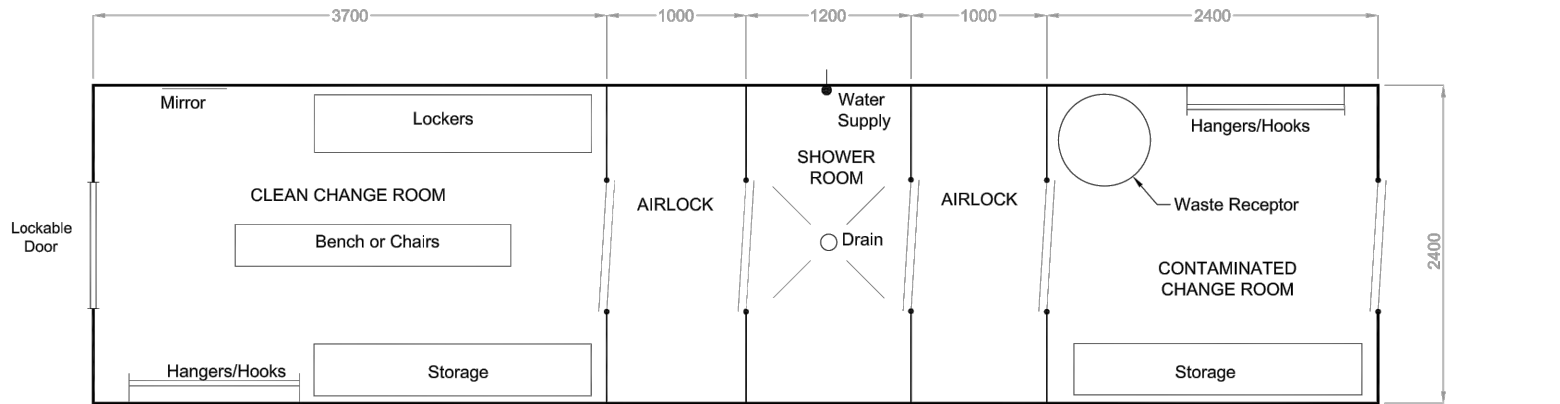
**Note:** All above items must be checked off or marked n/a (not applicable)

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### COMMENTS / AUTHORIZATION

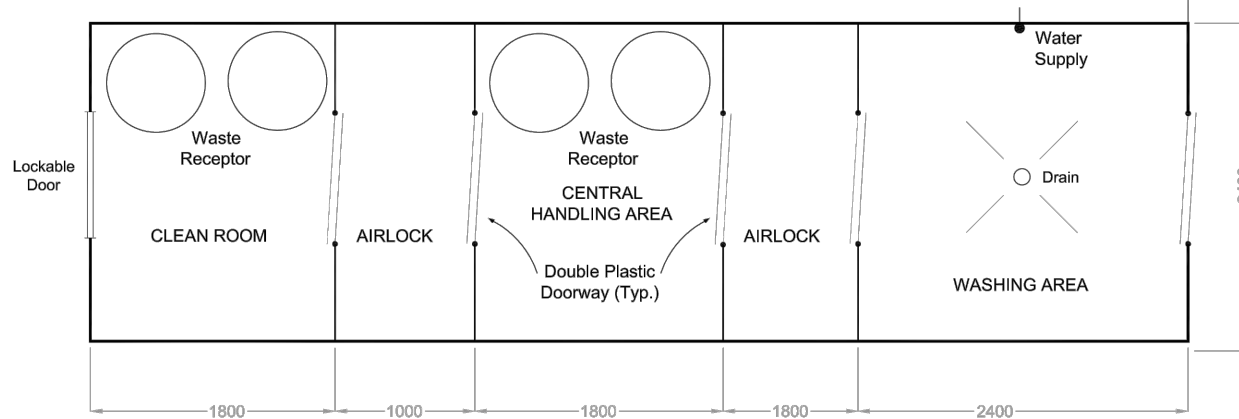
This authorization does not in any way replace the contract requirements as detailed in the Specifications, Scope of Work, Regulations, or on-site direction given by the Arcadis Inspector.

DATE: \_\_\_\_\_ ARCADIS INSPECTOR SIGNATURE: \_\_\_\_\_



WORKERS DECONTAMINATION ENCLOSURE SYSTEM

CONTAMINATED AREA



WASTE AND EQUIPMENT DECONTAMINATION ENCLOSURE SYSTEM



TYPICAL DECONTAMINATION ENCLOSURES

DIMENSIONS PROVIDED ARE FOR TYPICAL INSTALLATIONS AND MAY VARY SUBJECT TO THE PROPERTY SIZE AND AVAILABLE SPACE WITH THE APPROVAL OF THE INSPECTOR

**ASBESTOS ABATEMENT  
ELECTRICIAN'S SUBMITTAL FORM**

Abatement Contractor \_\_\_\_\_

Project Site \_\_\_\_\_

I hereby certify the following:

1. All electrical work has been performed by a licensed electrician and complies with the latest edition of the Ontario Electrical Safety Code and any other local codes and requirements.
2. Arrangements have been made for all inspections and approvals which may be required by government regulations, Electrical Safety Authority and any other authorities having jurisdiction.
3. The GFI panel has been properly constructed, inspected and installed by a licensed electrician in compliance to all regulatory requirements and codes.
4. All electrical circuits in the work area have been de-energized and locked out wherever practicable.
5. All systems that cannot be de-energized have been clearly identified.
6. Any electrical conditions which need special protection or consideration have been clearly identified.

Electrical Contractor \_\_\_\_\_

Electrician's Name (print) \_\_\_\_\_

Electrician's Signature \_\_\_\_\_

Electrician's License No. \_\_\_\_\_

Date \_\_\_\_\_

## 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
- .5 Section 32 16 23 Sidewalks

### 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 O86-14 Engineering Design in Wood
  - .4 CSA O121-2017 Douglas Fir Plywood
  - .5 CSA O141-05 (R2019) Softwood Lumber
  - .6 CSA S269.1-16 Falsework and Formwork

### 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 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 Consultant will review and return submitted drawings in accordance with an agreed schedule. Consultant's review will be for conformity to design concept and for general arrangement and shall not relieve Contractor of responsibility for errors or omissions in submitted drawings or of responsibility for meeting requirements of Contract Documents.

- .8 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.
  - .9 Do not commence placing sleeves, conduits, or piping before drawings have been reviewed and Consultant's comments incorporated on drawings issued to site.
  - .10 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 Joint Tape: non-staining, water impermeable, self-release.
- .7 Nails, Spikes and Staples: Galvanized, conforming to CSA B111.
- .8 Dovetail Anchor Slots: As specified in Section 04 05 19.
- .9 Form Release Agent: Colourless mineral oil which will not stain concrete.
- .10 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 Adequately brace and shore formwork to sustain loads (both concrete and working loads) applied during construction.
- .7 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 05 50 00 Metal Fabrications
- .5 Section 32 16 23 Sidewalks

### 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-18a 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 A23.3-14 Design of Concrete Structures
  - .3 CSA G30.18-09 (R2014) Carbon Steel Bars for Concrete Reinforcement
  - .4 CSA G40.20-13/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
  - .5 CSA W186-M1990 (R2012) 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 05 31 00 Steel Deck
- .5 Section 05 50 00 Metal Fabrications
- .6 Section 07 92 00 Joint Sealants
- .7 Section 10 80 00 Miscellaneous Specialties
- .8 Section 32 16 13 Concrete Curbs
- .9 Section 32 16 23 Sidewalks

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C260/C260M-10a (2016) Standard Specification for Air Entraining Admixtures for Concrete
  - .2 ASTM C295/C295M-19 Standard Guide for Petrographic Examination of Aggregates for Concrete
  - .3 ASTM C309-19 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete
  - .4 ASTM C330/C330M-17a Standard Specification for Lightweight Aggregates for Structural Concrete
  - .5 ASTM C494/C494M-19 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 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  - .10 ASTM D570-98(2018) 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 D638-14 Standard Test Method for Tensile Properties of Plastics
  - .13 ASTM D1259-06(2018) Standard Test Methods for Nonvolatile Content of Resin Solutions
  - .14 ASTM D1751-18 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
  - .15 ASTM D2240-15e1 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.

#### 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 Difference between elevation of high point and low point in specified area not to exceed:
  - .1 In any bay up to 100 m<sup>2</sup>: 12 mm.
  - .2 In any bay up to 400 m<sup>2</sup>: 25 mm.
- .3 Straightedge method: Finish floor slabs to meet following tolerances when measured at 72 +/- 12 hours after completion of floor finishing, before shores are removed from formed slabs, by placing a freestanding unlevelled straight edge anywhere on slab and allowing it to rest on two high points. Gap between straightedge placed on two high points and slab not to exceed:
  - .1 3 metre straightedge: 8 mm (Class A).
  - .2 2 metre straightedge: 4 mm.

#### 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 Admixtures:
  - .1 Conform to Reference Standards for chemical and air-entraining admixtures.
  - .2 Provide only admixtures that are free of chlorides.
  - .3 When requested, provide evidence acceptable to Consultant that superplasticizer does not increase shrinkage of concrete.
- .6 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
- .7 Bonding Agent: To ASTM C881, 100% reactive, 2 component, low viscosity, high modulus bonding adhesive.
- .8 Non-Metallic Hardener: Natural and synthetic materials with Mohs hardness 7 minimum, premixed with Portland cement.
  - .1 Basis-of-Design Product: Subject to compliance with requirements, provide Euclid Chemical Company; Surfex. or a comparable product by one of the following:
    - .1 BASF Corporation - Construction Systems.
    - .2 Sika Corporation
- .9 Non-Oxidizing Metallic Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of Portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
  - .1 Basis-of-Design Product: Subject to compliance with requirements, provide Euclid Chemical Company; EUCO-PLATE H.D. or a comparable product by one of the following:
    - .1 BASF Corporation - Construction Systems.
    - .2 Sika Corporation
- .10 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.
- .11 Premoulded Joint Fillers: Bituminous impregnated fiber board: to ASTM D1751.
- .12 Sealant: Refer to Section 07 92 00 – Joint Sealants
- .13 Mechanical Anchors: 'Kwik' Bolts, 'Cinch' Anchors or Parabolts.
- .14 Weep hole tubes: plastic.
- .15 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.

## 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 C-2 with 25 percent Portland cement replaced with cementitious hydraulic slag: for pavements, sidewalks, curbs and gutters.
  - .2 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.
  - .3 Slabs-on-Grade:
    - .1 Use type 20 Portland cement, or replace 35 percent type 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.
  - .4 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.

## 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 Hardened Floor Finish:
    - .1 Apply premixed material to total of 7.5 kg/m<sup>2</sup> of floor surface.
    - .2 Apply in two shakes, of half total specified amount in each shake; the second shake at right angles to the first.
    - .3 Follow manufacturer's special finishing instructions if concrete is air entrained.

3.5 Curing



- .1 Cure concrete in accordance with CSA A23.1 and as specified herein.
- .2 Curing Compound Method:
  - .1 Use curing and sealing compound specified except:
    - .1 On surfaces to receive epoxy or similar paint finish.
    - .2 On surfaces to which architectural finishes will be adhered, the adhesives for which are incompatible with the curing compound.
    - .3 Air-entrained concrete for exterior slabs and sidewalks placed between October 1<sup>st</sup> and March 31<sup>st</sup>.
  - .3 Select acrylic water compound except that if ambient conditions extend drying time unduly and if area is well ventilated and unoccupied by other workers, solvent based compound may be used.
  - .4 Apply curing compound in accordance with manufacturer's instructions, increasing application rate as necessary to cover surface completely.
  - .5 Curing Blanket or Wet Burlap Method: For exterior sidewalks and other finished concrete surfaces that will be exposed to freezing and thawing or deicing chemicals:
    - .1 Cover with curing blanket or wet burlap overlaid with 0.102 mm thick polyethylene and maintain in place for the additional curing for durability period in accordance with CSA A23.1 but in no case for less than 7 days.
    - .2 Wet blanket or burlap regularly to maintain in moist condition. Do not allow to dry out.
  - .6 Cure finished concrete surface with an approved curing and sealing compound which will leave the surface with a uniform appearance and with a minimum of discolouration after drying. Ensure that the curing compound will be compatible with the architectural finishes or adhesives for finishes to be applied later. Apply the compound in strict accordance with the manufacturer's instructions.
  - .7 Protect surface which will be exposed to direct sunlight during the curing period, with a light coloured, laminated waterproof paper immediately after the curing and sealing compound has hardened sufficiently for the paper to be placed without damage to the sealed surface. Lap the paper a minimum of 100 mm and seal the laps. Leave the paper in place for at least seven days.
- 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 03 30 00 Cast-in-Place Concrete

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C779/C779M-19 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
- .2 CSA Group (CSA)
  - .1 CSA-A23.1:19/ CSA-A23.2:19 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete.
- .3 American Concrete Institute (ACI)
  - .1 ACI 308 Standard Specification for Curing Concrete
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1113-96 Architectural Coatings.
  - .2 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 product data and application instructions for concrete floor treatments.

### 1.5 Performance Requirements

- .1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

### 1.6 Environmental Requirements

- .1 Temperature: Maintain ambient temperature of not less than 10°C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .2 Work area: Make the work area watertight protected against rain and detrimental weather conditions.
- .3 Moisture: Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .4 Ventilation:
  - .1 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
  - .2 Provide continuous ventilation during and after coating application.

### 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.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal.
- .4 Dispose of surplus chemical and finishing materials in accordance with federal, provincial and municipal regulations.

### PART 2 PRODUCTS

#### 2.1 Sealing Compounds

- .1 Surface sealers may not be formulated with aromatic solvents, mercury, formaldehyde halogenated solvents, lead, cadmium, hexavalent chromium and their compounds.
- .2 Liquid densifier/sealer: VOC Compliant, high performance, deep penetrating concrete densifier; an odourless, colourless and non-yellowing blend of silicate and silicate designed to harden, dustproof and protect concrete floors.
- .3 Basis of Design Product: Euco Diamond Hard by The Euclid Chemical Co.
  - .1 Acceptable alternate:
    - .1 Liqui- Hard by W.R. Meadows
    - .2 Sikafloor 3S by Sika Canada.
    - .3 MasterTop 333 by BASF
  - .4 Compliance:
    - .1 Maximum VOC content: 400 g/L
    - .2 VOC Content: 0 g/L.
    - .3 USDA approved.
    - .4 Ultraviolet resistant.
    - .5 Blush resistant.
    - .6 Non-yellowing.
    - .7 No odour.

#### 2.2 Mixes

- .1 Mixing, ratios and application in accordance with manufacturer's instructions.

### PART 3 EXECUTION

#### 3.1 Examination

- .1 Examine concrete surfaces to receive sealer. Notify Consultant if surfaces are not acceptable.
- .2 Do not begin surface preparation or application until unacceptable conditions are corrected.

### 3.2 Surface Preparation

- .1 Prepare concrete surfaces in accordance with manufacturer's instructions.
- .2 Cure concrete in accordance with ACI 308 and as specified in Section 03 30 00.

### 3.3 Application

- .1 Apply sealer to concrete surfaces in accordance with manufacturer's instructions.
- .2 Do not leave excess sealer residue on treated concrete surfaces. Remove excess hardened sealer.
- .3 Do not use as a curing compound.
- .4 Do not dilute sealer.
- .5 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.

### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean overspray. Clean sealant from adjacent surfaces.

### 3.5 Protection

- .1 Protect finished installation in accordance with manufacturer's instructions.
- .2 Protect horizontal surfaces from traffic until sealer has cured.

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 Multi Wythe Unit Masonry
- .2 Section 05 12 23 Structural Steel
- .3 Section 05 41 00 Structural Metal Stud Framing
- .4 Section 05 50 00 Metal Fabrications

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A153/A153M-16a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- .2 CSA Group (CSA)
  - .1 CSA A23.1-14/A23.2-14 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  - .2 CSA S304-14 Design of Masonry Structures.
  - .3 CSA A370-14 Connectors for Masonry.
  - .4 CAN/CSA A371-14 Masonry Construction for Buildings.
  - .5 CSA G30.3-M1983 (R1998) Cold-Drawn Steel Wire for Concrete Reinforcement.
  - .6 CSA G30.18-09 (R2014) Carbon Steel Bars for Concrete Reinforcement
  - .7 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 and connector 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 and connectors.
  - .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 Design Criteria

- .1 Non-conventional Masonry Connectors
  - .1 Deflection: maximum 2.0 mm, including free play when acted upon by 0.45 kN lateral load, in all possible positions of adjustment.
  - .2 Positive restraint at position of maximum adjustment.
- .2 Multi-component Ties - Free Play: Maximum 1.2 mm, when assembled in any possible configuration.

#### 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 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 Connectors: to CSA A370 and CSA S304.
  - .1 Finish: Steel components, hot dip galvanized to CAN/CSA A370.
  - .2 For steel stud/masonry veneer application; length to suit combined total wall thickness; with polyethylene insulation support where required: Side Mounting Rap Ties by Fero Corporation
  - .3 Side Mounting Rap Ties:
    - .1 Flat-Plate: Length to suit steel stud width and thickness of gypsum sheathing, membrane and insulation.
    - .2 V-Tie: Length to provide placement of legs at centerline of solid unit veneer.
    - .3 Insulation support.
  - .4 Strip Ties: Prescriptive corrugated strip tie. 100 mm x 22 mm x 0.91 mm thick corrugated tie conforming to CSA A370.
- .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 Dayton Superior Dur-O-Wall
  - .2 Hohmann and Barnard Inc.

## 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 Upon approval of Consultant, 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 A370, 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 Install masonry connectors in accordance with CSA A370, CSA A371, CSA A23.1 and CSA S304 unless indicated otherwise.
- .2 Bond walls of two or more wythes using seismic connectors and ladder type reinforcement in accordance with CSA S304, CSA A371 and as indicated.
- .3 Tie masonry veneer to backing in accordance with CSA S304, CSA A371 and as indicated herein.

### 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.

### 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 and connectors 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 and connectors which develop cracks or splits.

### 3.9 Field Touch Up

- .1 Touch up damaged and cut ends of galvanized reinforcement steel and connectors 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 04 05 19 Masonry Anchorage and Reinforcing

### 1.3 References

- .1 Canadian Concrete Masonry Producers Association (CCMPA) Quality Assurance Program.
- .2 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 D2240-15(2021) Standard Test Method for Rubber Property-Durometer Hardness
  - .5 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
- .3 American Concrete Institute (ACI)
  - .1 ACI 530.1-05/ASCE 6-05/TMS 602-05 Specification for Masonry Structures.
- .4 CSA Group (CSA)
  - .1 CSA A165 Series-14 (R2019) CSA Standards on 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

### 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 clay brick masonry units and two concrete 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 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 CAN 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.
- .7 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 Reclaimed Facebrick: Existing clay brick masonry units to be reused for patching and repair of existing exterior masonry walls shall be cleaned of all mortar materials prior to reuse. Do not use chipped, cracked or stained units. Refer to Section 02 41 19.13.
- .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 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 S. 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 'S' to ASTM C207.
  - .7 Type 'S' 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. Up to three (3) 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.

- .6 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/m<sup>3</sup>.

## 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 infill shall be erected as shown on the drawings of reclaimed brick veneer and concrete block back-up with a nominal 10 mm vert. mortar joint.
- .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 Sprayed Insulation

- .1 Apply air barriers and spray foam insulation over exterior face of concrete block inner wythe as specified in Sections 07 27 13 and 07 21 29. Do not proceed with veneer application until sprayed insulation has been inspected and approved.

### 3.6 Placement – Veneer Wythe

- .1 Use full-size clay 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 Install brick to patterns shown on the drawings.
- .4 Comply with tolerances in ACI 530.1-05/ASCE 6-05/TMS 602-05.
- .5 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.
- .6 Avoid using less-than-half-size units, particularly at corners, jambs, and where possible, at other locations.
- .7 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.
- .8 Install reclaimed facebrick at all openings to be infilled and exposed edges of existing exterior walls where indicated or required to make good damage caused by demolition and removals. Match existing construction including mortar colour.



### 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 Connectors

- .1 Refer to Section 04 05 19.

### 3.10 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.

### 3.11 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.

### 3.12 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.

### 3.13 Grouting

- .1 Grout masonry in accordance with CSA S304 and as indicated.

### 3.14 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.

### 3.15 Lateral Support and Anchorage

- .1 Refer to Section 04 05 19.

### 3.16 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.

### 3.17 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.

### 3.18 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.

### 3.19 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

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## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 41 00 Structural Metal Steel Framing
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 21 13 Building Insulation
- .4 Section 07 27 00 Vapour Permeable Air Barriers
- .5 Section 07 62 00 Metal Flashing and Trim
- .6 Section 05 50 00 Metal Fabrications.

### 1.3 References

- .1 CSA S136 - 01, section 3.1 (Design of Light Gauge Steel Structural Members).
- .2 CCMC Technical Guide for Mortarless Concrete Brick Veneer, Masterformat Number 04818, dated 2004-06-10.
- .3 National Building Code of Canada 2005, Article 9.20.6.4 Masonry Veneer Walls.
- .4 CSA Standard A165.2-94, Type I (Concrete Brick Masonry Units).
- .5 ASTM A653/A653M Standard specification for steel sheet zinc-coated (galvanized) or zinc iron alloy-coated (galvannealed) by hot-dip process.
- .6 ASTM A792/A792M Standard Specification for Aluminium and Aluminium-Alloy Sheet and Plate.
- .7 A153/A153M-04 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .8 CAN/CSA-086-01, Limit states Design of Wood Structure.
- .9 ASTM E330, Test method for structural performance of exterior windows, curtain walls and doors by uniform static air pressure difference.
- .10 ASTM E514-04, Standard Test method for water penetration and leakage through masonry.
- .11 CGSB-93GP-4M-78 Siding, soffits and fascia, steel, galvanized, pre-finished.

### 1.4 Submittals

- .1 Product Data
  - .1 CCMC Evaluation Report 12883-R
  - .2 Submit two copies of the latest product data indicating material properties, installation methods and use.
  - .3 Submit two samples of each material comprising the brick siding system. Include flashings, corner units, starter strip, door and window trim, and fasteners employed.
  - .4 Submit shop drawings in accordance with Section 01 33 00. Clearly indicate layout, typical details, and relationship of brick siding to openings, terminal points, and substrates.
  - .5 Manufacturers Installation Guide, latest edition.
  - .6 Submit laboratory tests and methods used at request of Consultant.

### 1.5 Quality Assurance

- .1 Install brick siding in strict accordance with manufacturer's installation guidelines.
- .2 Apply brick siding only to structures conforming to NBC for foundation and structural integrity, and only to a maximum height of 9.1 m (30'-0") unless an independent structural review is performed.

- .3 Reconstruct substrates exhibiting structural degradation due to wet or dry rot with new substrate materials before installing brick siding.
- .4 Installer: Company specializing in performing the work of this section with minimum two years of experience. Submit references for installer two months before installation.
- .5 Exterior dimensions to be uniform and consistent with length of brick controlled to 3 mm (1/8") from nominal length and 0.75 mm (1/32") dimensional tolerance on all other contact surfaces.

#### 1.6 Shipping, Handling and Storage

- .1 Deliver brick siding and accessories in accordance with manufacturer's technical guide, in original wrapping and bearing CCMC 12833 label on each pallet. Inspect bricks upon delivery at site and immediately inform manufacturer or dealer of any observed defects.
- .2 Handle materials in manner to prevent chipping, breaking or any damage to the job site. Store materials to avoid contamination from mud, grease or other debris prior to installation.
- .3 Protect bagged materials and brick siding units from precipitation and groundwater by covering and storage on pallets or other acceptable means.
- .4 Store materials to avoid contamination from mud, grease or other debris prior to installation.
- .5 Carefully stack and store flashings and metal trim to prevent creasing, twisting, or other damage.
- .6 Store materials close to point of assembly.

#### 1.7 Warranty

- .1 Manufacturer's Guarantee: Provide limited written guarantee for fifty years on product.
- .2 Contractor warrants work for [5] years if loss of work results from a defect in the construction or installation.

### PART 2 PRODUCTS

#### 2.1 Manufacturer

- .1 Materials in this section are based on products as manufactured by a Novabrik Producer and distributed according to the terms of licensing contracts granted by Novabrik International Inc. 1-866-678-2745 or 1-514-354-1555, Montreal, Quebec.
- .2 Provide alternate products for review prior to use.

#### 2.2 Materials

- .1 **Brick siding:** A mortarless concrete brick siding in accordance with CSA A165.2-04, Type 1, factory-moulded, smooth faced 205 mm wide x 100 mm high x 65 mm thick. Two (2) colours shall be selected by consultants from manufacturers full range of colours. Minimum average compressive strength of 25.0 MPa (3600 psi) to ASTM C140-05e1, adequate freeze-thaw protection and an average absorption rate of no more than 5%.

- .2 Furring: nominal 19 mm x 89 mm wood furring strips, SPF no.1/no.2 dry having a minimum specific gravity equal to 0.55.
- .3 Header reinforcement: 19mm exterior grade plywood as per manufacturers installation guide.
- .4 Base starter strip: 100% recycled PVC.
- .5 Corner starter strips: 100% recycled PVC.
- .6 Sheathing membranes: Vapour permeable air barrier as specified in section 07 27 00.
- .7 Cavity Insulation: Rigid insulation as specified in section 07 21 13.
- .8 Thermal clips: ASC solid stainless steel cladding Z-clips c/w 12.7mm thick thermal break pad as distributed by Soprema or approved equal.
- .9 Construction adhesive: PL Premium polyurethane construction adhesive or approved alternative.
- .10 Screw fasteners: corrosion resistant type as required per installation guidelines.
- .11 Steel sheet flashing: Hot-dip galvanized to ASTM A653/A653M, 0.053 mm (26 ga), to dimensions and profiles indicated. Incorporate allowance for adjustment to suit site conditions and tolerances. Colour: As selected by Consultant from manufacturer's standard colour range.
- .12 Bent plate corner reinforcement: Stainless steel plate as specified in section 05 50 00.

### PART 3 EXECUTION

#### 3.1 Examination

- .1 Prior to brick siding installation, examine dimensions, alignment and level of substrate supports. Notify Consultant in writing when supporting substrates do not comply with construction requirements and tolerances.
- .2 Commencement of work constitutes acceptance of substrate and anchoring points by Contractor.

#### 3.2 Preparation

- .1 Prepare walls, gable ends, around doors and windows, and corners in accordance with manufacturers Installation Guide.
- .2 Pull and mix brick from several pallets during installation to blend and assure proper colour treatment.

#### 3.3 Protection

- .1 Protect and prevent damage to exposed surfaces of existing work during transportation of materials and accessories. Provide traffic circulation routes and access for persons and materials to minimize accidents.

### 3.4 Installation

#### .1 Brick Siding Over Steel Stud Cavity Wall:

- .1 Install a vapour permeable air barrier system on the sheathing in accordance with specification section 07 27 00.
- .2 Apply a self-adhesive waterproof membrane flashing around openings, windows and doors to seal from water penetration. Ensure that adhesive flashing is adequately bonded to vapour/air barrier and in full contact with perimeter surface of opening.
- .3 Install thermal clips vertically at steel studs spaced as per manufacturer's written instructions.
- .4 Install 19mm exterior grade plywood wall base reinforcement to thermal clips using a Tek (wood to metal fastener) with a minimum of #12-24 Ø self-drilling screws. Plywood shall be installed 12.7mm above the top of foundation wall.
- .5 Install 19 mm x 89 mm vertical wood furring strips fastened to thermal clips using a Tek (wood to metal fastener) with a minimum of #12-24 Ø self-drilling screws. Screws must penetrate a minimum of 32 mm into thermal clips. Furring strip must be installed continuously to top of plywood reinforcement.
- .6 Level and fasten PVC starter strip to furring strip using Tek (wood to metal fastener) with a minimum of #12-24 Ø self-drilling screws. Screws must penetrate a minimum of 32 mm (1") into plywood base reinforcement.
- .7 Fasten first row of brick siding using one #10 x 64 mm wood screw per brick at every furring strip.
- .8 Fasten every fourth row of brick siding using one #10 x 64 mm wood screw per brick at every furring strip.

### 3.5 Door and Windows

- .1 Extend plywood header reinforcement 150 mm out from opening each side and secure according to manufacturer's fastening recommendations.
- .2 Install brick siding window sill by first fastening a horizontal furring strip down at a distance equal to the height of the sill plus 3 mm from the bottom of the opening. Check spacing with actual sill piece.
- .3 Making sure there is enough space between the window frame and horizontal furring strip, insert and set the manufacturers proprietary sill in construction adhesive and reinforce using #10 x 100 mm screws as necessary either on sides or underneath of sill. Caulk joint between window frame and top of sill. Screws must penetrate a minimum of 32 mm into structure.

### 3.6 90° or 45° Outside Corner Block

- .1 Install 19 mm x 140 mm vertical furring strips over corner while correcting out of plumb corners as the work progresses.

- .2 Install first section of metal corner strip starting 50 mm from base and fasten with selfdrilling screws at 250 mm o.c.
- .3 Slide first corner block down onto corner strip and align with first course of brick siding. Fasten block to corner strip using one self-drilling screw.
- .4 Apply construction adhesive between blocks. Install subsequent blocks to end of first corner strip, and continue in same fashion with subsequent corner strips.
- .5 Cut last corner strip and blocks to fit and secure as assembly to wall.

### 3.7 90° Outside Corner Block Joined to Dissimilar Siding

- .1 Terminate brick siding at corner or wrap around corner as indicated on drawings. Modify metal corner strip by bending or twisting if necessary.
- .2 Install J channel or moulding against brick siding and apply bead of caulk at joint.
- .3 Apply furring as necessary sized to suit application.

### 3.8 90° or 45° Inside Corner Block

- .1 Install 19 mm x 140 mm boards over corner and align the first corner block with the first course of brick siding.
- .2 Fasten each block with one #10 wood screw and apply a small amount of construction adhesive between blocks to lock them together.

### 3.9 Inside Corner with Overlapping Brick Siding

- .1 Cover corner with a self-adhesive waterproof membrane and install 19 mm x 150 mm boards over corner.
- .2 Install brick siding on one wall all the way to the corner.
- .3 While installing the adjoining wall, apply backer-rod foam up the full length of the brick wall. Cut and attach end pieces to achieve a consistent 10 mm gap.
- .4 Run bead of sealant down entire joint between the bricks.

### 3.10 Cleaning

- .1 Remove excess adhesive or sealant with solvent recommended by manufacturer.
- .2 Clean installation of debris or residue and remove unused materials and products. Leave site clear for other work.

End of Section



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## 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 21 00 Steel Joists
- .3 Section 05 31 00 Steel Deck
- .4 Section 05 41 00 Structural Metal Stud Framing
- .5 Section 05 50 00 Metal Fabrications
- .6 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International, (ASTM)
  - .1 ASTM A108-18 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
  - .2 ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - .3 ASTM A153/A153M-16a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .4 ASTM A307-14e1 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
  - .5 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .6 ASTM A1011/A1011M-18a 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-19e2 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
- .2 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 S16-14 Design of Steel Structures.
  - .4 CSA S136-07 North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2009), Update No. 2 (2010).
  - .5 CSA W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel Structures.
  - .6 CSA W48-18 Filler Metals and Allied Materials for Metal Arc Welding.
  - .7 CSA-W55.3-08 (R2013) Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .8 CSA W59-13 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 Structural Steel Painting Council
  - .1 SSPC-SP 6-91 Commercial Blast Cleaning.
- .4 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.

- .5 American Institute of Steel Construction (AISC)
  - .1 Code of Standard Practice for Steel Buildings and Bridges, Section 10, Architectural Exposed Structural Steel, latest edition.
- .6 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 American Welding Society, AWS 2.068, Welding Symbols, 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.

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- .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 Refer to Section 01 45 00 – Quality Control.
  - .2 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. Refer to Section 01 45 00 - Quality Control.
  - .3 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.
  - .4 Welding Inspectors and supervisors shall be certified by Canadian Welding Bureau to CSA W178.2, to minimum level 2 certification.

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- .5 Provide free access for inspectors to all places work is being performed, whether on site or off.
  - .6 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.
  - .7 Shop inspection shall ensure that structural steel is fabricated in accordance with the shop drawings, and the specified fabrication and welding procedures.
  - .8 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.
  - .9 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.
  - .10 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 columns, beams and girders.
    - .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.
  - .11 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.

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## 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 meet specified requirements of ASTM A307.
- .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.

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- .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.
  - .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



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## 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 05 41 00 Structural Metal Stud Framing

### 1.3 References

- .1 ASTM International, (ASTM)
  - .1 ASTM A108-18 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
  - .2 ASTM A1011/A1011M-18a 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 S16-14 Design of Steel Structures
  - .2 CSA S136-16 North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2009) Update No. 2 (2010)
  - .3 CSA W47.1-09 (R2014) 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-W59-13 Welded Steel Construction (Metal Arc Welding)
  - .6 CSA-W55.3-08 (R2013) Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings
  - .7 CSA W178.1-14 Certification of Welding Inspection Organizations
  - .8 CSA W178.2-14 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 meeting requirements of specified reference standards.
- .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-S136-07.
- .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 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.
- .2 Mark joists to indicate erection orientation when they are fabricated to special design or loading requirements.
- .3 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

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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

1.3 References

- .1 ASTM International, (ASTM)
  - .1 ASTM A653/A653M-20 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 S16-09 Design of Steel Structures
  - .2 CSA S136-07 North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2009), Update No. 2 (2010)
  - .3 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures.
  - .4 CSA W48-06 (R2011) 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 W59-03 (R2008) Welded Steel Construction (Metal Arc Welding)
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .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 S136-07 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.
- .2 Divert unused metal from landfill to metal recycling facility.
- .3 Dispose of unused paint material at official hazardous material collections site.
- .4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

### 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.
- .5 Caulking: to Section 07 92 00- Joint Sealants.
- .6 Shear studs: to CSA W59.

#### 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 04 05 19 | Masonry Anchorage and Reinforcing   |
| .2 | Section 04 81 80 | Mortarless Concrete Siding          |
| .3 | Section 07 27 00 | Vapour Permeable Air Barriers       |
| .4 | Section 05 12 23 | Structural Steel                    |
| .5 | Section 07 21 13 | Building Insulation                 |
| .6 | Section 07 26 00 | Vapour Retarders                    |
| .7 | Section 07 92 00 | Joint Sealants                      |
| .8 | Section 08 50 00 | Aluminum Doors, Windows and Screens |
| .9 | Section 09 21 16 | Gypsum Board                        |

### 1.3 References

- .1 The National Building Code of Canada.
- .2 The Ontario Building Code.
- .3 ASTM International (ASTM)
  - .1 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM A792/A792M-10 (2015) Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
  - .3 ASTM A879/A879M-12(2017) Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
  - .4 ASTM A1003/A1003M-15 Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
  - .5 ASTM C955-18e1 Standard Specification for Cold-Formed Steel Structural Framing Members
  - .6 ASTM C1007-20 Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
- .4 American National Standards Institute (ANSI)
  - .1 ANSI/AWSD1.3 Structural Welding Code-Sheet Steel.
- .5 CSA Group (CSA)
  - .1 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .2 CSA S16.1-M Limit States Design of Steel Structures.
  - .3 CSA S136-12 Cold Formed Steel Structural Members.
  - .4 CSA W47.1 Certification of Companies for Fusion Welding of Steel Structures.
  - .5 CSA W59 Welded Steel Construction (Metal-Arc Welding).
  - .6 CSA W178.1 Certification of Welding Inspection Organizations
  - .7 CSA W178.2 Certification of Welding Inspectors
- .6 Canadian General Services Board (CGSB)
  - .1 CGSB 1-GP-181M Standard for Coating, Zinc Rich, Organic Ready Mix.
- .7 Canadian Sheet Steel Building Institute (CSSBI)
  - .1 CSSBI 51-06 Lightweight Steel Framing Design Manual.
  - .2 CSSBI S6-90 Guide Specification for Lightweight Steel Framing.

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings indicating layout and details of fabrication and erection. Indicate member sizes and gauges of materials, framing, method of fastenings, spacing of all members, bridging and bracing. Indicate design loads.
- .3 Indicate all framing systems including exterior and interior framing and soffits.
- .4 Lightweight steel framing systems shall be designed by, and each shop drawing shall bear the stamp of a registered Professional Engineer licensed to practice in the Province of Ontario. Each submission of the shop drawings shall bear the seal of the Engineer.
- .5 Submit engineering design calculations or data verifying the capacity of the members and the ability of the assemblies to meet the design requirements.
- .6 Detail welded connections using standards symbols for welded joints as published in current CISC Handbook of Steel Construction.
- .7 Submit field review reports specified in Section 3.7 within 3 working days of each inspection. Reports shall be submitted directly from the Design Engineer to the Consultant.
- .8 Submit mill test reports covering chemical and mechanical properties of steel, and coating designation.
- .9 Inspection Reports: Inspection and Testing company shall:
  - .1 Submit reports at least weekly when the work of this Section is in progress.
  - .2 Distribute inspection reports as follows:
    - .1 General Contractor.
    - .2 Consultant.
    - .3 Owner.
    - .4 Lightweight Steel Framing fabricator.
  - .3 Sign report by inspector who performs inspection, describing progress of work, deficiencies observed and corrective action taken.
  - .4 Include deficiency list of outstanding items from previous reports, and comment on status.

#### 1.5 Qualifications

- .1 Contractor undertaking work of this Section shall have a minimum of 5 years of experience in lightweight steel framing.
- .2 Design of lightweight steel framing shall be by a Professional Engineer licensed in the Province of Ontario, experienced in lightweight steel framing design.
  - .1 Lightweight steel framing design engineer shall be insured against 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.
- .3 Consultant will review lightweight steel framing to verify general conformance with overall design concept of the structure.

- .4 Companies engaged in welding shall be certified by the Canadian Welding Bureau to CSA Standard W47.1. Companies shall have welding procedures approved and welders qualified for the base material types and thicknesses that are to be welded.
- .5 Undertake welding only by fabricators certified by Canadian Welding Bureau under Division 1 or 2.1. Use welders qualified for the base material types and thicknesses that are to be welded.

#### 1.6 Design

- .1 Design shall be based on Limit States Design Principles using factored loads and resistances.
- .2 Loads and load factors shall be in accordance with the National Building Code of Canada.
- .3 Resistances and resistance factors shall be determined in accordance with the National Building Code and CSA S136.
- .4 Maximum allowable deflection of metal studs under specified loads shall be  $L/600$ .
- .5 Design bridging as necessary to align members during erection, and to provide necessary structural integrity during construction and in the completed structure. Design bridging to prevent member rotation and translation perpendicular to the minor axis.
- .6 Design lintels over all openings in accordance with the National Building Code.
- .7 Design components or assemblies to accommodate specified erection tolerances.
- .8 Member spacing shall not exceed the spacing indicated on the drawings.
- .9 Allow for movement of the structure. Design wind bearing stud end connections to accommodate floor/roof deflections such that the studs are not loaded axially.
- .10 Connections between lightweight steel framing members shall be by bolts, welding or sheet metal screws.
- .11 Resistances for sheet metal screws shall be based on the manufacturer's lower bound test values multiplied by the appropriate resistance factor,  $\phi_c$ , given in CSA S136.
- .12 Provide bridging at spacing to satisfy structural requirements, but not at greater than the following: at the lesser of 1500 mm or 1/4 of span, for joists and rafters.
- .13 Neglect contribution of sheathing to restrain member rotation and translation perpendicular to the minor axis.
- .14 Design bracing system to limit lateral deflections of building components under wind or seismic load to height/500.
- .15 Use bolts, welding or sheet metal screws to make connections between lightweight framing members.
- .16 Determine sheet metal screw capacities in accordance with CSA S136.

- .17 Design top and bottom tracks to transfer joint and member loads, but not less than one gauge size thicker than the wall stud thickness.
- .18 Design connections to masonry walls to stabilize the walls and resist lateral forces due to wind and seismic forces.

#### 1.7 Protection

- .1 Provide and maintain adequate temporary bracing for all work of this Section until permanent lateral support is in place.

#### 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 Use all means necessary to protect all materials before, during and after installation and to protect the installed work and materials of other trades affected by this work.
- .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.
- .5 Store lightweight steel framing members on site, flat. Protect from contact with ground.

#### 1.9 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Metal Stud Framing

- .1 Steel to ASTM A1003 Minimum grade, Grade 'D', 50 ksi yield, galvanized Z180 coating.
- .2 Thickness, exclusive of coating: not less than 1.22 mm. Use thicker material where required by Engineered design to satisfy structural requirements. Comply with thickness tolerance requirements of CSA S136. Material thicknesses shall be greater than or equal to the specified thicknesses with underruns not to exceed the tolerance requirements of CSA S136.
  - .1 Thicknesses of framing members specified or indicated on drawings is exclusive of galvanized coating.
- .3 Stud sizes as indicated on the drawings.
- .4 Provide all necessary tracks, bridging, fasteners, hardware and other accessories as required for a complete installation.
- .5 Provide double or triple stud arrangements at locations where support of interior or exterior fixtures, fittings and accessories is required.
- .6 Zinc Rich Paint: zinc rich, organic, ready mix to CAN/CGSB 1.181. Low VOC type.

## 2.2 Fastenings

- .1 Sheet Metal Screws: self-tapping with a minimum coating thickness of 0.008 microns of zinc or cadmium. Screws shall have low profile heads where covered by sheathing.
- .2 Sheathing Screws: As specified in Section 09 21 16.
- .3 Welding Electrodes: to CSA W59, 480 mPa minimum tensile strength series.
- .4 Anchors: appropriate anchors sized to suit loads, substrate material, and edge distances, manufactured by Hilti Canada or Confast, installed as per manufacturer's recommendations.

## 2.3 Accessories

- .1 Deflections Tracks and Slide Clips: Manufacturer's standard telescoping or slotted tracks to suit design and load conditions.

## 2.4 Sheathing

- .1 As specified in Section 09 21 16 – Gypsum Board.

## PART 3 EXECUTION

### 3.1 General

- .1 Fabrication and erection shall conform to the reviewed shop drawings. Modifications required to accommodate as-built conditions (other than minor dimensional changes) shall be submitted for review.
- .2 Provide Lightweight Steel Framing systems at exterior wall locations where indicated.

### 3.2 Welding

- .1 Welds shall conform to CSA W59.
- .2 For metal less than 3.0 mm thick, shop drawings may show nominal weld leg sizes. For such material, the effective throats of welds shall not be less than the thickness of the thinnest connected part.
- .3 Touch-up welds with zinc rich paint.

### 3.3 Screws

- .1 Steel screws shall equal or exceed the minimum diameter indicated on the shop drawings.
- .2 Penetration beyond joined materials shall be not less than 3 exposed threads.

### 3.4 Fabrication

- .1 Where specified, provide cut-outs centred in the webs of members to accommodate services. Unreinforced cut-outs shall be limited to the dimensions in CSSBI 51-06. The effect of cut-outs on the strength and stiffness of the member shall be considered.

- .2 Fabrication tolerances for members shall conform CSSBI 51.
- .3 The steel thickness exclusive of coating shall be marked on each member by embossing, stamping with indelible ink or by colour coding.

### 3.5 Erection

- .1 Comply with requirements of ASTM C1007.
- .2 Lightweight steel framing shall be erected true and plumb within the specified tolerances.
- .3 Temporary bracing shall be employed wherever necessary to withstand all loads to which the structure may be subject during erection and subsequent construction. Temporary bracing shall be left in place as long as required for the safety and integrity of the structure. Ensure that during erection, a margin of safety consistent with the requirements of the National Building Code and CSA S136 exists in the uncompleted structure.
- .4 Erection Tolerances:
  - .1 For the purposes of this Section, camber is defined as the deviation from straightness of a member or any portion of a member with respect to its major axis, and sweep is defined as the deviation from straightness of a member or any portion of a member with respect to its minor axis.
  - .2 For axial load bearing studs, out of plumbness and out of straightness (camber and sweep) shall not exceed 1/1000th of the member length.
  - .3 For wind bearing studs, out of plumbness shall not exceed 1/500th of the member length.
  - .4 For track, camber shall not exceed 1/1000th of the member length.
  - .5 Studs shall seat into top and bottom tracks. The gap between the end of the stud and the web of the track shall not exceed 1.6mm for axial load bearing studs or 5 mm for wind bearing studs.
  - .6 Spacing of studs shall not be more than 3.0mm from the design spacing. The cumulative error in spacing shall not exceed the requirements of the finishing materials.
- .5 Make all field measurements necessary to insure the proper fit of all members.
- .6 Cutting of members may be by saw or shear. Torch cutting is not permitted.
- .7 All axially loaded members shall be aligned vertically to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections.
- .8 Completed bearing shall be maintained under tracks to provide for load transfer in axially loaded assemblies. Any discrepancy shall be brought to the attention of the Consultant.
- .9 Holes that are field cut into lightweight steel framing members shall conform to the requirements of CSSBI 51.
- .10 Splicing of axial load bearing members is not permitted.
- .11 Insulation shall be placed in all jamb and header assemblies that will be inaccessible after their installation into the wall. Ensure that insulation is kept dry and not compressed. Use fibrous fill insulation as specified under Section 07 21 13.

- .12 Handling and lifting of prefabricated panels shall not cause permanent distortion to any member or collateral material.
- .13 Thoroughly inspect installation prior to application of covering materials and touch up all scratched or otherwise damaged surfaces with a heavy coating of zinc rich paint.

### 3.6 Sheathing

- .1 Water resistant gypsum sheathing shall be installed horizontally on all walls. Refer to Section 09 21 16.

### 3.7 Inspection

- .1 The lightweight steel framing Design Engineer, responsible for the production of the shop drawings, shall provide periodic field review during construction and shall submit reports in accordance with Section 1.4.
  - .1 The cost of this field review shall be paid for by the Contractor.
- .2 Additional inspection and testing of materials and workmanship shall be carried out by a qualified Independent Inspection Agency appointed by the Consultant.
  - .1 The cost of this additional inspection shall be paid for out of the Cash Allowances for Inspection and Testing.
  - .2 Any testing or inspection required by the Consultant because of an error by the Contractor or due to departure from the contract documents by the Contractor, shall be paid for by the Contractor.
  - .3 Inspection shall include:
    - .1 Checking that mill test reports are properly correlated to materials.
    - .2 Sampling fabrication and erection procedures for general conformity to the requirements of the specification.
    - .3 Checking that the welding conforms to the requirements of this specification.
    - .4 Checking fabricated members against specified member shapes.
    - .5 Visual inspection of all welded connections including sample checking of joint preparation and fit-up.
    - .6 Sample checking of screwed and bolted joints.
    - .7 Sample checking that tolerances are not exceeded during fit-up or erection.
    - .8 Additional inspection and testing of welded connections as required by CSA W59.
    - .9 General inspection of field cutting and alterations required by other trades.
    - .10 Submission of reports to the Consultant, the Contractor and the authorities having jurisdiction covering the work inspected with details of deficiencies discovered.
  - .4 Provide the necessary cooperation to ensure that the inspection can proceed.
  - .5 The inspection provided in this section does not relieve the Contractor of his responsibility for the performance of the contract. The Contractor is solely responsible for quality control and he shall implement his own supervisory and quality control procedures.
  - .6 Materials or workmanship not conforming to the requirements of the contract documents may be rejected at any time during the progress or work.

### 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 04 05 19 Masonry Anchorage and Reinforcing
- .3 Section 04 81 80 Mortarless Concrete Siding
- .4 Section 05 12 23 Structural Steel
- .5 Section 05 31 00 Steel Deck
- .6 Section 05 41 00 Structural Metal Stud Framing
- .7 Section 06 10 00 Rough Carpentry
- .8 Section 06 20 00 Finish Carpentry
- .9 Section 09 21 23 Interior Painting

### 1.3 References

- .1 The Ontario Building Code.
  - .1 MMAH Supplementary Standard SB-8, September 14, 2012. Design, Construction and Installation of Anchorage Systems for Fixed Access Ladders.
- .2 ASTM International (ASTM)
  - .1 ASTM A53/A53M-20 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-16a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .4 ASTM A240/A240M-20 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  - .5 ASTM A264-12(2019) Standard Specification for Stainless Chromium-Nickel Steel-Clad Plate
  - .6 ASTM A269/A269M-15a (2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - .7 ASTM A276/A276M-20 Standard Specification for Stainless Steel Bars and Shapes
  - .8 ASTM A307-14e1 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - .9 ASTM A312/A312M-19 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
  - .10 ASTM A380/A380M-17 Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
  - .11 ASTM A385/A385M-20 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
  - .12 ASTM A511/A511M-20 Standard Specification for Seamless Stainless Steel Mechanical Tubing and Hollow Bar
  - .13 ASTM A1008/A1008M-20 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
  - .14 ASTM A1011/A1011M-18a 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
  - .15 ASTM C1107/C1107M-20 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

- .16 ASTM D1187/D1187M-97(2018) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- .17 ASTM D6386-16a Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
- .18 ASTM F593-17 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- .19 ASTM F594-09(2020) Standard Specification for Stainless Steel Nuts
- .20 ASTM F3125/F3125M-19e2 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
- .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.
- .7 American Welding Society AWS D1.6, Structural Welding Code - Stainless 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.
- .3 Submit duplicate minimum 300 x 300 mm samples of stainless steel materials in specified finish.

#### 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, landing and ladder 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 Design service access ladders, stairs and guards to Ministry of Labour requirements.
- .4 All access ladders shall be designed to the minimum requirements noted on the drawings and MMAH Supplementary Standard SB-8, whichever is more stringent. This shall include through-bolting anchors at masonry walls.
- .5 Except where specified otherwise, and where required by applicable codes, detail and fabricate stairs to NAAMM Metal Stairs Manual.
- .6 Design trench drain grates and frame assemblies, in accordance with OBC loading requirements for vehicular traffic.

#### 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.
- .4 Protect architecturally exposed materials during fabrication, delivery, handling, storage and erection to prevent marring of surfaces exposed to view, by marking, bending, denting or coarse grinding.

#### 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 Stainless Steel

- .1 Stainless steel shall be grade and type designated below for each form required:
  - .1 Plate ASTM A264 Type 316L
  - .2 Bar Stock ASTM A276 Type 316L
  - .3 Tubing ASTM A511 Type 316L
  - .4 Pipe ASTM A312 Type 316L
  - .5 Sheet ASTM A167 Type 316L
  - .6 Tubing ASTM A269 Type 316L
  - .7 Bolts ASTM A593 Type 316L
  - .8 Nuts ASTM A594 Type 316L
  - .9 Pickle and passivate stainless steel prior to fabrication and installation to remove any latent black steel to ASTM A380.
- .2 Stainless Steel Bolts and Nuts: To ASTM F593 and ASTM F594

## 2.3 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 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.
- .5 Stainless Steel: NAAMM AMP-504 Finish No. 4.

### 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 and AWS D1.6 for stainless steel. 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 Bollards

- .1 Steel pipe bollards schedule 40 standard weight, steel pipe of size shown, complete with anchors and sleeves, install plumb and free of defects detrimental to appearance and performance. Bollards shall be one piece construction no welds allowed.
- .2 Concrete supplied and installed under the works of Section 03 30 00.
- .3 Finish: prime painted except where cast into concrete.

### 3.5 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 Fabricate units from slotted channel framing where indicated.
  - .2 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.

### 3.6 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.

### 3.7 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.

### 3.8 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.

### 3.9 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.

### 3.10 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.

### 3.11 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.

### 3.12 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean exposed prefinished and plated items and items fabricated from stainless steel as recommended by the metal manufacturer and protect from damage until Substantial Performance of the project.

End of Section

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## 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 81 80 Mortarless Concrete Siding
- .4 Section 05 41 00 Structural Metal Stud Framing
- .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 Roofing
- .10 Section 08 11 00 Metal Doors and Frames
- .11 Section 08 50 00 Aluminum Doors, Windows and Screens

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - .2 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .3 ASTM D2559 - 12a(2018) Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions
  - .4 ASTM F1667 – 18a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .2 CSA Group (CSA)
  - .1 CSA A247- M86 (R1996) Insulating Fiberboard.
  - .2 CSA B111-1974(R2003) Wire Nails, Spikes and Staples.
  - .3 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .4 CSA O80 SERIES-15 Wood Preservation
  - .5 CSA O86-14 Engineering Design in Wood
  - .6 CSA O121-17 Douglas Fir Plywood.
  - .7 CSA O141-05 (R2014) Softwood Lumber
  - .8 CSA O151-17 Canadian Softwood Plywood
  - .9 CSA O437 Series-93 (R2011) Standards on OSB and Waferboard
  - .10 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, Latest Edition.
- .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 When required by authorities having jurisdiction, submit sequential erection drawings indicating all necessary false work, temporary construction bracing and hoisting.
- .3 Submit shop drawings for wood trusses stamped and signed by a Professional Engineer registered in the Province of Ontario. Include statement that manufactured wood trusses and beams are designed in accordance with the referenced standards.
- .4 Certified Wood:
  - .1 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.
- .2 Certified Wood: submit listing of wood products and materials used in accordance with CSA Z809 or FSC or SFI.
- .3 Design of wood roof structural system including wood trusses and stick framed roof members (rafters, joists, ties etc.) and design of wood stairs shall be in accordance with the Ontario Building Code and CSA 086. Design loads shall be as required by the Ontario Building Code, the National Building Code Supplement and as indicated on the drawings.
- .4 Design roof framing connections to resist uplift loads required by the referenced standards
- .5 Provide Independent Specialty Engineer's letters of review and sign-off letters as specified in Section 01 78 00 for pre-engineered roof trusses and engineered lumber.

#### 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 Poplar Plywood: to CSA 0153, standard construction.
  - .4 Mat formed structural panel board (oriented strand board): to CSA O437.0, 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 Nailing Discs: flat caps, minimum 25 mm diameter, minimum 0,627 mm thick, sheet metal, formed to prevent dishing.
- .9 Sealant: 'Mono' as manufactured by Tremco Manufacturing Ltd. or equivalent by Dow-Corning.
- .10 Wood Preservative to CSA O80 SERIES.
- .11 Adhesive: Contractors gun grade cartridge loaded wood adhesive, general purpose, to ASTM D2559.
- .12 Building Paper: to CAN2-51.32-M, 15# asphalt impregnated paper.
- .13 Vapour Retardant: 0.152 mm polyethylene film to CGSB 51.34 Type 1.
- .14 Fibreglass Insulation: to CSA A101, loose batt type, minimum density of 24 kg/m<sup>3</sup>.
- .15 Galvanizing: to CSA-G164. Use galvanized fasteners, and hardware for exterior work, preservative treated lumber, and materials in contact with concrete or masonry.
- .16 Fire Retardant Treatment
  - .1 Arch Wood Protection, Inc., "Dricon FRT" or equal by Chemical Specialties, Inc., "D-Blaze", Hoover Treated Wood Products "Pyro-Guard" or Osmose Wood Preserving Co., Inc. "FirePRO" interior Type A fire-retardant wood treatment.

- .2 Pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 (lumber) and C27 (Plywood), respectively, for treatment type indicated; identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction.
  - .1 Treated materials shall meet FR-S ratings of not more than 25 for flame spread, smoke developed and fuel contributed when tested in accordance with UL 723 or ASTM E84, with no increase in flame spread and evidence of significant progressive combustion upon continuation of test for additional 30 minutes.
  - .2 No increase in above ratings when subjected to standard ASTM D2898 rain test.
  - .3 For interior locations use fire-retardant chemical formulation that produces "Interior Type A" treated lumber and plywood with the following properties under conditions present after installation:
    - .1 No reduction takes place in bending strength, stiffness and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
    - .2 No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
    - .3 No corrosion of metal fasteners results from their contact with treated wood.
  - .4 Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.
  - .5 Kiln-dry all lumber and plywood materials after treatment to maximum 15% moisture content.

### 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 Erection of Framing Members
  - .1 Install members true to line, levels and elevations. Space framing members and frame all openings as detailed on the drawings.
  - .2 Construct continuous members from pieces of longest practical length.
  - .3 Install spanning members with crown edge up.
  - .4 Anchor wood framing to supporting walls with galvanized metal strap ties.
- .4 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.

.5 Electrical Equipment Backboard: provide backboards for mounting electrical equipment as indicated. Use 19 mm thick fir face veneer fire retardant softwood plywood on 19 mm x 38 mm furring around perimeter and at maximum of 305 mm intermediate spacing.

.1 Install plywood backboards with countersunk screws.

.6 Blocking: Provide solid wood backing to support equipment and fixtures as required.

.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

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## 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 E1333-14 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emissions Rates from Wood Products Using a Large Chamber.
  - .2 ASTM F1667-18a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .2 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
- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Quality Standards Illustrated.
- .4 Canadian Plywood Association (CanPly)
  - .1 The Plywood Handbook 2005.
- .5 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 O141-05 (R2014) Softwood Lumber
  - .6 CSA O151-17 Canadian Softwood Plywood
  - .7 CSA O153-13 (R2017) Poplar Plywood.
  - .8 CSA Z760-94 (R2001) Life Cycle Assessment
- .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.
- .3 Submit duplicate 300 mm long samples of each type of solid wood or 300 x 300 mm square type of plywood to receive stain or natural finish.
- .4 Submit samples of plastic laminate materials.

#### 1.5 Quality Assurance

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB 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.
- .3 Hardwood Veneered Plywood: To CSA O115, of thickness indicated, Type II Select Grade Maple, where transparent finish is required and Solid Grade where paint finish is required. Good two sides for work with two sides exposed to view; good one side for work with one side exposed to view. Use particle board core with Type I bond.
- .4 Particleboard: to ANSI A208.1.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .5 Medium density fibreboard (MDF): to ANSI A208.2, density 640-800 kg/m<sup>3</sup>.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.

### 2.3 Plastic Laminate

- .1 Plastic laminate facing sheet: ANSI/NEMA LD 3-2005 High-Pressure Decorative Laminates (HPDL) PF-S and GP-S;
  - .1 Backing sheet: BK Grade by manufacturer of facing sheet.
  - .2 Core: CSA O151
  - .3 Laminating adhesive: CSA O112.
  - .4 Core sealer: clear water resistant synthetic resin sealer.
  - .5 Colours, pattern, gloss and texture will be selected by Consultant from full range of products by one of the following:
    - .1 Formica,
    - .2 Arborite,
    - .3 Pionite,
    - .4 Nevamar
    - .5 Wilsonart.
  - .6 Up to three (3) colours and patterns will be selected by the Consultant.

### 2.4 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:
- .1 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 Provide 10 mm thick solid matching wood strip on plywood and particle board edges 13 mm or thicker, exposed in final assembly.
  - .5 Ease edges of solid lumber components to 1.6 mm radius.
- .2 Plastic Laminate Components
- .1 Fabricate plastic laminate window stools as detailed. Stools shall be minimum 19 mm thick plastic laminate plywood, with edge banding on all exposed faces. Fabricate in one piece, without joins, wherever as possible. Where necessary, joins shall be centred on window mullions and tightly butted together with concealed splines.
  - .2 Fabricate vanities and change room shelving units as detailed.
  - .3 Unless otherwise specified herein, comply with requirements of ANSI/NEMA LD 3 Annex 'A'.
  - .4 Assembly: Bond plastic laminate to core with adhesive, under pressure.
  - .5 Core: unless otherwise indicated: 19 mm thick.
  - .6 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.
  - .7 Use largest practicable plastic laminate sheet size.
  - .8 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.
  - .9 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.

#### 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.
- .10 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .11 Install window stools with wood levelling shims, after installation of windows and interior finishing is complete. Screw levelling shims to metal stud framing with self-tapping sheet metal screws. Bond stools to shims with waterproof adhesive. Tightly butt all joints and bond together with adhesive and concealed splines. Cut to fit tight to all penetrations.
- .12 Apply mildew resistant sealant to perimeter of all vanity tops and window stools as specified in Section 07 92 00.

### 3.4 Door Installation

- .1 Install doors in accordance with instructions in Section 08 11 00 and Section 08 14 16 and manufacturer's printed instructions.

### 3.5 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.

### 3.6 Miscellaneous

- .1 Install Toilet and Bath Accessories as specified in Section 10 28 10, including accessories supplied

by Owner.

3.7 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

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## 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 20 00 Finish Carpentry
- .4 Section 07 92 00 Joint Sealants
- .5 Section 09 21 16 Gypsum Board
- .6 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM F1667 – 18a 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 Canadian Softwood Plywood
  - .4 CSA O153-13 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.

### 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, anchorage, materials, dimensions, thickness, and finishes.
  - .2 On casework and countertop elevations show location of backing required for attachment within walls.
- .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 full range of manufacturer's standard plastic laminates for selection by the Consultant.
- .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. Base cabinet to have minimum one drawer. Mockup of material and finish to be provided. 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, 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 To ANSI/HPVA HP-1-09, Grade A face, book matched, flat cut maple face and No. 3 edge.
- .5 Particleboard: Meeting requirements of AWMAC's STANDARDS (NAAWS). To ANSI A208.1 , minimum density of 720kg/m<sup>3</sup> Grade "R".
- .6 MDF: Medium Density Fiberboard meeting requirements of AWMAC's STANDARDS (NAAWS).
- .7 Edgeband
  - .1 For wood veneer casework: Veneer of same species and cut as exposed surfaces.
  - .2 For Plastic Laminate Casework: [PVC] [High Pressure Decorative Laminate (HPDL)].
- .8 Hardboard: To CGSB 11-GP-3M, Type 2, 6 mm thick or as indicated.

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- .9 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, pattern, gloss and texture will be selected by Consultant from full range of products by one of the following:
      - .1 Formica,
      - .2 Arborite,
      - .3 Pionite,
      - .4 Nevamar
      - .5 Wilsonart.
  
  - .10 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.
  
  - .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 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 Shelf Standards: Knappe & Vogt 255 Series Recessed Steel Pilaster Standards Zinc Finish. Install 25mm from front and rear edges of shelves to prevent tipping when asymmetrically loaded.
    - .2 Shelf Clips: Knappe & Vogt 256R Series Pilaster shelf clips. Zinc finish with Rubber Cushion.
    - .3 Hinges: Blum concealed hinges, 125° clip and 125° opening with self-closing spring. Full or half overlay. Nickel plated steel.
    - .4 Cabinet Pulls: Richelieu D-Pull No: 30134-170, 96 mm c.c. brushed stainless steel.
    - .5 Cabinet Locks: CCL 0737 pin tumbler MK & KA by room.
    - .6 Draw Locks: CCL 0738 pin tumbler Master Keyed and Keyed alike by room.
    - .7 Catches: Type optional with manufacturer.
    - .8 Drawer Slides: Knappe & Vogt 8450FM Soft-Close Full-Extension Drawer Slide
    - .9 Door and Drawer Bumpers: "Quietex" bumpers.
    - .10 Wardrobe Hook: Richelieu 3" double wardrobe hook, #2235, brushed nickel finish.



- .11 Roller Casters: Colson Casters Ltd. Series 3 tread lock swivel casters with 76 mm diameter polyurethane wheels, zinc plated steel brake pedals, rubber brake shoes, complete with screws to suit. Wheels: polyurethane HI-TECH treads mounted on ribbed polyolefin cores. Alternate: Richelieu Faultless swivel caster series.
- .12 Provide other hardware and hardware accessories as detailed or required.
- .13 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 Wood Casework: AWMAC Standard Custom Grade.
- .3 Construction Type: Frameless
- .4 Cabinet and door interface: Flush overlay.
- .5 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.
- .6 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 Grade A Face, flat cut, book matched material suitable for clear finish meeting requirements of AWMAC's STANDARDS (NAAWS) for Grade specified.

- .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 and drawer 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 Apply moisture repellent sealer to concealed backs of cabinetwork.
- .11 Install cabinet hardware in accord with hardware manufacturer's directions. Unless otherwise indicated, provide each door with pull and with minimum two hinges. Provide locks where indicated.
- .12 Coordinate installation of wiring for electrical work with Electrical.

#### 2.5 Drawers

- .1 Sides: Particle board with melamine surfaces.
- .2 Bottoms: MDF or hardboard with melamine surfaces
- .3 Joinery: Meeting requirements of AWMAC's STANDARDS (NAAWS) for Grade specified.

#### 2.6 Laminated Plastic Countertops

- .1 Core material: exterior grade hardwood plywood with a non-telegraphing grain.
- .2 Use largest practicable plastic laminate sheet size.
- .3 Back splashes: as indicated, 100 mm high.

- .4 Front edges: As indicated
- .5 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.

## 2.7 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 Accurately scribe and closely fit components to irregularities of adjacent surfaces.
- .4 Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.
- .5 Countersink mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end.
- .6 Where permitted, nail with small headed finishing nails. Countersink nail heads with nail setter.
- .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.
- .10 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.
- .11 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.
- .12 Provide for wiring and cable management systems wiring grommets as indicated on the drawings.
- .13 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

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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 81 80 | Mortarless Concrete Siding             |
| .3  | Section 04 22 00 | Concrete Unit Masonry                  |
| .4  | Section 05 41 00 | Structural Metal Stud Framing          |
| .5  | Section 06 10 00 | Rough Carpentry                        |
| .6  | Section 07 26 00 | Vapour Retarders                       |
| .7  | Section 07 27 00 | Vapour Permeable Air Barriers          |
| .8  | Section 07 27 13 | Modified Bituminous Sheet Air Barriers |
| .9  | Section 07 51 00 | Built-Up Bituminous Roofing            |
| .10 | Section 07 92 00 | Joint Sealants                         |
| .11 | Section 08 11 00 | Metal Doors and Frames                 |
| .12 | Section 08 50 00 | Aluminum Doors, Windows and Screens    |
| .13 | Section 31 23 10 | Excavating, Trenching and Backfilling  |

1.3 References

- .1 ASTM International (ASTM)
- .1 ASTM C423-17 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - .2 ASTM C518-17 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .3 ASTM C578-19 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
  - .4 ASTM C612-14(2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
  - .5 ASTM C665-17 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
  - .6 ASTM D1621-16 Standard Test Method for Compressive Properties of Rigid Cellular Plastics
  - .7 ASTM D1623-17 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
  - .8 ASTM E1677-17 Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls
  - .9 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 CSA Group (CSA)
- .1 CSA B111-1974 (R2003) Wire Nails, Spikes and Staples
- .3 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.
- .4 Canadian General Services Board (CGSB)
- .1 CGSB 71-GP-24M Adhesive, Flexible, for Bonding to Cellular Polystyrene Insulation.
  - .2 CAN 2-51.32 Sheathing, Membrane, Breather Type.

#### 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: extruded expanded polystyrene to ULC S701.1 TYPE 4. Thickness as detailed, 400 x 2440 mm boards with butt edges. Material shall have the following characteristics when tested to the reference standards:
  - .1 Compressive Strength: ASTM D1621: 207 kPa.
  - .2 Water Absorption: ASTM D2842: maximum 0.7% by volume.
  - .3 Water Absorption: ASTM C272: maximum 0.3% by volume.
  - .4 Water Vapour Permeance, ASTM E96: 90 ng/Pa•s•m<sup>2</sup>

- .5 Coefficient of Linear Thermal Expansion, ASTM D696:  $6.3 \times 10^{-2}$  mm/m $^{\circ}$ C
- .6 Thermal resistance RSI: ASTM C518: 0.87/25 mm
  - .1 Styrofoam SM Insulation as manufactured by DuPont de Nemours Inc

- .2 Rigid Insulation above grade: Extruded polystyrene insulation to ULC 701.1 Type 2. Insulation shall have a minimum compressive strength of 40 KPa, RSI value of not less than 0.88/25 mm and a moisture absorption rate of not more than 0.9% by volume. Insulation boards shall be 50 mm thick or as detailed, 400 x 2400 mm with butt edges.
  - .1 Styrofoam Cavitymate as manufactured by Dow Chemical.
  - .2 Owens Corning Foamular 400
  - .3 Rigid Insulation above grade at E.I.F.S: as specified in Section 07 24 00.

## 2.2 Exterior Metal Stud Wall

- .1 Batt Insulation for exterior stud walls: To CAN/ULC-S702, Type 1.
  - .1 Fire performance:
    - .1 Non-combustibility: To CAN/ULC S114.
    - .2 Surface Burning Characteristics: To CAN/ULC S102.
      - .1 Flame spread: 0.
      - .2 Smoke developed: 0.
  - .2 Thermal resistance: To ASTM C518.
    - .1 RSI value/25.4 mm at 24  $^{\circ}$ C: 0.71 m $^2$ K/W.
  - .3 Density: 32 kg/m $^3$  to ASTM C167.
  - .4 Recycled content: 40 % minimum.
  - .5 Material: Rockwool Comfortbatt

## 2.3 Acoustic Insulation

- .1 Acoustic insulation for gypsum board partitions is specified in Section 09 21 16.

## 2.4 Spray Foam Insulation

- .1 Spray Foam Insulation: 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.

## 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 Vapour Retarder: As specified in Section 07 26 00.
- .5 Air Barrier: As specified in Section 07 27 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. Use only.
- .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 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.

3.4 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.

3.5 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

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## 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 41 00 Structural Metal Stud Framing
- .3 Section 06 10 00 Rough Carpentry
- .4 Section 07 21 13 Building Insulation
- .5 Section 07 27 00 Vapour Permeable Air Barrier
- .6 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .7 Section 07 51 00 Built-Up Bituminous Roofing
- .8 Section 07 92 00 Joint Sealants
- .9 Section 09 21 16 Gypsum Board
- .10 Section 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
  - .2 ASTM E154/E154M-08a (2019) 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 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 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34 Vapour Barrier, Polyethylene Sheet, for Use in Building Construction
- .3 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

- .1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm, 6 mils thick.
- .2 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for all lap joints and perimeter seals.
- .3 Mastic: as recommended by membrane manufacturer and compatible with substrate.
- .4 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer.
- .5 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

### 2.2 Sheet Vapour Barrier for Below Concrete Slabs on Grade

- .1 Vapour retarder membrane below slabs on grade shall be manufactured from virgin polyolefin resins and shall meet or exceed all requirements of ASTM E1745, Class A.

- .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.
  - .6 Puncture Resistance (ASTM D1709): >3,200 grams.
  - .7 Tensile Strength ASTM E154, Section 9: 72 Lb. Force/Inch
- .2 Thickness of Retarder (plastic), ACI 302.1R-96, not less than 15 mils.
- .3 Acceptable product: Sealtight Perminator HP, as manufactured by W.R. Meadows or Stego Wrap Vapor Barrier by Stego Industries LLC.
- .2 Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 100 mm. Perminator Tape by W.R. Meadows or Stego Tape by Stego Industries LLC.
- .3 Pipe Collars: Construct pipe collars from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

### PART 3 EXECUTION

#### 3.1 Vapour Retarders in Walls

- .1 Ensure services are installed and inspected prior to installation of vapour retarder.
- .2 Use sheets of largest practical size to minimize joints. Install horizontally on wall surfaces.
- .3 Adhere membrane to metal studs with continuous ribbons of mastic.
- .4 Tape all joints.
- .5 Seal perimeter of sheet vapour barrier as follows:
  - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
  - .2 Lap sheet over sealant and press into sealant bead.
  - .3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .6 Seal lap joints of sheet vapour barrier as follows:
  - .1 Attach first sheet to substrate using sealant/adhesive.
  - .2 Apply continuous bead of sealant over solid backing at joint.
  - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
  - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .7 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
  - .1 Install moulded box vapour barrier.
  - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.
- .8 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

- .9 Refer to building elements schedule on the drawings and details for locations of vapour retarders.

### 3.2 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.

### 3.3 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.

### 3.4 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 41 00 Structural Metal Stud Framing
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 21 13 Building Insulation
- .4 Section 07 26 00 Vapour Retarders
- .5 Section 07 51 00 Built-Up Bituminous Roofing
- .6 Section 07 62 00 Sheet Metal Flashing and Trim
- .7 Section 07 92 00 Joint Sealants
- .8 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D882-18 Standard Test Method for Tensile Properties of Thin Plastic Sheeting
  - .2 ASTM D903-98(2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
  - .3 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .4 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
  - .5 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
  - .6 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - .7 ASTM E331-00(2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
  - .8 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
  - .9 ASTM E2178-13 Standard Test Method for Air Permeance of Building Materials
  - .10 ASTM E2357-18 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- .2 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 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 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.m<sup>2</sup> when subjected to pressure differential of 75 Pa as measured in accordance with 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.m<sup>2</sup> when subjected to hourly wind design loads in accordance with NBC, using 1 in 10 year probability, as measured in accordance with 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.
- .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.

### 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.

### 1.10 Warranty

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of three 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: 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 Primary Sheet-Applied, Vapour Permeable Water Resistive Air Barrier (Basis of Design):
  - .1 Self-adhered vapour permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and patented permeable adhesive technology with split-back poly-release film; having the following typical physical properties:
    - .1 Thickness: 0.58 mm (23 mils )
    - .2 Water Vapour Permeance (ASTM E96): 1658 ng/Pa.m<sup>2</sup>.s., (29 perms)
    - .3 Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
    - .4 Air Permeance (ASTM E2178): Pass
    - .5 Nail Sealability (ASTM D1970): Pass
    - .6 Dry Tensile Strength (ASTM D882):
      - .7 41 lbf /182N MD
      - .8 29 lbf /129N CD
    - .9 Surface Burning Characteristics (ASTM E84):
      - .10 Flame Spread: Class A
      - .11 Smoke Development: Class A
    - .12 Low Application Temperature: -7 degrees C (20 degrees F)
  - .2 Acceptable Products:
    - .1 Blueskin VP160 by Henry Company.
    - .2 Sopraseal Stick VP by Soprema.
    - .3 Delta-Vent SA by Dörken Systems Inc.

### 2.3 Adhesive and Primers

- .1 As recommended by manufacturer.

### 2.4 Mastics & 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 counter top 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

- .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 51 00 Built-Up Bituminous Roofing
- .4 Section 07 62 00 Sheet Metal Flashing and Trim
- .5 Section 07 92 00 Joint Sealants
- .6 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D412-16 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 D4541-17 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
  - .4 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
  - .5 ASTM E330/E330M-14 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 E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
  - .8 ASTM E2178-13 Standard Test Method for Air Permeance of Building Materials
  - .9 ASTM E2357-18 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 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 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.m<sup>2</sup> 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.m<sup>2</sup> 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.

#### 1.10 Warranty

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of three 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: 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.m<sup>2</sup> @ 75 Pa to ASTM E283
  - .3 Vapour permeance: 1.6 ng/Pa.m<sup>2</sup>.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 Soprseal Stick 1100T by Soprema

#### 2.3 Adhesive and Primers

- .1 As recommended by manufacturer.

#### 2.4 Mastics & 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 at transitions and/or where indicated on the drawings in accordance with manufacturer's instructions.
- .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

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## 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 31 00 | Steel Deck                              |
| .3  | Section 05 41 00 | Structural Metal Stud Framing           |
| .4  | Section 05 50 00 | Metal Fabrications                      |
| .5  | Section 06 10 00 | Rough Carpentry                         |
| .6  | Section 07 21 13 | Building Insulation                     |
| .7  | Section 07 26 00 | Vapour Retarders                        |
| .8  | Section 07 27 13 | Modified Bituminous Sheet Air Barriers. |
| .9  | Section 07 52 00 | Modified Bituminous Roofing             |
| .10 | Section 07 62 00 | Sheet Metal Flashing and Trim           |
| .11 | Section 07 92 00 | Joint Sealants                          |

### 1.3 References

- .1 The National Building Code of Canada.
- .2 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 A792/A792M-23 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .3 ASTM C553-13(2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  - .4 ASTM D1005-95(2020) Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers.
- .3 CSA Group (CSA)
  - .1 CSA S136-16 North American specification for the Design of Cold Formed Steel Structural Members
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S702-09-AM1, Standard for Thermal Insulation, Mineral Fibre, for Buildings
- .5 Canadian Sheet Steel Building Institute (CSSBI)
  - .1 CSSBI 20M-2008 Standard for Sheet Steel Cladding for Architectural, Industrial and Commercial Building Applications.
  - .2 CSSBI B14-93 Steel Roofing and Siding Installation Guide.
  - .3 CSSBI-B15-1993 Snow, Wind and Earthquake Load Design Criteria for Steel Building Systems
  - .4 CSSBI B16-1994 Prefinished Sheet Steel for Building Construction.
- .6 Canadian Institute of Steel Construction (CISC)
  - .1 CISC Standard Code of Practice (2009).

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings including plans, elevations and details.
  - .1 All dimensions must be verified in the field prior to submittal of shop drawings.



- .2 Show profile, size, lap dimensions and details, connections, attachments, anchorage, caulking, and closure details.
  - .3 Indicate details of complete wall assembly including liner panel, insulation, sub-framing, exterior panel, flashing, trim and accessories.
  - .4 Shop drawings shall be stamped and signed by a registered Professional Engineer registered in the Province of Ontario.
- .3 Submit full range of manufacturer's colours.
- .4 Submit duplicate samples of each type of fastener proposed to be used.
- .5 Submit engineering design calculations for all materials and assemblies when requested by the Consultant.
- .6 Provide maintenance data for metal cladding for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00.
- 1.5 Design
- .1 Design metal cladding and assemblies to sustain all applied loads as required by the National Building Code of Canada.
  - .2 Design metal cladding and fasteners for a positive wind load of 0.96 kPa and a negative wind load of 0.56 kPa and a maximum deflection of 1/180 of the span at maximum load.
  - .3 Spacing of sub-framing system shall be not greater than 1200 mm centres.
  - .4 Stress shall not exceed 144 MPA for Grade A steel.
  - .5 Design shall be performed by a professional Engineer licensed to practice in Ontario.
- 1.6 Pre-Installation Conference
- .1 Arrange a pre-installation conference to review with all affected trades, requirements for metal wall systems installation.
- 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 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 Submit manufacturer's warrantee that prefinished materials will not lose chip, crack or lose film

integrity for 40 years and will not chalk or fade for 30 years following date of Substantial Performance.

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Sheet Metal: To ASTM A635M-09b and CSA136-07, galvanized sheet steel, commercial quality with a minimum yield stress of 230 MPA, and a working stress of 144 MPA. Material shall have Z275 designation zinc coating unless noted otherwise.
- .2 Roof Screen Cladding: Exterior Corrugated Wall Panel:
  - .1 2 2/3 x 7/8 Corrugated.
  - .2 C.N.T. 0.76 mm.
  - .3 Zinc Coating Designation Z275.
- .3 Metal Soffit: Exterior Hidden Fastener Wall Panel:
  - .1 Vicwest Bellara Plank Series. 135 mm exposure width x 15 mm deep x 3660mm long plank.
  - .2 0.55 mm thick (26 Ga)
  - .3 Finish: Expressence, architectural print series, wood grain.
  - .4 Colours:
    - .1 Colour 1: Obsidian Barnboard
    - .2 Colour 2: Natural Maple
- .4 Z Bars and Sub-framing Systems:
  - .1 Zinc coated steel minimum 1.22 mm base steel thickness.
  - .2 Depth as indicated or required by engineering design.
- .5 Flashings and Trim:
  - .1 Flat Sheet.
  - .2 Minimum C.N.T. 0.48 mm
  - .3 Zinc coating designation of Z275.
  - .4 Colour to match cladding colour.

### 2.2 Finishes

- .1 Unless noted otherwise, 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  $1.0 \pm 0.1$  mils when tested to ASTM D1005.
- .2 Cladding colours shall be selected by the Consultant from full range of manufacturer's standard colours. Up to two colours may be selected.

### 2.3 Accessories

- .1 Fasteners: Panel fastened with exposed self-tapping "confas" or Tapcon screws, prefinished nylon hat to match colour of cladding. Interior sheets and sub-girts fastened with type "AB" hex head cadmium plated high carbon steel, self-tapping sheet metal screws.
- .2 Closures: Unifoam PVC closures to profile of cladding.

- .3 Sealants: Refer to Section 07 92 00 - Joint Sealants.

## 2.4 Fabrication

- .1 Fabricate all metal flashing, starter strips, closures, and trim as required for complete installation of wall cladding. Hem all exposed edges minimum 13 mm for appearance and stiffness. Mitre and seal corners with sealant.
- .2 Fabricate flashings and trim to suit existing material profile and configuration.

## PART 3 EXECUTION

### 3.1 Examination

- .1 Examine building frame and substrate, take field measurements and examine other work which may affect this work.
- .2 Check the accuracy and alignment of the building substrate. If not within tolerances set forth in the CISC Standard Code of Practice, the matter shall be brought to the attention of the Consultant before proceeding with erection of the metal cladding.
- .3 Ensure that all air barrier membranes and air seals are in place and have been accepted by the Consultant.
- .4 Notify Consultant of any conditions which would prevent proper installation.
- .5 Do not proceed with cladding installation until work which will be concealed has been inspected and approved.
- .6 Commencement of work implies acceptance of existing conditions.

### 3.2 Installation

- .1 Erection shall be carried out by the manufacturer's trained erection crews or their approved erector, in accordance with the manufacturer's specifications.
- .2 Install all flashings and seal to provide a weather-tight structure.
- .3 Fasteners or method of attachment shall withstand all loads of wind or of suction as may be imposed on the metal cladding. Exposed fasteners shall have pre-coated or nylon coated heads to match colour of the metal wall cladding.
- .4 Installation shall be in accordance with the reviewed shop drawings, the manufacturer's printed instructions and the referenced standards.
- .5 Install sub-framing, girts, trim, flashings, insulation and metal cladding as indicated.
- .6 Fasten sub-framing to backup with self-tapping screws or masonry anchors of sufficient length to penetrate a minimum of 19 mm into the structure. Locate sub framing at maximum 1200 mm centres but not more than required to support applied wind loads.
- .7 Fasten cladding to support framing at roof screens in accordance with reviewed shop drawings.

- .8 Apply a continuous bead of caulking on faces of all supports and at top, bottom and ends of cladding to provide a complete seal.
- .9 On lapped joints, caulk continuously between laps to provide a complete water seal.
- .10 Bed all flashings, closures and corner pieces in sealant to provide a weather tight installation.
- .11 Caulk all openings, joints and around perimeter to provide a weathertight installation.
- .12 Complete all air seals between metal cladding and other systems or materials as detailed. Air barrier membranes are specified under Section 07 27 13.
- .13 Provide expansion joints required by shop drawings complete with metal closures, flashings, trim and caulking, to provide a weather tight installation.
- .14 Provide all matching trim, fasteners and accessories to make building weathertight.
- .15 There shall be no apparent difference between face sheets of same colour when viewed from a minimum distance of 15 metres. Remove and replace off-colour sheets as directed by the Consultant.

### 3.3 Touch-Up

- .1 Repair and touch up with colour matching high grade enamel minor surface damage, only where permitted by the Consultant and only where appearance after touch-up is acceptable to Consultant.
- .2 Replace damaged panels and components that, in opinion of the Consultant, cannot be satisfactorily repaired.

### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean all exposed panel surfaces in accordance with manufacturer's instructions.

End of Section

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## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- |    |                  |                                       |
|----|------------------|---------------------------------------|
| .1 | Section 05 31 00 | Steel Deck                            |
| .2 | Section 06 10 00 | Rough Carpentry                       |
| .3 | Section 07 21 13 | Building Insulation                   |
| .4 | Section 07 27 13 | Modified Bituminous Sheet Air Barrier |
| .5 | Section 07 62 00 | Sheet Metal Flashing and Trim         |
| .6 | Section 07 71 00 | Roof Specialties and Accessories      |
| .7 | Section 07 92 00 | Joint Sealants                        |

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C208-12 (2017) e1 Standard Specification for Cellulosic Fiber Insulating Board
  - .2 ASTM C1177/C1177M-17 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
  - .3 ASTM C1278/C1278M-17 Standard Specification for Fiber-Reinforced Gypsum Panel
  - .4 ASTM D226/D226M-17 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
  - .5 ASTM D1863/D1863M-05(2018) Standard Specification for Mineral Aggregate Used on Built-Up Roofs
  - .6 ASTM D2178/D2178M-15a Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
  - .7 ASTM D3746/D3746M-85(2015)e1 Standard Test Method for Impact Resistance of Bituminous Roofing Systems
  - .8 ASTM D4586/D4586M-07(2018) Standard Specification for Asphalt Roof Cement, Asbestos-Free
  - .9 ASTM D4601/D4601M-04(2020) Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
  - .10 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
- .2 CSA Group (CSA)
  - .1 CAN/CSA-A123.2-03 (R2018) Asphalt-Coated Roofing Sheets.
  - .2 CAN/CSA A123.3-05 (R2015) Asphalt Saturated Organic Roofing Felt
  - .3 CAN/CSA-A123.4-04 (R2018) Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems
  - .4 CAN/CSA-A123.16-04(R2014) Asphalt-Coated Glass Base Sheet.
  - .5 CSA A123.17-05(R2014) Asphalt Glass Felt Used for Roofing and Waterproofing.
  - .6 CAN/CSA-A123.21-14 Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems
  - .7 CAN/CSA A247-M86 (R1996) Insulating Fibreboard
- .3 Canadian General Services Board (CGSB)
  - .1 CAN/CGSB-37.5Cutback Asphalt Plastic Cement.
  - .2 CGSB 37-GP-9Ma Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
  - .3 CGSB 37-GP-15M Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.

- .4 CGSB 37-GP-19M Cement Plastic, Cutback Tar.
- .5 CAN/CGSB-37.29 Rubber-Asphalt Sealing Compound.
- .6 CAN/CGSB-51.33-M Vapour Retarder Sheet, Excluding Polyethylene, for Building Construction.
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102-18 Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 ULC 704-11 Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
  - .3 ULC-S706.1:2020 Standard for Insulating Wood Fibre Boards for Buildings
  - .4 ULC 770 -15 Standard Test Method for Determination of Long Term Thermal Resistance of Closed Cell Thermal Insulating Foams.
  - .5 Underwriters' Laboratories of Canada (ULC) List of Equipment and Materials Volume II Building Construction including supplements to date.
- .5 Canadian Roofing Contractors Association (CRCA) Metric Specification Manual.
- .6 Factory Mutual Engineering Corporation (FM): Loss Prevention Data, Insulated Steel Deck 1-28, FM Approval Guide including Revisions to date.

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit complete list of all products intended for use, together with samples and manufacturer's technical literature.
- .3 Submit verification that materials and products meet performance requirements specified in the Referenced Standards.
- .4 Submit shop drawings of all components and accessories and including layout drawings and details for the tapered insulation system. Submit shop drawings for prefabricated work.
- .5 Submit shop drawings detailing roof size, membrane sheet placement, location and type of penetrations, type of vapour retarder, insulation and insulation fasteners.
- .6 Submit shop drawings for tapered insulation. Indicate degree of slope and layout of sloping boards and fill boards on roof surfaces. Ensure positive drainage to roof drains.

#### 1.5 Quality Control

- .1 The Owner will appoint an Independent Inspection and Testing Company, to be paid out of the Cash Allowances, for testing and inspection of roofing systems.

#### 1.6 Quality Assurance

- .1 Provide built-up roofing systems including insulation and all related materials to conform to ULC Class A design criteria, as shown and as specified herein.
- .2 The roofing Contractor shall be of recognized standing with a proven record of satisfactory installations and shall be a member in good standing of the Canadian Roofing Contractors Association and/or the Ontario Industrial Roofing Contractors Association.
- .3 Roofing work shall be executed under the full time supervision of a competent foreman.

- .4 A membrane manufacturer's representative shall be available to review installation procedure and to impact the completed installation to verify compliance with all specifications and details.
- .5 Prior to scheduled commencement of the roofing installation and associated work, conduct a pre-construction meeting at the project site with the installer, Consultant, Owner, roof manufacturer's representative and any other persons directly involved with the performance of the work. Record conference discussions to include decisions, agreements, and open issues and furnish copies of recorded discussions to each attending party. The primary purpose of the meeting is to review foreseeable methods and procedures related to roofing work.

#### 1.7 Design Criteria

- .1 General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
- .2 Roofing System: to CSA-A123.21 for wind uplift resistance.
- .3 Compatibility between components of system and adjacent materials is essential.
  - .1 Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

#### 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 Deliver and store materials undamaged in original containers with manufacturer's label and seals intact. All packed materials shall bear the manufacturer's name brand, and applicable specification number and printed instructions for storage and application. Materials not identified shall be removed off the site.
- .4 The roofing contractor shall have adequate facilities or access to facilities to take receipt of and store roofing materials so that the materials are ready to be built in.
- .5 Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- .6 All materials shall be protected from moisture at all times.
- .7 Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- .8 No material shall be placed in direct contact with the earth.
- .9 Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

#### 1.9 Environmental Requirements

- .1 Apply roofing in periods only approved by the roofing inspector.

- .2 Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.
- .3 Materials shall not be applied during inclement weather. Do not apply roofing over wet decks, or where frost or snow is present.

#### 1.10 Protection

- .1 Provide adequate protection of materials and work of this trade from damage by weather, traffic and other causes. At the end of each day's work seal exposed edges of roofing membrane. Protect work of other trades from damage resulting from the work of this trade. Make good such damage at no additional expense to the Owner and to the satisfaction of the Consultant.
- .2 Protect adjacent properties and public areas in accordance with regulatory requirements and municipal by-laws.

#### 1.11 Fire Protection

- .1 Protect roof junctions at parapets, roof curbs and upstands with a fire-resistant tape or barrier to prevent combustible materials within assemblies from ignition arising from the use of torches. Install prior to installation of base sheets.
- .2 Use a heat detector gun to spot any smouldering or concealed fire at the end of each work day. Establish a minimum one (1) hour fire watch after application.
- .3 Do not apply torch directly to dry or unprotected wood surfaces.
- .4 Maintain a clean site and have one approved ABC fire extinguisher within 6 meters of each roofing torch. Respect all safety measures described in manufacturer's technical data sheets. Do not place torches near combustible or flammable products.

#### 1.12 Waste Management and Disposal

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

#### 1.13 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 Defects to include but not be restricted to leaking, failure to stay in place, undue expansion, lifting, deformation, loosening and splitting of seams, joint deformation, failure to adhere, deterioration, blisters, etc.
- .3 Manufacturer's Extended Warranty: Provide manufacturers extended twenty (20) year warrantee to cover repair or replacement costs for labour, materials and workmanship required to restore roof or system to watertight condition, after a leak has occurred, due to defective materials or system related failures. Warranty shall be Non Pro Rated and must be covered to the original installation cost for the full twenty years from the date of Substantial Performance.



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## PART 2 PRODUCTS

### 2.1 Materials

#### .1 General

- .1 Use materials as specified herein only.
- .2 Compatibility between roofing system components is essential. All materials used on the roof shall be endorsed for compatibility by the applicator and the materials manufacturer.
- .3 Materials shall conform to the reference specification numbers named including all revisions to date or shall be the product named.

#### .2 Asphalt Primer: to CGSB 37-GP-9Ma, unfilled, penetrating, non-fibrated, cutback asphalt.

#### .3 Substrate Board: Glass Mat, Gypsum Board: to ASTM C1177, water resistant board, 13 mm thick or as noted on drawings.

#### .4 Air/Vapour Barrier Membrane

##### .1 Membrane: self-adhesive composite sheet of rubberized asphalt integrally bonded to high density polyethylene film;

- .1 Thickness: 1.0mm.
- .2 Air leakage: less than 0.005 L/s.m<sup>2</sup> @ 75Pa to ASTM E283,
- .3 Water vapour permeance: 1.6 ng/Pa.m<sup>2</sup>.s to ASTM E96,
- .4 Low temperature flexibility: -30°C to CGSB 37-GP-56M.
- .5 Elongation: 200% to ASTM D412-modified.
- .6 Acceptable Products;
  - .1 Blueskin SA, by Bakor Inc.
  - .2 Air Shield, by W.R. Meadows of Canada.
  - .3 ExoAir 110, by Tremco Limited.
  - .4 Sopraseal Stick 1100, by Soprema.
  - .5 CCW-705, by Carlisle Coatings and Waterproofing.

##### .2 Primer: as recommended by manufacturer.

#### .5 Roofing Asphalts: Type 1 and 3 oxidized asphalt conforming to CSA A123.4. Type 2 asphalt shall be used for horizontal surfaces and slopes up to 1:8, and type 3 for vertical and sloped surfaces over 1:8.

#### .6 Base Insulation: to ASTM C1289 and ULC 704-11 Rigid, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.

- .1 Thickness 2 layers, 50mm thick.
- .2 Base layer 1220 x 2440 mm boards.
- .3 Compliances: UL, WH or FM listed under Roofing Systems Federal Specification HH-I-1972, Class 1.

#### .7 Top Layer Mineral Wool Insulation: to ASTM C726 and ULC 102 and ULC 107 high density bitumen coated stone wool insulation board.

##### .1 Top layer rigid stone wool insulation boards shall meet the following performance criteria:

- .1 Board thickness: 89 mm
- .2 1219 x 1219 boards.
- .3 Thermal resistance to ASTM C518:
  - .1 R 3.8 hr.ft<sup>2</sup>.F/Btu / RSI 0.68 m<sup>2</sup>K/W at 25 °C.
  - .2 R 4.3 hr.ft<sup>2</sup>.F/Btu / RSI 0.72 m<sup>2</sup>K/W at - 4 °C.
  - .3 R 3.6 hr.ft<sup>2</sup>.F/Btu / RSI 0.64 m<sup>2</sup>K/W at 43 °C.

- .4 Non-combustible in accordance with CAN/ULC S114, 1-NCC (non-combustible core) rated roof insulation in accordance with FM Approval 4450/4470.
- .5 Water absorption of less than 1.0 % in accordance with ASTM C209,
- .6 Recycled content: 40 % minimum,
- .7 Hail damage resistance: Class 1-SH in accordance with FM 4470,
- .8 Impact resistance: Class 4 in accordance with FM 4473, and UL 2218.
- .2 Toprock DD Plus, Rockwool MonoBoard Plus, Soprarock DD Plus or equivalent.
- .8 Tapered Insulation: compatible with roofing system, slope as shown on the drawings, factory tapered to provide slope to drains (slopes as per drawings), wax-impregnated fibreboard, to CAN/ULC-S706:
  - .1 Accu-Plane Systems Inc.
  - .2 Posi-Slope.
  - .3 Or equivalent as approved by the Consultant.
- .9 Insulation Accessories: As required, preformed crickets, sumps and mitres to match roof insulation.
- .10 Insulation Fasteners at Steel Deck: FM approved and tested with specified underlayment substrate board to FM I-90 Uplift Classification. Self-tapping metal screw and plate fastening devices approved by the manufacturer of the substrate and of appropriate length to penetrate the top flange of the deck a minimum of 19 mm, but not long enough to extend past the bottom of the deck rib. Fasteners shall be coated with Zn-97 base coat and composite flouropolymer finish.
- .11 Base Sheet: polyester/glass/polyester trillaminat reinforcement membrane coated with waterproofing asphalt; 1.5kg/m<sup>2</sup> weight; to ASTM D228;
- .12 Roofing Felt: ASTM D2178 Type IV inorganic fibreglass mat impregnated with asphalt.
- .13 Cant Strips: ASTM C208, Type II, Grade 1 rigid board wood fiber insulation, or ASTM C728; rigid board perlite insulation cants 76 x 76 x 38 mm, preformed to 45 degree angle.
  - .1 GAF Materials Corp. Energy Guard Perlite Cant Strip or equivalent.
- .14 Roof Surfacing Aggregate: To ASTM D1863, 9.5 mm pea gravel size well graded crushed or round, clean and dry, free from fines, splinters, dust, sand or organic impurities, soft or friable materials.
- .15 Base Sheet Flashing: Mop grade SBS modified bituminous membrane with minimum thickness of 2.2 mm and with minimum 180 g/m<sup>2</sup> polyester reinforcement. Type II, Class C, Grade 1 conforming to CGSB 37-GP-56M.
  - .1 GAF Material Corp. Rubberoid Mop Smooth Base Sheet.
  - .2 Soprema Elastophene 180 SS.
- .16 Cap Sheet Flashing: Mop grade SBS modified bituminous membrane with minimum thickness of 4.0 mm and with minimum 250 g/m<sup>2</sup> polyester reinforcement. Type I, Class A, Grade 2 conforming to CGSB 37-GP-56M.
  - .1 GAF Material Corp. Rubberoid Mop Plus.
  - .2 Soprema Sopralene 250GM.
- .17 Nails, bolts, screws and other flashings - same metal finish as sheet metal being used. The size of fastenings shall suit the applicable conditions. All nails, screws and other flashings shall be subject to the approval of the Consultant.

- .18 Caulking Sealant: Compatible with roofing materials, as specified in Section 07900.
- .19 Bituminous Paint: To CGSB 1-GP-108M.
- .20 Pitch Pockets: Lexsuco Spun Aluminum Mastic Pans.
- .21 Pourable Sealer: 2-part polyurethane sealer intended for use by the manufacturer to seal pitch pans and other penetrations.
- .22 Stack jacks (vent pipe flashings): Lexsuco or Thaler standard mill finish aluminum insulated vent stack covers applicable at all plumbing vent pipes. Rubber sleeves and sleeves supplied by other trades will not be acceptable.
- .23 New Roof Drains: As specified under mechanical.
- .24 Rain Collars and Clamps: Fabricated from same material as exhaust stacks, with continuously soldered seams and extending a minimum of 50 mm down face of sleeve. Allow 6 mm gap all around between rain collar and sleeve or pitch pockets. Clamps to be fabricated from same material as collar.

### PART 3 EXECUTION

#### 3.1 Existing Conditions

- .1 Examine work of other trades and notify in writing to the Consultant and Contractor that the work is acceptable or of any defects or discrepancies. Verify that work of other trades which penetrates roof deck or requires men and equipment to transverse roof deck has been completed or adequate protection is provided.
- .2 Examine surfaces for inadequate anchorage, foreign material, moisture and unevenness which would prevent the execution and quality of application of the roofing system as specified. Do not proceed with application of the roof system until defects are corrected. Installation of any part of the work without the written acceptance of such surfaces shall require immediate removal of such installed work.

#### 3.2 Workmanship

- .1 Do workmanship in strict accordance with applicable standards in Canadian Roofing Contractors Association Roofing Specifications Manual except where specified otherwise and to the approval of the Consultant.
- .2 Regard the manufacturer's printed recommendations and specifications as the minimum requirement for materials, methods and workmanship not otherwise specified.
- .3 Do not overheat bitumen. Maximum temperature for type I, type II and type III oxidized asphalt is 245° C. Do not apply to the roof under 200° C. Once asphalt temperature exceeds 245° C the material will be considered unsatisfactory and must be removed from the site.
- .4 All plies of roofing felt except as otherwise specified shall be mopped solid and squeegeed into bitumen.
- .5 Unsuitable or damaged materials shall immediately be removed from the site.

- .6 Wherever two or more plies of roofing felt are applied to the surface of the built up roofing system, the edge of the roofing felt plies must not be left in a total raw edge thickness, but applied with progressive increases of 150 mm of each successive layer of felt applied.
- .7 Should at the conclusion of any day's work gravelling-in operations be incomplete or postponed, all newly applied roofing shall receive a continuous and uniform protective coating of bitumen.
- .8 Bitumen shall be supplied direct from the refinery. Bitumen temperature in tankers shall not exceed 190° C. Bitumen shall be transferred into standard kettles and heated to the required temperature. Tankers must be equipped with a thermometer at all times. Operator to leave the tanker lid open at all times to permit fumes to escape. Bitumen shall be maintained in the tanker at the lowest possible temperature.

### 3.3 Preparation

- .1 Remove existing roofing over areas shown, including stone ballast, roof membranes, flashings, cover board, insulations, cant strips and vapour retarders. Remove only enough roofing that can be replaced in the same day.
- .2 Inspect and remove or replace existing wood roof curbs and copings. New wood curbs and copings are specified in Section 06 10 00. Coordinate with others to ensure that all curbs, blocking and the like is in place, level and secure, prior to commencement of roofing.
- .3 Remove and dispose of existing metal siding and flashing assemblies at upper walls on High School.
- .4 Remove existing roof drains where required. Retrofit/extend drainage piping to suit new installation.
- .5 Remove and reinstall all mechanical equipment on the roof as necessary to facilitate application of new roof system. This includes temporary removal and replacement of any associated duct work. Temporary removal of any gas lines is the responsibility of the contractor and gas lines shall be reinstalled in accordance with applicable regulations and authorities having jurisdiction. Provide all adjustments necessary to suit new roof elevations.
  - .1 Disconnection, removal and re-installation of existing equipment shall be performed by the mechanical or electrical contractor.
- .6 Clean and prepare existing roof deck and other substrate materials suitable for new vapour retarder application in accordance with manufacturer's instructions.

### 3.4 Application: Substrate Board

- .1 Install glass mat substrate board and mechanically fasten over new metal roof deck and in accordance with manufacturer's directions.

### 3.5 Application: Vapour Retardant

- .1 Prime substrate and adhere roof vapour retarder over underlay board with approved adhesive at manufacturer's recommended rate.
- .2 Overlap vapour retarder minimum 100 mm for side laps and 150 mm for end laps.

- .3 Extend vapour retarder under cant strips and blocking. Extend to perimeter and deck protrusions.
- .4 Seal roof vapour retarder to wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building air/vapour barrier envelope.
- .5 Inspect entire vapour retardant application and proceed with installation only after unsatisfactory conditions have been corrected.

### 3.6 Installation: Roof Insulation

- .1 Keep insulation dry at all times. Insulation showing evidence of having been dampened since its manufacture or separation of laminations shall not be used. Lay insulation panels in rows with all joints staggered.
- .2 Lay board in tight contact to prevent gaps and resulting loss of thermal insulation value. Cut boards to fit neatly around projections through roof.
- .3 Fasten through first layer of base insulation to steel deck with approved screw and plate fasteners spaced in accordance with Factory Mutual requirements and reviewed shop drawings. Fasteners shall penetrate deck a minimum of 19 mm.
- .4 Adhere second layer of top insulation with adhesive. Firmly set the units of roof insulation, long joints continuous and short joints staggered, into a full width mopping of hot asphalt (within 14<sup>o</sup> C of the EVT). The asphalt shall be applied at a nominal rate of 1.46 kg/m<sup>2</sup>. Insulation shall be installed in (2) two layers as per the drawings. All joints must be offset a minimum of 150 mm between layers. Walk-in insulation boards to ensure full embedment in asphalt.
- .5 Install tapered insulation in accordance with reviewed shop drawings.
- .6 At roof drains, reduce the insulation thickness by 13 mm for a distance of 610 mm from the centre of the drain. Fill the flutes of the steel deck at roof drains with insulation board adhered with adhesive for a distance of 610 mm from the centre of the drain to ensure total support at all drains prior to placement of vapour retardant.
- .7 Cover board: Cover entire roof with a layer of cover board, fully adhered in a complete 100% hot mopping of asphalt type III, to the top layer of insulation. Embed cover board firmly into the hot asphalt.
- .8 Protect all exposed edges of insulation where roofing temporarily terminates at the end of a working day by forming a water cut-off. Water cut-off shall consist of 2 plies of felt continuously mopped and coated with asphalt, extending from the surface of the roof membrane minimum 200 mm onto the deck. Ensure water cut-off is continuously secured to the deck and is removed prior to proceeding with work the following day.
- .9 Insulation shall not be installed to bridge across expansion joints or control joints.

### 3.7 Installation: Cant Strips

- .1 Apply a continuous and uniform mopping of Type III asphalt along all intersections of roofing and vertical surfaces to the width of the cant strips. Immediately set cant strips in place. Lay true to line and level. Butt joints flush and accurately and mitre all corners.

### 3.8 Built Up Roofing Application

- .1 Roof membrane shall consist of 4 plies (base sheet plus 3 plies) of inorganic fibreglass and asphalt impregnated roofing felts laid in hot asphalt and covered with gravel.
- .2 Solidly mop surface of roof insulation with Type I hot asphalt at rate of 1.0 kg/m<sup>2</sup> and embed 4 plies of felts lapping each ply 700 mm over preceding one and mopping solidly between in a similar mopping of hot asphalt. Do not allow dry felts to contact each other.
- .3 Apply felts smooth, free from air pockets, wrinkles, fish mouths, prominent lap joints or tears. Lap end joints at least 150 mm and avoid end joints coinciding with underlying joints. Terminate all roofing felts at top of cant strip. Stagger the felts to finish in an even surface with all felt cant strip. Stagger the felts to finish in an even surface with all felt plies tightly sealed with asphalt at the top of all cant strips.
- .4 At parapets apply two layers of felt strip flashing, the first layer to extend 250 mm onto roofing and the second layer 200 mm and each layer carried up full height to top of vertical surface in an even line and secure to wood blocking with large headed roofing nails and to each other with Type III asphalt.
- .5 At curbs and other vertical surfaces, similarly flash with two ply of felt strip flashing, extending 300 mm high above roof level, unless otherwise shown, or extending full height of curbs, felts turned over top of curb and down face of wood blocking and nailed thereto and install flashings.
- .6 Install built-up flashings at all roof curbs, sleepers, vent pipes, ducts, and all other projections through the roof as required and as shown on the drawings.

### 3.9 Parapet and Cap Flashing

- .1 Cap, parapet and curb flashings shall consist of two layers of SBS modified bituminous membrane flashing hot mopped into Type III asphalt covered with sheet metal flashing specified under Section 07 62 00.
- .2 Install base sheet of SBS modified bituminous base sheet in type III asphalt ensuring full bond and extending a minimum of 150 mm onto roof surface. Properly secure flashings to their support without sags, blisters, fishmouths or wrinkles. Terminate as detailed.
- .3 Install cap sheet of SBS modified bituminous base sheet in type III asphalt ensuring full bond and extending a minimum of 200 mm onto roof surface. Properly secure flashings.
- .4 Sheet metal flashings shall be installed as specified in Section 07 62 00.

### 3.10 Gravel Surfacing

- .1 Temporarily block all roof hoppers when gravel is being placed to prevent gravel from falling down leaders into drains. Exercise care to remove temporary blocking when work is not proceeding to avoid flooding.

- .2 Over final ply of felt apply a flood coating of hot asphalt at rate of 3.0 kg/m<sup>2</sup> using an approved bitumen and gravel application machine and embed roofing gravel. Apply gravel at rate of 20 kg/m<sup>2</sup>. Sweep up excess gravel with mechanical broom and re-pour any bare spots. Apply a second topping of asphalt and gravel using 3.0 kg/m<sup>2</sup> of asphalt and spread gravel to provide a total uniform weight (including asphalt) of not less than 36 kg/m<sup>2</sup> for both pours.

### 3.11 Control Joints

- .1 Supply and install control joints where indicated on the drawings. Roofing felts shall be solid mopped in place and terminate at top of cants. Install flexible flashing in the longest convenient lengths mopped in place with hot Type III asphalt, extending out onto roofing felts a distance of 300 mm from toe of cant and carried up over face of cant strip, up full height of curb and turned over wood blocking and nailed thereto with large headed roofing nails.

### 3.12 Pavers

- .1 Refer to Section 078 80 00

### 3.13 Mechanical and Electrical Equipment

- .1 All electrical conduits and gas lines must be sufficiently supported as directed by the Consultant.
- .2 Install rain collars complete with clamping rings over all pitch pockets and stacks where vandal proof caps cannot be installed.
- .3 Provide purpose made stack jack flashings at all plumbing vents.
- .4 Seal flashing sleeves in accordance with manufacturer's directions and CRCA standard details.

### 3.14 Roof Drains

- .1 Flash in drain flange with three plies of glass felt in Type II asphalt. Extend first ply a minimum of 300 mm beyond the edge of the flange and each succeeding ply 150 mm beyond underlying ply.
- .2 Install clamping ring and aluminum strainer over raised bosses and install screws to tighten ring against membrane flashing until secure and apply gravel.
- .3 Removal of existing drains and installation of new drains shall be in accordance with manufacturer's instructions. Ensure rain water pipes are fully supported prior to removal of the existing roof drains.

### 3.15 Field Quality Control

- .1 Provide necessary facilities and co-operate with designated inspection and testing agency.
- .2 Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- .3 Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Consultant.

- .4 Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- .5 Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.16 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.17 Protection

- .1 Protect roofing system from damage and wear during remainder of construction period.

End of Section



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## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 04 81 80 Mortarless Concrete Siding
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 51 00 Built Up Bituminous Roofing
- .4 Section 07 71 00 Roof Specialties and Accessories
- .5 Section 07 92 00 Joint Sealants

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM D523-14 (2018) Standard Test Method for Specular Gloss
- .2 CSA Group (CSA)
  - .1 CSA B111 Wire Nails, Spikes and Staples
  - .2 CSA 136-16 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.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 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: 0.48 mm thick 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.
- .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  $1.0 \pm 0.1$  mils when tested to ASTM D1005. This Section shall supply all metal flashing for all roof and wall applications whether shown or not, and as necessary for the complete installation.
- .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: same metal finish as sheet metal being used to CSA B111. The size of fastenings shall suit the applicable conditions.
- .7 Underlay: No. 15 perforated asphalt felt to CSA A123.3-M or dry sheathing, breather type, to CAN/CGSB-51.32
- .8 Cleats: Of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

### 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 Secure metal flashings in reglets at 610 mm centres and further secure metal to vertical surfaces at locks as required.
- .10 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.
- .11 Imperfections in metal flashing work such as holes, dents, creases, or oil-canning will not be accepted.
- .12 Fabricate and install scuppers as detailed and in accordance with CRCA specifications and standards.

### 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 31 00 Steel Deck
- .2 Section 05 50 00 Metal Fabrications
- .3 Section 06 10 00 Rough Carpentry
- .4 Section 07 21 13 Building Insulation
- .5 Section 07 51 00 Built Up Bituminous Roofing
- .6 Section 07 62 00 Sheet Metal Flashing and Trim
- .7 Section 07 92 00 Joint Sealants

### 1.3 References

- .1 CSA Group (CSA)
  - .1 CSA A231.1-14/ A231.2-14 Precast Concrete Paving Slabs/Precast Concrete Pavers

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings and manufacturers literature:
  - .1 Indicate size and description of components and materials, arrangement of hardware, operating mechanism, required clearances, fasteners, anchoring, and finishes.

### 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 Do not store roof pavers in piles or on pallets on roof

### 1.6 Waste Management and Disposal

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

### 1.7 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 Pedestals and leveling plates made of high density polyethylene with integral spacer ribs on upper surface.

- .1 Pavel Paver Pedestals, model 5X as supplied by Envirospec Inc.
- .2 Precast concrete paving stones to CSA A231.1/A231.2:
  - .1 Fabricated for exterior use with textured non-slip finish.
  - .2 460 x 460 x 50 mm thick.
  - .3 Colour: Grey.
- .3 Mechanical Vent Flashings: As recommended by roof system manufacture and to suit mechanical installations. Prefabricated.

## 2.2 Conduit Flashings

- .1 MEF-1 Rigid Conduit Flashing
  - .1 Rigid conduit flashing: Thaler MEF-1 standard 305 mm high flashing; 1.6 mm mill finish 1100-0T alloy aluminum; with EPDM Triple Pressure Grommet Seal for conduit 12 mm and larger, and for conduit 10 mm diameter and smaller; EPDM Base Seal; bituminous painted deck flange.

## PART 3 EXECUTION

### 3.1 Service Route Walkway Guardrail and Support

- .1 Apply an asphaltic or other type protective coating to aluminum stack jack Flashing to a height of 50 mm above roof surface and aggregates to avoid corrosive reaction. If coating deck flange with a bituminous paint on site, allow 24 hours for drying before applying roof membrane.

### 3.2 Concrete Pavers

- .1 Install concrete paving slabs in accordance with manufacturer's instructions and as indicated.
- .2 Set pavers on plastic paver pedestals. Install levelling plates as required.

### 3.3 Mechanical Vent Flashings

- .1 Co-ordinate size, material, and locations with Mechanical Sections. Provide mechanical vent flashings at all mechanical equipment and pipe penetrations through the roof.
- .2 Flashings shall be compatible with roofing assemblies.
- .3 Install vent flashings and other penetration flashings and seal to roof membrane in accordance with manufacturer's recommendations and details.
- .4 Secure all vent flashings and accessories to deck with bolts to meet the manufacturer's specifications.
- .5 Coordinate with other trades for location and size of vent flashings.

### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

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## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 31 00 Steel Deck
- .2 Section 07 92 00 Joint Sealants
- .3 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-20 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.

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- .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 mm<sup>2</sup> 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 Fire stop 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 Control and sway joints in fire-resistance rated partitions and walls.
  - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
  - .6 Around mechanical and electrical assemblies penetrating fire separations.
  - .7 Rigid ducts: greater than 129 cm<sup>2</sup>: 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.
  - .8 All electrical boxes installed in fire rated gypsum board assemblies.
  - .9 All locations required by the Ontario Building Code.
  - .10 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

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## 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 81 80 Mortarless Concrete Siding
- .3 Section 05 41 00 Structural Metal Stud Framing
- .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 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 50 00 Aluminum Doors, Windows and Screens
- .14 Section 08 80 05 Glazing
- .15 Section 32 16 23 Sidewalks

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C510-16 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
  - .2 ASTM C661-15 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
  - .3 ASTM C719-14 (2019) Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
  - .4 ASTM C794-18 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
  - .5 ASTM C834-17 Standard Specification for Latex Sealants
  - .6 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants
  - .7 ASTM C1087-16 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
  - .8 ASTM C1193-16 Standard Guide for Use of Joint Sealants
  - .9 ASTM C1247-20 Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids
  - .10 ASTM C1248-18 Standard Test Method for Staining of Porous Substrate by Joint Sealants
  - .11 ASTM C1311-14 Standard Specification for Solvent Release Sealants
  - .12 ASTM C1330-18 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
  - .13 ASTM D412-16 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  - .14 ASTM D624-00(2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
  - .15 ASTM D2203-01(2018) Standard Test Method for Staining from Sealants
  - .16 ASTM D2240-15e1 Standard Test Method for Rubber Property—Durometer Hardness
- .2 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).

- .3 U. S. Environmental Protection Agency (EPA)
  - .1 EPA 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.
- .4 South Coast Air Quality Management District (SCAQMD) California State
  - .1 SCAQMD Rule 1168-03: Adhesives and Sealants.

#### 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.
  - .2 Samples for Verification: For each joint sealant product, for each colour selected.
- .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 Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit samples of each substrate or adjacent material that will be in contact with or affect joint sealants. Current manufacturer test data of products on matching substrates will be acceptable.
- .5 Adhesion: Use ASTM C719 and ASTM C794 to determine requirements for joint preparation, including cleaning and priming.
- .6 Compatibility: Use ASTM C1087 to determine materials forming joints and adjacent materials do not adversely affect sealant materials and do not affect sealant colour.
- .7 Stain Testing: Use ASTM C510, ASTM C1248, or ASTM D2203 to verify non-staining characteristics of proposed sealants on specified substrates.
- .8 Pre-construction manufacturer laboratory testing is not required when sealant manufacturer can furnish data acceptable to Consultant based on previous testing for materials matching those of the 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 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.



- .5 Stain Test Characteristics: Where sealants are required to be non-staining, provide sealants tested per ASTM C1248 as non-staining on porous joint substrates specified.

## 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: Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT; SWRI validated.
  - .1 Basis of Design Product: Tremco Spectrem 2.
  - .2 Volatile Organic Compound (VOC) Content: 50 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.
- .3 SJS#3: Single-Component, Nonsag, Non-Staining, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT.
  - .1 Basis of Design Product: Tremco Spectrem 3.
  - .2 Volatile Organic Compound (VOC) Content: 20 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.
- .4 SJS#4: Multi-Component, Nonsag, Non-Staining, Field-Tintable Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT.
  - .1 Basis of Design Product: Tremco Spectrem 4-TS.
  - .2 Volatile Organic Compound (VOC) Content: 20 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.
- .5 SJS#5: 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: Single-Component, Nonsag, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.
- .1 Basis of Design Product: Tremco Vulkem 116.
  - .2 Volatile Organic Compound (VOC) Content: 60 g/L maximum.
  - .3 Colour: As selected by Consultant from manufacturer's standard line.
- .4 UJS#4: 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.
- .5 UJS#5: Immersible, Multi-Component, Pourable, Traffic-Grade Polyurethane Joint Sealant: ASTM C920, Type M, Grade P, Class 35, Use T, O, and I.
- .1 Basis of Design Product: Tremco Vulkem 445SSL.
  - .2 Tensile Strength, ASTM D412: 1.7 MPa, at 100 percent elongation.
  - .3 Tear Strength, ASTM D412: 6.1 kN/m.
  - .4 Adhesion to Concrete, After Water, ASTM C794: 4.4 kN/m
  - .5 Hardness, ASTM C661: 40 durometer Shore A, minimum.
  - .6 Accelerated Weathering, ASTM C793: Pass.
  - .7 Volatile Organic Compound (VOC) Content: 106 g/L maximum.
  - .8 Colour: As selected by Consultant from manufacturer's standard line.
- .6 UJS#6: Multi-Component, Non-sag, Polyurethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, Use I.
- .1 Basis of Design Product: Tremco Dymeric 240 FC.
  - .2 Volatile Organic Compound (VOC) Content: 0 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 Joint 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 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 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.
- .7 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 SJS#1: Single-component neutral-curing low-modulus silicone sealant.
  - .2 UJS#1: Single-component non-sag urethane sealant.
  - .3 Compatibility: Compatible with air barrier components specified in Section 07 27 13.
- .2 Exterior construction joints in cast-in-place.
  - .1 SJS#1, SJS#2: Single-component neutral-curing non-staining silicone sealant.
  - .2 SJS# 4: Multi-component neutral-curing non-staining field tintable silicone sealant.
  - .3 UJS#1, UJS#2, UJS#3: Single-component non-sag urethane sealant.
- .3 Exterior movement joints in concrete unit masonry.
  - .1 SJS#1, SJS# 2: Single-component neutral-curing non-staining silicone sealant.
  - .2 SJS#4: Multi-component neutral-curing non-staining field tintable silicone sealant.
  - .3 UJS#1, UJS#2, UJS#3: Single-component non-sag urethane sealant.
- .4 Exterior movement joints in brick masonry.
  - .1 SJS#1, SJS# 2: Single-component neutral-curing non-staining silicone sealant.
  - .2 SJS#4: Multi-component neutral-curing non-staining field tintable silicone sealant.
  - .3 UJS#1, UJS#2, UJS#3: Single-component non-sag urethane sealant.
- .5 Exterior concealed watertight joints in cladding systems.
  - .1 SJS#1: Single-component neutral-curing silicone sealant.
  - .2 UJS#1, UJS#2: Single-component non-sag urethane sealant.
- .6 Exterior joints between different materials listed above.
  - .1 SJS#1, SJS# 2: Single-component neutral-curing non-staining silicone sealant.
  - .2 SJS#4: Multi-component neutral-curing non-staining field tintable silicone sealant.
  - .3 UJS#1, UJS#2: Single-component non-sag urethane sealant.
- .7 Exterior perimeter joints at frames of doors, windows, storefront frames, curtain wall frames, and louvers.
  - .1 SJS#1, SJS# 2: Single-component neutral-curing non-staining silicone sealant.
  - .2 SJS#4: Multi-component neutral-curing non-staining field tintable silicone sealant.
  - .3 UJS#1, UJS#2: Single-component non-sag urethane sealant.
- .8 Exterior joints within aluminum storefront framing, curtain walls, and window systems:
  - .1 SJS#1, SJS# 2: Single-component neutral-curing non-staining silicone sealant.

- .9 All other exterior non-traffic joints.
  - .1 SJS#1, SJS# 2: Single-component neutral-curing non-staining silicone sealant.
  - .2 SJS#4: Multi-component neutral-curing non-staining field tintable silicone sealant.
  - .3 UJS#1, UJS#2: Single-component non-sag urethane sealant.

- .10 Exterior horizontal traffic and traffic isolation joints:
  - .1 UJS# 4, UJS#5: 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, UJS#2: Single-component non-sag urethane sealant.
- .2 Interior movement joints in interior unit masonry.
  - .1 UJS#1, UJS#2: 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.
  - .2 LJS#1: Siliconized acrylic latex
- .5 Interior sanitary joints between plumbing fixtures, food preparation fixtures, and casework and adjacent walls, floors, and counters.
  - .1 SJS#5: Mildew-Resistant, Single-Component, nonsag, acid-curing silicone joint sealant.
- .6 Interior traffic joints in floor and between floor and wall construction.
  - .1 UJS# 4, UJS#5: 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.

End of Section

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## 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 81 80 | Mortarless Concrete Siding |
| .3 | Section 04 22 00 | Concrete Unit Masonry      |
| .4 | Section 05 12 23 | Structural Steel           |
| .5 | Section 07 84 00 | Firestopping               |
| .6 | Section 07 92 00 | Joint Sealants             |
| .7 | Section 09 21 16 | Gypsum Board               |
| .8 | Section 09 51 13 | Acoustic Panel Ceilings    |
| .9 | Section 09 53 00 | Acoustical Suspension      |

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A36/A36M-19 Standard Specification for Carbon Structural Steel
  - .2 ASTM A283/A283M-18 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
  - .3 ASTM A786/A786M-15 Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
  - .4 ASTM B209-14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - .5 ASTM B221-14 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - .6 ASTM D412-16 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  - .7 ASTM D2000-18 Standard Classification System for Rubber Products in Automotive Applications
  - .8 ASTM D2240-15e1 Standard Test Method for Rubber Property—Durometer Hardness
  - .9 ASTM D2628-91(2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- .2 Aluminum Association (AA)
  - .1 DAF-45, Designation System for Aluminum Finishes.
- .3 Underwriters Laboratories (UL)
  - .1 UL 263 (2011) Standard for Fire Tests of Building Construction and Materials
  - .2 UL 2079 (2015) Standard for Tests for Fire Resistance of Building Joint Systems

### 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 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<sup>2</sup> uniform load and 136 kilogram concentrated load with maximum 82.7 kN/m<sup>2</sup> 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 Fire rated joint covers shall have been tested by an independent, nationally recognized testing and listing entity in accordance with ANSI/UL No. 263, ASTM E119, UL 2079, or ASTM E1966, including hose stream test, where applicable, at the full rated period. Covers shall be listed with an independent, nationally recognized testing and listing entity. Fire rating shall be 2 hours.
- .5 Design exterior expansion joint cover assemblies to accommodate joint movements within service temperature range of -35 ° C to 65 ° C.

#### 1.6 Quality Assurance

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Submit certificates, copies of independent test reports, or research reports showing compliance with fire resistance rating and other specified performance requirements.

#### 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.

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 Aluminum: ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 6061-T6, sheet and plate.
- .2 Stainless Steel brake formed or roll formed sections: to ASTM A167, type 304.
- .3 Protect aluminum surfaces in contact with cementitious materials with heavy metal free high solids primer or chromate conversion coating.



- .4 Extruded Preformed Seals: Single or multilayered rubber extrusions as classified under ASTM D2000, designed with or without continuous, longitudinal, internal baffles and formed to fit compatible frames, in colour as selected by Consultant from manufacturer's standard colours.
- .5 Vinyl-acrylic extrusions: high impact vinyl acrylic in integral colour selected by Owner's Representative from manufacturer's standard range.
- .6 Silicone: ASTM D2000 extruded elastomeric flat seal.
- .7 Santoprene: UV resistant grade.
  - .1 Black extruded wall and ceiling joint cover face seals.
  - .2 Neutral extruded wall and ceiling joint cover back seals.
- .8 Fire Barrier: Metaflex patented single package membrane type fire barrier required for indicated fire resistance, or approved equal. Asbestos not acceptable.
- .9 Flame Sealant: Metacaulk 990, or approved equal; sealant shall permit joint movement and shall, upon exposure to heat, increase in volume to resist penetration of fire through voids in construction.
- .10 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 Fabrication

- .1 Expansion Joint Assembly: Expansion joint assemblies shall be Emseal Emshield or Construction Specialties Thinline Series fire rated and non-fire rated as required, or equivalent product by other manufacturer approved by Consultant. Width as indicated on drawings.
- .2 Extruded Aluminum Cover Assemblies: Provide continuous extruded aluminum frame assemblies of suitable profile to receive free floating cover plate. Furnish depth and configuration to suit type of construction with no exposed fasteners. All aluminum in contact with concrete to have zinc chromate finish, exposed aluminum to be finished as noted free of gaskets and fillers assemblies to be capable of +50% expansion and contraction without loss of cover. Floor covers must withstand minimum 227 kg point load without damage or permanent deformation unless otherwise indicated.
- .3 Fabricate components in longest practical lengths.
- .4 Prefabricate transition pieces and corner fittings as required.
- .5 Miter and weld joints as applicable.
- .6 Resilient filler strip shall be key-locked or bonded to aluminum retainers.
- .7 Fabricate fire rated expansion joint cover assemblies as detailed. Provide centering bars, sealing washers, gaskets, splice covers, and closures as necessary for complete installation.
- .8 Fabricate fire barrier and provide fire-resistant sealant as required for fire-resistant installations.

- .9 .Provide necessary and related parts, devices, water barrier, anchors, form clips, and other items required for water-resistant and fire-resistant installations.
- .10 Provide corners, tees, transitions, curb risers, etc. assembled with connection mitered and secured to ensure proper fit and alignment as applicable.
- .11 Cover plates shall have serrated exposed surface.
- .12 Shop assemble components and package with anchors and fittings. Provide components in single lengths where possible; minimize site splicing.

### 2.3 Finishes and Colours

- .1 Metal Finishes:
  - .1 Comply with NAAM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products are fabricated. Protect finishes on exposed surfaces with protective covering before shipment.
  - .2 Factory-Primed Concealed Surfaces: Protect concealed metal surfaces that will be in contact with concrete and masonry surfaces when installed by applying a shop coat of manufacturer's standard primer to contact surfaces. Provide minimum dry film thickness of 2.0 mils
  - .3 Aluminum surfaces exposed to view: Mill finish for floor system and prime painted ready for field painting for wall and ceiling systems.
  - .4 Stainless Steel: Satin finish.

## 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 Install expansion joint covers. Align work plumb, level, and flush with adjacent surfaces. Rigidly anchor to substrate. Make allowances for change in joint size due to difference between installation and building operating temperatures.
- .2 Provide anchorage devices and fasteners where necessary for securing expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.
- .3 Perform all cutting, drilling and fitting required for installation of expansion joint covers. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels.
- .4 Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
- .5 Set floor covers at elevations to be flush with adjacent finished floor materials. If necessary, shim to level, but ensure base frames have continual support to prevent rocking and vertical deflection.
- .6 Locate wall and ceiling covers in continuous contact with adjacent surfaces. Securely attach in place with all required accessories.
- .7 Coordinate installation of panel to panel expansion joint assemblies at acoustic panel ceilings with Section 09 51 13 and 09 53 00.
- .8 Locate anchors at interval recommended by manufacturer, but not less than 75 mm from each end and not more than 610 mm on centres.
- .9 Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames.
- .10 Fire Rated Joint Covers: Install fire rated covers to requirements of applicable fire rated design. Install fire barriers and flame sealant as required.
- .11 Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- .12 Vulcanize or heat-seal all field splice joints in preformed seal material to provide watertight joints using manufacturer's recommended procedure.
- .13 Apply manufacturer's approved adhesive, epoxy, or lubricant-adhesive to both frame interfaces prior to installing preformed seal.
- .14 Seal transitions in accordance with manufacturer's instruction.

### 3.5 Adjusting

- .1 Adjust joint cover to freely accommodate joint movement.

- .2 Protect cover plates during construction. Remove shop protection prior to final inspection.

### 3.6 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Do not remove strippable protective material until finish work in adjacent areas is complete. When protective material is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

End of Section

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## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 04 81 90 Mortarless Concrete Siding
- .2 Section 05 41 00 Structural Metal Steel Framing
- .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 71 13 Automatic Door Operators
- .8 Section 08 80 05 Glazing
- .9 Section 09 21 16 Gypsum Board
- .10 Section 09 22 16 Non-Structural Metal Framing
- .11 Section 09 91 13 Exterior Painting
- .12 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM C177-19 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
  - .3 ASTM C518-17 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 C591-20 Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
  - .6 ASTM C1289-20 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
  - .7 ASTM E90-09 (2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .8 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .9 ASTM E2074-00e1 Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies (Withdrawn 2007)
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99 Ready-Mixed Organic Zinc-Rich Coating.
  - .2 CGSB 41-GP-19M-84 Rigid Vinyl Extrusions for Windows and Doors.
- .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 ULC 104-2015 Standard Method for Fire Tests of Door Assemblies.
  - .2 ULC 105- 2016 Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.
  - .3 ULC 106-2015 Standard Method for Fire Tests of Window and Glass Block Assemblies
  - .4 ULC 701-2011 Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .5 ULC 702.1- 2014 Standard for Thermal Insulation, Mineral Fibre, for Buildings.
  - .6 ULC 704-11 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 80-2019 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, ASTM E2074 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/m<sup>3</sup> minimum sanded to required thickness. ULC approved.
  - .2 Exterior Doors: Polyisocyanurate: Rigid, modified polyisocyanurate, closed cell board. Density; 32 kg/m<sup>3</sup> minimum, thermal values; RSI 2.17 minimum, in accordance with ASTM C591 (un-faced) or ASTM C1289 (faced).
  - .3 Temperature Rise Rated (TRR): Core composition to provide the fire-protection rating and limit the temperature rise on the unexposed side of door to 250°C at 30 or 60 minutes, as determined by governing building code requirements. Core to be tested as part of a complete door assembly, in accordance with ULC 104 and shall be listed by a nationally recognized testing agency having a factory inspection service.
- .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 Frame Thermal Breaks: Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19MA.
- .4 Door silencers: single stud rubber/neoprene type.
- .5 Fiberglass: to ULC 702, loose batt type, minimum density of 24 kg/m<sup>3</sup>.
- .6 Metallic paste filler: to manufacturer's standard.



.7 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 Compliance: 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 Prior to installation, remove temporary shipping spreaders.
- .4 Prior to installation, the area of floor on which the frame is to be installed, and within the path of the door swing, shall be checked and corrected for flatness.
- .5 Check door and frame product for correct size, swing, rating and opening number.
- .6 The supplier shall be advised of any discrepancies prior to installation.
- .7 Set frames plumb, square, level and at correct elevation.
- .8 Secure anchorages and connections to adjacent construction.
- .9 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width. Provide vertical support at centre of head for openings exceeding 1200 mm in width.

- .10 During the setting of frame product, check and correct as necessary for opening width, opening height, square, alignment, twist and plumb, in accordance with the CSDMA "Recommended Dimensional Standards for Commercial Steel Doors and Frames".
- .11 Remove wood spreaders after frames have been built-in.
- .12 Make allowance for deflection to ensure structural loads are not transmitted to frame product.
- .13 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.
- .14 Adjust operable parts for correct clearances and function.
- .15 Install louvers, glazing and door silencers.
- .16 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.
- .17 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

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## 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 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D1761-12 Standard Test Methods for Mechanical Fasteners in Wood
  - .2 ASTM D5456-18 Standard Specification for Evaluation of Structural Composite Lumber Products
  - .3 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  - .4 ASM E413-16 Classification for Rating Sound Insulation
  - .5 ASTM E1332-16 Standard Classification for Rating Outdoor-Indoor Sound Attenuation
  - .6 ASTM E2235-04(2012) Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods
- .2 American National Standards Institute (ANSI):
  - .1 ANSI A208.1 - Standard for Particleboard.
- .3 CSA Group (CSA)
  - .1 CSA O115-M1982 (R2001) Hardwood and Decorative Plywood.
  - .2 CSA O132.2 Series-90 (R2003) Wood Flush Doors
- .4 Canadian General Services Board (CGSB)
  - .1 CAN/CGSB-71.19 Adhesive, Contact, Sprayable
  - .2 CAN/CGSB-71.20 Adhesive, Contact, Brushable
- .5 Underwriters Laboratories Canada (ULC)
  - .1 ULC 104-2015 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-13 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 shop drawings and door schedules.
  - .1 Indicate door types, sizes, thickness, and details of construction.

#### 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.

#### 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 (2) 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 0132.2-M.
- .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.
- .4 Door thickness: not less than 45mm.
- .5 Adhesive: To CSA 0132.2, Type II, water resistant, for interior use.

## 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 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 CAN/CSA-0132.2 Series, Appendix A.
- .3 Adjust hardware for correct function.
- .4 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 04 81 80 Mortarless Concrete Siding
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 06 20 00 Finish Carpentry
- .4 Section 07 21 13 Building Insulation
- .5 Section 07 26 00 Vapour Retarders
- .6 Section 07 27 00 Vapour Permeable Air Barrier
- .7 Section 07 27 15 Modified Bituminous Sheet Air Barriers.
- .8 Section 07 92 00 Joint Sealants.
- .9 Section 08 71 10 Finishing Hardware
- .10 Section 08 80 05 Glazing
- .11 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM B221-14 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - .2 ASTM B456-17 Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
  - .3 ASTM B633-19 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
  - .4 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - .5 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
  - .6 ASTM E1105-15 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
  - .7 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40-97 Anticorrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-79.1-M91 Insect Screens
- .3 CSA Group (CSA)
  - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights
  - .2 CSA A440S1-09 Canadian Supplement to AAMA/WDMA/CSA 101/1.S.2/A440, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights
  - .3 CSA-A440.4-07(R2012) Window, Door, and Skylight Installation
  - .4 CSA-A440.2-14/A440.3-14 Fenestration energy performance/User guide to CSA A440.2-14, Fenestration energy performance.
  - .5 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 Aluminum Association (AA), Designation System for Aluminum Finishes (2000)
- .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 Submit shop drawings.
  - .1 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes, fasteners, and caulking. Indicate location of manufacturer's nameplates.
  - .2 Submit point to point wiring diagrams for electric strikes.
  - .3 Submit a complete finishing hardware schedule for each door.
- .3 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.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials and assemblies comply with specified performance characteristics and criteria and physical requirements.
- .5 Closeout Submittals: Provide operation and maintenance data for doors, windows and hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### 1.5 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 or storefront 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.

#### 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.

### 1.8 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 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/ft<sup>2</sup>, 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.

### 1.9 Sequencing

- .1 Co-ordinate work of this Section with air barrier placement, flashing placement, and other related components or materials.

### 1.10 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

### 1.11 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.
- .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 from 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 Manufacturers

- .1 Manufacture: The following manufacturers are considered as acceptable 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 Kawneer
  - .5 Oldcastle
  - .6 Windspec
  - .7 Zimmcors

### 2.2 Materials

- .1 Materials: to AAMA/WDMA/CSA 101/I.S.2/A440 supplemented as follows:
  - .1 All doors, windows and storefront framing shall be by same manufacturer.
  - .2 Sash: aluminum, thermally broken.
  - .3 Main frame: aluminum, thermally broken.
  - .4 Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.
- .2 Aluminum Extrusions: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish and not less than 1.8 mm wall thickness at any location for the main frame and complying with ASTM B221: 6063-T6 alloy and temper.
- .3 Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components. Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials. Stainless steel where exposed.
- .4 Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- .5 Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- .6 Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- .7 Sealant: For sealants required within fabricated systems, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- .8 Glass: As scheduled and as specified in Section 08 80 05.

- .9 Exterior aluminum sills and facings: extruded aluminum and brake formed aluminum sheet metal of type and size to suit job conditions; minimum 3 mm thick, complete with joint covers, jamb drip deflectors, chairs, anchors and anchoring devices.

## 2.3 Window and Screen Types

- .1 Exterior Windows:
  - .1 Kawneer 518 Isoport thermally broken window frames.
  - .2 127 mm deep profile.
  - .3 25 mm sealed, glazed units as specified in Section 08800.
  - .4 Install with high performance thermally broken sill receptor.
  - .5 Operable units where indicated.
    - .1 Casement: opening out, with removable double glazing, insulating glass. Anderberg friction arms and spring loaded locking device to automatically lock window in closed position. Maximum opening 100 mm. Casement units to be compatible with fixed window framing.
    - .2 Screens: to CAN/CGSB-79.1.
      - .1 Insect screening mesh: count 18 x 16.
      - .2 Fasteners: tamper proof.
      - .3 Screen frames: aluminum, colour to match window frames.
    - .3 Spandrel Panel
      - .1 1" insulated panel with aluminum on both sides.
      - .2 Colour of Aluminum to match window mullion.
- .2 Entrance Framing:
  - .1 Exterior Units: Thermally Broken Storefront Framing: thermally broken, inside glazed.
    - .1 Classification rating: to CSA-A440/A440.1.
    - .2 Air Tightness: A3.
    - .3 Water tightness: B3.
    - .4 Wind load resistance: C3.
    - .5 Surface condensation control: compliant with standard CSA-A440.2/A440.3.
    - .6 Forced Entry: Pass test for resistance to forced entry.
    - .7 Basis of Design: Kawneer 451 T series
  - .2 Interior Units: Non-Thermally Broken Storefront Framing.
    - .1 Basis of Design: Kawneer 451 series
  - .3 Depth of framing units as indicated or as required by engineered design.

## 2.4 Doors

- .1 Interior Doors
  - .1 To size indicated on schedules and drawings.
  - .2 Medium stile with intermediate horizontal rails where detailed.
  - .3 Reinforce doors for continuous hinges.
  - .4 Rails and stiles to be 90 mm ± wide, bottom rail 165 mm ± high. Frame 45 mm thick.
  - .5 Door members to be 3.0 mm nominal thickness. Glazing mouldings to be lock in type with glazing gaskets.
  - .6 Interior glass: clear, 6.0 mm thick, tempered specified in Section 08 80 05.
- .2 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 Clear anodized finish.
- .7 Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
- .8 Provide adjustable glass jacks to help center the glass in the door opening.
- .9 Provide flush stops for insulating glass in exterior doors.
- .10 Exterior glass: 25 mm sealed units, insulating glass specified in Section 08 80 05.

## 2.5 Door Hardware

- .1 Prepare doors and frames for hardware specified in Hardware Schedule:

## 2.6 Glazing

- .1 Glaze doors, windows and screens in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- .2 Glass: As scheduled and as specified in Section 08 80 05– Glazing.

## 2.7 Fabrication

- .1 Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 supplemented as follows:
  - .1 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
  - .2 Face dimensions detailed are maximum permissible sizes.
  - .3 Brace frames to maintain squareness and rigidity during shipment and installation.
  - .4 Finish steel clips and reinforcement with shop coat primer to CAN/CGSB-1.40.

## 2.8 Air Barrier and Vapour Retarder

- .1 Equip frames with site 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.

## 2.9 Aluminum Finishes

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
- .2 Kawneer Permadize (50% PVDF), AAMA 2604, Fluoropolymer Coating; colour: Black

## 2.10 Isolation Coating

- .1 Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 0.762 mm thickness per coat.

## PART 3 EXECUTION

### 3.1 Window and Screen Installation

- .1 Install in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, shop drawings and manufacturer's instructions.
- .2 Arrange components to prevent abrupt variation in colour.
- .3 Erect and secure window units in prepared openings, plumb and square, free from warp, twist or superimposed loads.
- .4 Secure work accurately to structure and in a manner not restricting thermal movement of materials.
- .5 Provide shims under sill frame at setting block locations, and as recommended by window frame manufacturer.
- .6 Conceal all anchors and fitments. Exposed heads of fasteners not permitted.
- .7 Mechanically fasten flexible membrane air and vapour seal to window frame with continuous aluminum channel as detailed on drawings.
- .8 Maintain dimensional tolerances after installation. Maintain alignment with adjacent work.
- .9 Isolate aluminum surfaces from dissimilar materials adjacent after installation, using coating of bituminous paint.
- .10 Seal framing joints with butyl polyisobutylene or silicone sealant.
- .11 Install glazing splines and gaskets uniformly, with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.
- .12 Continuously and uniformly compress glazing splines and gaskets during installation.

### 3.2 Sill Installation

- .1 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Use one piece lengths at each location.
- .2 Cut sills to fit window opening.
- .3 Secure sills in place with anchoring devices located at ends and evenly spaced 600 mm on centre in between.
- .4 Fasten joint cover plates and drip deflectors with self-tapping stainless steel screws.

- .5 Maintain 6 to 9 mm space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 to 6 mm space at each end.

### 3.3 Door Installation

- .1 Erect and secure aluminum framing plumb, square and level, free from warp, twist or superimposed loads.
- .2 Use concealed fastenings where possible. Where concealed fasteners are not feasible, use flat headed screws in countersink holes. Exposed bolt or nut heads are not permitted.
- .3 Match exposed fastenings with finish or surfaces on which they occur.
- .4 Assess each component for appearance and colour. Any variations in appearance and colour will not be permitted.
- .5 Secure work adequately and accurately to the structure in the required position.
- .6 Install and adjust hardware in accordance with hardware templates and manufacturer's instructions.
- .7 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.
- .8 Coordinate installation of electrically operated hardware with Electrical and Security subcontractors.

### 3.4 Caulking

- .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
- .2 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Consultant.

### 3.5 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.

### 3.6 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.



- .2 Wash down exposed interior metal surfaces using a solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
- .3 Clean exposed exterior non-metal surfaces as recommended by manufacturer of the material.
- .4 Clean interior and exterior surfaces as soon as adjacent construction which might soil surfaces, is completed.

End of Section

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## 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 50 00 Aluminum Doors, Windows and Screens

### 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 A156.16-2013 Auxiliary Hardware.
  - .15 ANSI/BHMA A156.18-2012 Materials and Finishes.
  - .16 ANSI/BHMA A156.19-2013 Power Assist and Low Energy Power - Operated Doors.
  - .17 ANSI/BHMA A156.21-2014 Thresholds.
  - .18 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:
  - .1 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 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.
- .5 Furnish the following:
  - .1 Key Management Software: KW-SSN1. Confirm requirement of new or upgraded software with 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 The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures for coordinating all portions of work under the Contract, unless the Contract Documents give other specific instructions.
  - .2 Conduct periodic inspections to ensure that door frames are installed plumb, level and square with verification by installer prior to installation of doors and door hardware.
  - .3 Hardware supplier to attend site meetings as required to ensure proper execution of the guidelines set forth herein.
  - .4 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

**Rivett Architectural Hardware Ltd.**

**Door Listing**

**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

<b>Door Number</b>	<b>Set Number</b>
119	1
119A	2
120	3
120A	4
121	3
122	5
122A	6
122B	6
122C	7
122D	8
122E	9
123	10
A1-101	11
A1-101A	12
A1-101B	12
A1-102A	13
A1-102B	14
A1-102C	15
A1-103	16
A1-103A	17
A1-103B	18
A1-104	13
A1-105	19
A1-106	20
A1-107	16
A1-107A	17
A1-107B	18
A1-108	21
A1-109	22
A1-110	14
A1-111	16
A1-111A	23
A1-111B	23
A1-112	11
A1-112A	2
C103	24
C103A	25



**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 1**

1 SINGLE DR # 119 EXTERIOR FROM VESTIBULE 119

LHR

1 - 915 x 2150 x 45 x ALD x ALF

weatherstripping/threshold by door supplier

**Qty**

: :	1 EA SWING CLEAR ROTON HINGE	780-210HD X 83"-ALUM
: :	1 EA PANIC DEVICE	35AEO X 626
: :	1 EA DOOR PULL	12L X 12" X 630
: :	1 EA RIM CYL.	20-021 X 626
: :	1 EA ELECTRIC STRIKE	9600 X 630
: :	1 EA CARD READER	BY SECURITY
: :	1 EA DOOR OPERATOR	SW200i X SINGLE HSG X 628
	110v to head of f rame by EC	
: :	1 EA WALL MOUNT SWITCH	#6R-3 X H/C PUSH X 630
	single gang junction boxes and low voltage wiring to push buttons by EC	
: :	1 EA REMOTE WALL MOUNT SWITCH	#6R-3 REMOTE-C/W RECEV. X 630
: :	1 EA ALUMINUM MOUNTING POST	#CM-42-BSU-CLR
	install on exterior pad (push button is wireless)	
: :	1 EA CONCEALED STOP	104S X 630
: :	1 EA SWEEP	W13S X 3'-0" X 628
: :	1 EA LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 2**

1 SINGLE DR # 119A VESTIBULE 119 FROM LOBBY C103 LHR  
1 SINGLE DR # A1-112A VESTIBULE A1-112 FROM CORRIDOR A1-C102 LHR

2 - 965 x 2134 x 45 x HMD x PSF

**Qty**

:	:	6	EA	HINGE		BB1168-114 X 101- 626
:	:	2	EA	PANIC DEVICE		BE98L X 996L X LHR X 628
:	:	1	EA	ELECTRIC STRIKE		9600 X 630
				electric strike @ 119A only		
:	:	2	EA	DOOR OPERATOR		SW200i X SINGLE HSG X 628
				110v to head of frame by EC		
:	:	4	EA	WALL MOUNT SWITCH		#6R-3 X H/C PUSH X 630
				single gang junction boxes and low voltage wiring to push buttons by EC		
:	:	2	EA	CONCEALED STOP		104S X 630
				template installation to stop door at 95 degrees		
:	:	4	EA	KICKPLATE		190S X 152 X 914 X 630
				install on both sides of door		
:	:	2	EA	LABOUR CHARGE		LABOUR - INSTALL OPER. & E/ST

**Set # 3**

1 SINGLE DR # 120 LOBBY C103 TO MEETING RM 1 120 LH  
1 SINGLE DR # 121 LOBBY C103 TO MEETING RM 2 121 RH

2 - 965 x 2134 x 45 x SCWD x PSF

**Qty**

:	:	6	EA	HINGE		BB1168-114 X 101- 626
:	:	2	EA	OFFICE LOCKSET		ALX53PD X SAT X ASA X 626
:	:	2	EA	KICKPLATE		190S X 152 X 914 X 630
:	:	2	EA	FLOOR STOP		243F X 626

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 4**

1 PAIR OF DRS # 120A MEETING RM 1 120 FROM STORAGE 120A LHR/RHR

1 - PAIR OF 965 x 2134 x 45 x SCWD x PSF

**Qty**

: :	6 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	STOREROOM LOCKSET	ALX80PD X SAT X ASA X 626
		install on RHR door	
: :	2 EA	FLUSH BOLT	283D X 626
		install in edge of LHR door	
: :	1 EA	ASTRAGAL	W8 X 7'-0" X 628

**Set # 5**

1 SINGLE DR # 122 LOBBY C103 TO RECEPTION 122 RH

1 - 965 x 2134 x 45 x SCWD x PSF

**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	OFFICE LOCKSET	ALX53PD X SAT X ASA X 626
: :	1 EA	CLOSER	4040XP X 689
: :	2 EA	KICKPLATE	190S X 152 X 914 X 630
: :	1 EA	FLOOR STOP	243F X 626

**Set # 6**

1 SINGLE DR # 122A RECEPTION 122 TO OFFICE 2 122A RH

1 SINGLE DR # 122B RECEPTION 122 TO OFFICE 1 122B RH

2 - 965 x 2134 x 45 x SCWD x PSF

**Qty**

: :	6 EA	HINGE	BB1168-114 X 101- 626
: :	2 EA	OFFICE LOCKSET	ALX53PD X SAT X ASA X 626
: :	2 EA	KICKPLATE	190S X 152 X 914 X 630
: :	2 EA	FLOOR STOP	243F X 626

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 7**

1 SINGLE DR # 122C RECEPTION 122 TO STORAGE/FILES 122C RH

1 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	STOREROOM LOCKSET	ALX80PD X SAT X ASA X 626
: :	1 EA	KICKPLATE	190S X 152 X 914 X 630
: :	1 EA	FLOOR STOP	243F X 626

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**Set # 8**

1 SINGLE DR # 122D RECEPTION 122 TO HEALTH 122D RH

1 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	LATCHSET	ALX10S X SAT X ASA X 626
: :	1 EA	KICKPLATE	190S X 152 X 914 X 630
: :	1 EA	FLOOR STOP	243F X 626

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**Set # 9**

1 SINGLE DR # 122E HEALTH 122D TO WASHROOM 122E LH

1 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	PRIVACY SET	ALX40S X SAT X ASA X 626
: :	1 EA	KICKPLATE	190S X 152 X 914 X 630
: :	1 EA	FLOOR STOP	243F X 626

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**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 10**

1 SINGLE DR # 123 LOBBY C103 TO UNIVERSAL W/RM 123

RH

1 - 965 x 2134 x 45 x SCWD x PSF

**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	STOREROOM LOCKSET	ALX80PD X SAT X ASA X 626
: :	1 EA	ELECTRIC STRIKE	1600CLB X 630
		low voltage wiring to strike by EC	
: :	1 EA	DOOR OPERATOR	SW200i X SINGLE HSG X 628
		110v to head of f rame by EC	
: :	1 EA	DOOR OPERATOR ADD ON	SW200i ADD FOR INSWING ARM
: :	1 EA	OCCUPIED & EMERGENCY KIT RECES	#OCC-1-EMR-R KIT
		single gang junction boxes and all low voltage wiring to boxes by EC	
: :	1 EA	LABOUR CHARGE ( STD BUTTON)	LABOUR - INSTAL OP-OCC1-ES-EMR
: :	1 EA	KICKPLATE	190S X 152 X 914 X 630
: :	1 EA	FLOOR STOP	243F X 626

**Set # 11**

1 SINGLE DR # A1-101 EXTERIOR FROM VESTIBULE A1-101

LHR

1 SINGLE DR # A1-112 EXTERIOR FROM VESTIBULE A1-112

LHR

2 - 965 x 2150 x 45 x ALD x ALF

weatherstripping/threshold by door supplier

**Qty**

: :	6 EA	HINGE	BB1199-114 X 101-NRP- 630
: :	2 EA	PANIC DEVICE	35AEO X 626
: :	2 EA	DOOR PULL	12L X 12" X 630
: :	2 EA	RIM CYL.	20-021 X 626
: :	2 EA	ELECTRIC STRIKE	9600 X 630
: :	2 EA	CARD READER	BY SECURITY
: :	2 EA	DOOR OPERATOR	SW200i X SINGLE HSG X 628
		110v to head of frame by EC	
: :	4 EA	WALL MOUNT SWITCH	#6R-3 X H/C PUSH X 630
		single gang junction boxes and low voltage wiring to push buttons by EC	
: :	2 EA	CONCEALED STOP	104S X 630
: :	2 EA	SWEEP	W13S X 4'-0" X 628
: :	2 EA	LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 12**

1 SINGLE DR # A1-101A VESTIBULE A1-101 FROM CORRIDOR A1-C101 LHR  
1 SINGLE DR # A1-101B VESTIBULE A1-101 FROM EARLY ON A1-102 RHR

2 - 965 x 2134 x 45 x HMD x PSF

**Qty**

: :	6 EA HINGE	BB1168-114 X 101- 626
: :	1 EA PANIC DEVICE	BE98L X 996L X LHR X 628
: :	1 EA PANIC DEVICE	BE98L X 996L X RHR X 628
: :	2 EA ELECTRIC STRIKE	9600 X 630
: :	2 EA CARD READERS	BY SECURITY
: :	2 EA DOOR OPERATOR	SW200i X SINGLE HSG X 628
	110v to head of frames by EC	
: :	2 EA WALL MOUNT SWITCH	#6R-3 X H/C PUSH X 630
	single gang junction boxes and low voltage wiring to push buttons by EC	
: :	4 EA KICKPLATE	190S X 152 X 914 X 630
: :	2 EA CONCEALED STOP	104S X 630
	template installation to stop doors at 95 degrees	
: :	2 EA LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST

**Set # 13**

1 SINGLE DR # A1-102A EARLY ON A1-102 TO OFFICE A1-102A RH  
1 SINGLE DR # A1-104 CORRIDOR A1-C101 TO OFFICE 3 A1-104 LH

2 - 965 x 2134 x 45 x SCWD x PSF

**Qty**

: :	6 EA HINGE	BB1168-114 X 101- 626
: :	2 EA OFFICE LOCKSET	ALX53PD X SAT X ASA X 626
: :	2 EA KICKPLATE	190S X 152 X 914 X 630
: :	2 EA FLOOR STOP	243F X 626

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 14**

1 SINGLE DR # A1-102B EARLY ON A1-102 TO WASHROOM A1-102B RH  
1 SINGLE DR # A1-110 CORRIDOR C103A TO STAFF W/RM A1-110 RH

2 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	6 EA	HINGE	BB1168-114 X 101- 626
: :	2 EA	PRIVACY SET	ALX40S X SAT X ASA X 626
: :	2 EA	KICKPLATE	190S X 152 X 914 X 630
: :	2 EA	FLOOR STOP	243F X 626

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**Set # 15**

1 SINGLE DR # A1-102C EARLY ON A1-102 FROM IT/SERVER A1-102C LHR

1 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	STOREROOM LOCKSET	ALX80PD X SAT X ASA X 626
: :	1 EA	FLOOR STOP	243F X 626

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**Set # 16**

1 SINGLE DR # A1-103 CORRIDOR A1-C101 TO PRE-SCHOOLERS A1-103 RH  
1 SINGLE DR # A1-107 CORRIDOR A1-C101 TO TODDLERS A1-107 RH  
1 SINGLE DR # A1-111 CORRIDOR A1-C102 TO INFANT A1-111 RH

3 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	9 EA	HINGE	BB1168-114 X 101- 626
: :	3 EA	OFFICE LOCKSET	ALX53PD X SAT X ASA X 626
: :	3 EA	KICKPLATE	190S X 152 X 914 X 630
: :	3 EA	FLOOR STOP	243F X 626

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**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 17**

1 SINGLE DR # A1-103A PRE-SCHOOLERS A1-A103 FROM SHARED W/RM A1- LHR  
1 SINGLE DR # A1-107A TODDLERS A1-107 FROM SHARED W/RM A1-103A RHR  
2 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	6 EA HINGE	BB1168-114 X 101- 626
: :	2 EA DOOR PULL	12L X 12" X 630
: :	2 EA PUSH PLATE	30S X 101 X 406 X 630
: :	2 EA CLOSER	1461 X DEL X 689
: :	4 EA KICKPLATE	190S X 152 X 914 X 630

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**Set # 18**

1 SINGLE DR # A1-103B PRE-SCHOOLERS A1-103 FROM STORAGE A1-103B LHR  
1 SINGLE DR # A1-107B TODDLERS A1-107 FROM STORAGE A1-107A RHR  
2 - 965 x 2134 x 45 x SCW x PSF

---

**Qty**

: :	6 EA HINGE	BB1168-114 X 101- 626
: :	2 EA STOREROOM LOCKSET	ALX80PD X SAT X ASA X 626
: :	2 EA FLOOR STOP	243F X 626

---

**Set # 19**

1 SINGLE DR # A1-105 CORRIDOR A1-C101 TO LAUNDRY/JANITOR A1-105 LH  
1 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	3 EA HINGE	BB1168-114 X 101- 626
: :	1 EA STOREROOM LOCKSET	ALX80PD X SAT X ASA X 626
: :	1 EA KICKPLATE	190S X 152 X 914 X 630
: :	1 EA FLOOR STOP	243F X 626

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**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

**Schedule 91073**  
**Date Sep 23-24**

**Set # 20**

1 SINGLE DR # A1-106 CORRIDOR A1-C101 TO KITCHEN A1-106 RH

1 - 965 x 2134 x 45 x SCWD x PSF x 45min

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**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	CLASSROOM LOCKSET	ALX70PD X SAT X ASA X 626
: :	1 EA	CLOSER	4040XP X 689
: :	1 EA	KICKPLATE	190S X 152 X 914 X 630
: :	1 EA	FLOOR STOP	243F X 626

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**Set # 21**

1 SINGLE DR # A1-108 CORRIDOR A1-C101 TO STAFF ROOM A1-108 LH

1 - 965 x 2134 x 45 x SCWD x PSF

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**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	CLASSROOM LOCKSET	ALX70PD X SAT X ASA X 626
: :	1 EA	KICKPLATE	190S X 152 X 914 X 630
: :	1 EA	FLOOR STOP	243F X 626

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**Set # 22**

1 SINGLE DR # A1-109 CORRIDOR C103A FROM STORAGE A1-109 RHR

1 - 965 x 2134 x 45 x HMD x PSF

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**Qty**

: :	3 EA	HINGE	BB1168-114 X 101- 626
: :	1 EA	STOREROOM LOCKSET	ALX80PD X SAT X ASA X 626
: :	1 EA	FLOOR STOP	243F X 626

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**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**ECOLE ELEMENTAIRE PET - TORONTO, ONTARIO**

Schedule **91073**  
Date **Sep 23-24**

**Set # 23**

1 SINGLE DR # A1-111A INFANT A1-111 TO INFANT CHANGE A1-111A LH  
1 SINGLE DR # A1-111B INFANT A1-111 TO INFANT SLEEP A1-111B RH

2 - 965 x 2134 x 45 x SCWD x PSF

**Qty**

: :	6 EA HINGE	BB1168-114 X 101- 626
: :	2 EA LATCHSET	ALX10S X SAT X ASA X 626
: :	2 EA KICKPLATE	190S X 152 X 914 X 630
: :	2 EA FLOOR STOP	243F X 626

**Set # 24**

1 SINGLE DR # C103 LOBBY C103 FROM CORRIDOR C103A RHR

1 - 965 x 2134 x 45 x HMD x PSF x 45min

**Qty**

: :	3 EA HINGE	BB1168-114 X 101- 626
: :	1 EA PANIC DEVICE	BE98L-F X 996L X RHR X 628
: :	1 EA CLOSER	4040XP X 689
: :	2 EA KICKPLATE	190S X 152 X 914 X 630
: :	1 EA FLOOR STOP	243F X 626

**Set # 25**

1 SINGLE DR # C103A EXIST CORR C102 FROM LOBBY C103 LHR

1 - 965 x 2134 x 45 x HMD x PSF x 45min

**Qty**

: :	3 EA HINGE	BB1168-114 X 101- 626
: :	1 EA PANIC DEVICE	98L-F X 996L X LHR X 628
: :	1 EA RIM CYL.	20-021 X 626
: :	1 EA ELECTRIC STRIKE	9500 X UL X 630
: :	1 EA CARD READER	BY SECURITY
: :	1 EA CLOSER	4040XP X 689
: :	2 EA KICKPLATE	190S X 152 X 914 X 630
: :	1 EA FLOOR STOP	243F X 626

PART 1 GENERAL

1.1 General

- .1 Conform to the requirements of Division 1.

1.2 Related Sections

- .1 Section 08 11 00 Metal Doors and Frames
- .2 Section 08 50 00 Aluminum Doors, Windows and Screens
- .3 Section 08 71 10 Door Hardware

1.3 References

- .1 American National Standards Institute (ANSI)
  - .1 ANSI/BHMA A156.10 -2017 Power Operated Pedestrian Doors
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.108-M89 Bituminous Solvent Type Paint
- .3 Canadian Electrical Code.
- .4 Ontario Building Code.
- .5 Accessibility for Ontarians with Disabilities Act (AODA)

1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings: Submit shop drawings for review indicating all components, required clearances, electrical hook-up and coordination required with the work of related trades.
  - .1 Indicate materials, thickness, anchorage, finishes and operation. Indicate minimum acceptable clearances required.
  - .2 Provide layout for installation of door controller paddles and devices including mounting heights and conduit requirements.
  - .3 Submit wiring diagrams and schematics.
- .3 Provide maintenance data for automatic door operators complete with pertinent details and spare parts list for incorporation into Maintenance Manuals specified in Section 01 78 00 – Closeout Submittals.

1.5 Maintenance

- .1 Instruct Owner in operation and maintenance of door operators.

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.

## 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 General

- .1 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 Manufacturer: This specification is based on Stanley Magic Swing Door Operators. Equivalent products by the following manufacturers are acceptable, subject to approval of the Consultant:
  - .1 Besam,
  - .2 Dorma
  - .3 Dor-O-Matic.
  - .4 Horton Automatics,
  - .5 ABLOY Door Security Solutions Canada

### 2.2 Material/Design/Operation

- .1 Operator
  - .1 Shall be Stanley Magic-Swing, electro-mechanical system sealed against dirt, dust and corrosion in a cast aluminum case and fully lubricated to minimize wear and friction of the moving parts between temperature extremes of -20 ° C and +60 ° C. The entire operator shall be removable from the header as a unit.
  - .2 Size operators to suit weight of doors as indicated on the Door and Frame Schedule.
  - .3 Aluminum header extrusions to be minimum 3.0 mm wall thickness and have a clear anodized finish to match adjacent frames.
  - .4 Back paint all aluminum in contact with steel with bituminous paint to CGSB 1.108 and install PVC isolating strips.
  - .5 All automatic entrance equipment is to comply with all sectors of ANSI A-156.10 and be C.S.A. approved.
- .2 Power Opening: The operator shall open the door with a 1/8 hp DC motor through reduction gears, ball screw actuator and a forged steel rack and pinion. Opening time to back-check (approximately 75°) shall be 1.25-1.6 seconds. The drive train shall have positive, constant engagement. A force no greater than 25 lbF at the lock stile shall stop the door from opening. The operator shall stop the door in the open position by electrically reducing the motor voltage and holding against an adjustable 90° stop.
- .3 Spring Closing: The operator shall close the door by spring energy. Closing speed shall be controlled by employing the motor as a dynamic brake and closing to latch check (approximately 10°) shall be in 3 seconds. Closing through last 10° shall be in 1.5 seconds minimum. The closing spring shall be a helical compression spring, pre-loaded for positive closing action at a low material stress level for long spring life.

- 
- .4 Emergency Release: The operator shall have built in emergency release with controlled spring return to the closed position without manual resetting. While the door is in the emergency release mode, a disconnect switch shall prevent powered operation. No header or jamb mounted stops or cams shall be required for emergency function. Not more than 50 lbF at the lock stile shall be required for emergency use per ANSI A-156.10.
  - .5 Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power.
    - .1 Entrapment Protection: the forces and speeds of power opening, manual opening in both directions of swing, and spring closing in both directions of swing shall conform to the requirements of ANSI-A-156.10.
  - .6 Electrical Control: A solid state, completely enclosed electronic control with quick connect plugs shall incorporate the following features:
    - .1 A "safety plus" - 1 ½ second extension of both operate and safety signals after pressure has been removed from the control mats.
    - .2 A 2 ½ ampere current limiting circuit which limits the opening force of the operator to a maximum of 24 lbF at the lock stile.
    - .3 A "soft-start" motor driving circuit that reduces power to the motor after seven seconds of maintained opening speed.
    - .4 A cam actuated emergency breakout switch to disconnect power to the motor when the door is manually pushed in the emergency direction. The operator shall then automatically reset and power will be resumed.
  - .7 Door Arm
    - .1 Linkage assembly shall provide positive control of door through entire swing; shall permit use on butt hung doors.
    - .2 Header shall be 140 mm wide by 152 mm high extruded aluminum of 3.0 mm thickness. Access to the operator and electronic control box shall be by a full length removable cover, edge rabbited to the header to insure flush fit. Finish to be anodized.
  - .8 Controls
    - .1 Shall be manufacturer's standard Touchless, stainless steel push plate embossed with Handicap Symbol and "WAVE TO OPEN". Size of plate to meet Code requirements.
      - .1 BEA-10MS08U- Black.
    - .2 Provide CSA approved 50 x 100 mm minimum galvanized steel junction box or size to match frames.
    - .3 Control devices shall be weatherproof.
    - .4 Where indicated, install junction box/control on door control pedestal. Pedestal shall be stainless steel, brushed finish purpose made for door operator controls.
      - .1 152 x 152 mm stainless steel pedestal.
      - .2 1220 mm high with sloped top.
      - .3 1 single gang and 2 double gang openings. (Intercom/Card Reader/Door operator). Centrelines between 900mm and 1100mm to meet OBC Barrier Free requirements.

### PART 3 EXECUTION

#### 3.1 Inspection

- .1 Inspect the site to ensure that no defects are present in the completed phases of the work which would result in poor application or installation or cause latent defects of the automatic door equipment.

#### 3.2 Installation

- .1 Install components and wire operators in accordance with Manufacturer's instructions.
- .2 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
- .3 Coordinate installation of operators with other Sections. Supply material to be built into the work when required.
- .4 Install control switches at heights in accordance with referenced standards and reviewed shop drawings.
- .5 Pedestals for automatic door operators shall be mounted on concrete foundations in accordance with manufacturer's recommendations and installation instructions. Exterior air entrained concrete as specified in Section 03 30 00.
- .6 Maintain minimum headroom requirements at doors as indicated on the reviewed shop drawings.
- .7 Adjust door operating components to ensure smooth opening and closing of doors.
- .8 Instruct the Owner in the correct operation, care and maintenance of the door operators.

#### 3.3 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

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## 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 50 00 Aluminum Doors, Windows and Screens
- .4 Section 08 88 13 Fire Resistant Glazing
- .5 Section 10 28 10 Toilet and Bath Accessories

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C162-05 (2015) Standard Terminology of Glass and Glass Products.
  - .2 ASTM C542-05(2017) Standard Specification for Lock-Strip Gaskets
  - .3 ASTM C1048-18 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
  - .4 ASTM C1376-15 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
  - .5 ASTM C1503-18 Standard Specification for Silvered Flat Glass Mirrors
  - .6 ASTM D790-17 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
  - .7 ASTM D1003-13 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics
  - .8 ASTM D1929-20 Standard Test Method for Determining Ignition Temperature of Plastics
  - .9 ASTM D2240-15e1 Standard Test Method for Rubber Property—Durometer Hardness
  - .10 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .11 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - .12 ASTM E1300-16 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 National Fire Protection Association
  - .1 NFPA 80 Standard for Fire Doors, Fire Windows.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-12.1-17 Safety Glazing
  - .2 CAN/CGSB-12.2-91 (R2017) Flat, Clear Sheet Glass.
  - .3 CAN/CGSB-12.3-91 (R2017) Flat, Clear Float Glass.
  - .4 CAN/CGSB-12.4-91 (R2017) Heat Absorbing Glass
  - .5 CAN/CGSB-12.8-17 Insulating Glass Units
- .5 CSA Group (CSA)
  - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
- .6 Consumer Product Safety Commission
  - .1 CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials.
- .7 Environmental Choice Program (ECP).
  - .1 CCD-045-95 Sealants and Caulking.
- .8 Flat Glass Manufacturers Association (FGMA).
  - .1 FGMA Glazing Manual - 1997.
- .9 Glass Association of North America (GANA)

- .1 GANA Glazing Manual 50th Anniversary Edition-2008.
- .2 GANA Laminated Glazing Reference Manual - 2009.
- .3 GANA Sealant Manual-2008.
- .4 GANA Guide to Architectural Glass (2010).
- .5 GANA/PGC International Protective Glazing Manual (2010).
- .10 South Coast Air Quality Management District, California State (SCAQMD)
  - .1 SCAQMD Rule 1168-03, Adhesives and Sealants Applications.
- .11 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 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials and assemblies comply with specified performance characteristics and criteria and physical requirements.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Samples: Submit duplicate 300 x 300 mm size samples of glass and sealant material.
- .7 Manufacturer's Instructions: Submit manufacturer's installation instructions.
- .8 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 and Laminators Safety Glass Association Standards Manual for glazing installation methods.
- .2 Installer: Company specializing in the installation of structural glazing with five years proven experience and approved by the manufacturer for installation of their products.
- .3 Safety glass products shall comply with the testing requirements of CAN/CGSB-12.1, Type 1 for Laminated Glass and Type 2 for Tempered Glass.
- .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 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.

- .6 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)
- .7 Single-source fabrication responsibility: All glass fabricated for each type shall be processed and supplied by a single fabricator.
- .8 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .9 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.

#### 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.
- .4 Warrant Laminated glass for ten years against delamination and discolouration.

### PART 2 PRODUCTS

#### 2.1 Materials-Flat Glass

- .1 Float glass: to CAN/CGSB-12.3, glazing quality, 6 mm thick minimum.
- .2 Sheet glass: to CAN/CGSB-12.2, selected, 6 mm thick minimum.
- .3 Fire Resistant Glazing (FRG): Fire resistant glazing as specified in section 08 88 13.

#### 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, 25 mm overall thickness.
  - .1 Basis of Design: Guardian Glass
  - .2 Glass: CAN/CGSB-12.1(tempered) CAN/CGSB-12.9(heat strengthened)
  - .3 Glass thickness: 6.4 mm (heat strengthened)
  - .4 Inter-cavity space thickness: 12.7 mm with low conductivity spacers.
  - .5 Inert gas fill: argon.
  - .6 Inboard Glass Lite: 6.4mm tempered
  - .7 Guardian Makeup Name: acid etch (DX22 pattern to City of Toronto Standard) on surface#1 & SNX 62/27 low E coating on surface #2.

#### 2.3 Spandrel Glass

- .1 Spandrel Glass: to CAN/CGSB-12.9, 8 mm thick.
  - .1 Type 2 Heat strengthened.
  - .2 Class A-Float.

- .3 Style 1 Opacifying coating on the No. 2 (inboard) surface.
- .4 Form M-Monolithic.
- .5 Colour to be selected by the Consultant from full range of manufacturer's standards. Up to two (2) colours will be selected.

#### 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 D 2240, to suit glazing method, glass light weight and area.
- .3 Spacer shims: Neoprene 50-60 Shore A durometer hardness to ASTM D 2240, 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 Dry Method- Preformed Glazing

.1 Cut glazing tape to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant.

.2 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

.3 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

.4 Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.

.5 Trim protruding tape edge.

3.6 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.

3.7 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.

### 3.8 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.
- .5 Remove labels after work is complete.
- .6 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .7 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 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 S104-15 Standard Method for Fire Tests of Door Assemblies
  - .2 CAN/ULC S106-15 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 Shop Drawings: Submit shop drawings showing layout, profiles and product components.
- .3 Samples: Submit 150 x 150 mm glass samples.
- .4 Technical Information: Submit latest edition of manufacturer's product data.
- .5 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<sup>2</sup>

.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 41 00 | Structural Metal Stud Framing          |
| .2  | Section 06 10 00 | Rough Carpentry                        |
| .3  | Section 07 21 13 | Building Insulation                    |
| .4  | Section 07 26 00 | Vapour Retarders                       |
| .5  | Section 07 27 00 | Vapour Permeable Air Barriers          |
| .6  | Section 07 27 13 | Modified Bituminous Sheet Air Barriers |
| .7  | Section 07 84 00 | Firestopping                           |
| .8  | Section 07 92 00 | Joint Sealants                         |
| .9  | Section 09 22 16 | Non-Structural Metal Framing           |
| .10 | Section 09 91 23 | Interior Painting                      |

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C475/C475M-17 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 C954-18 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 C1002-18 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 C1047-14a (2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
  - .7 ASTM C1177/C1177M-17 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
  - .8 ASTM C1178/C1178M-18 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
  - .9 ASTM C1278/C1278M-17 Standard Specification for Fiber-Reinforced Gypsum Panel
  - .10 ASTM C1280 - 18 Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
  - .11 ASTM C1396/C1396M - 17 Standard Specification for Gypsum Board
  - .12 ASTM C1629/C1629M-19 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
  - .13 ASTM E90-09 (2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  - .14 ASTM E814-13a (2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
  - .15 ASTM E1966-15 (2019) Standard Test Method for Fire-Resistive Joint Systems
- .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-51.34 Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .2 CAN/CGSB 19-GP-21M Sealing and Bedding Compound for Acoustical Purposes
- .4 Underwriters Laboratories of Canada (ULC)

- .1 ULC 102-2018 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .2 ULC 114-2018 Standard Method of Test for Determination of Non-Combustibility in Building Materials
- .3 ULC 129- 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-253 Application of Gypsum Sheathing.

#### 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.
- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.

#### 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.
- .4 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- .5 Mock-Ups
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up gypsum board wall installation including one inside corner and one outside corner. Mock-up may be part of finished work.
  - .3 Allow two working days for inspection of mock-up by Consultant before proceeding with rest of the work.
  - .4 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

#### 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 IULC 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: CGC Fibrerock abuse resistant fibre/gypsum panels, 16 mm thickness.
- .3 Water and Moisture Resistant Board: to ASTM C1396, 12.7 mm thick, 1220 mm wide with tapered edges.
- .4 Glass Mat Exterior Gypsum Sheathing: to ASTM C1177, 12.7 mm thick, 1219 mm wide x 2440 mm long, square edge.
  - .1 Weight: 9.27 kg/m<sup>2</sup>
  - .2 Surfacing: Fiberglass mat on face, back, and long edges.
  - .3 Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
  - .4 Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
  - .5 Humidified Deflection (ASTM C1177): Not more than 6.0 mm.
  - .6 Permeance (ASTM E96): Not less than 23 perms.
  - .7 R-Value (ASTM C518): 0.56.
  - .8 Mold Resistance (ASTM D3273): 10, in a test as manufactured.
- .9 Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

- .1 CGC Securock
- .2 Georgia Pacific DENS-Glass Gold
- .3 Certainteed GlasRoc

## 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 Sheathing Screws: To ASTM C1002, corrosion resistant, heat treated self-tapping sheet metal screws minimum 32 mm long.
- .3 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.
- .4 Joint Filler and Topping: To ASTM C475 vinyl or latex base, slow setting.
- .5 Joint Treatment for Gypsum Sheathing: 50 mm wide, 10 x 10 woven threads per 25 mm, self-adhering fibreglass joint tape and Borden HPPG Elmer's Siliconized Acrylic Latex Caulk.
- .6 Laminating Compound: as recommended by manufacturer, asbestos-free.

## 2.3 Acoustic Insulation

- .1 Acoustic Attenuation: Min 50 STC in accordance with ASTM E90.
- .2 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<sup>3</sup>:
    - .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.
- .3 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
- .4 Thickness to suit depth of wall framing and as indicated.
- .5 Acoustic sealant: as specified in Section 07 92 00 - Joint Sealants.

## 2.4 Accessories

- .1 Casing beads, corner beads 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 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.
- .6 Laminate gypsum board to existing masonry wall surfaces where indicated.
- .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 Gypsum Sheathing

- .1 Install in accordance with GA-253, ASTM C1280 and manufacturer's recommendations.
- .2 Install exterior gypsum sheathing horizontally on all exterior walls where indicated. Stagger joints between adjacent sheets.
- .3 Screw-attach gypsum sheathing to each stud with 32 mm self-drilling corrosion resistant sheathing screws spaced 10 mm from ends and edges 200 mm o.c. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink. Apply sealant around sheathing perimeter at interface with other materials and install flashing as indicated on the drawings.
- .4 Apply fibreglass joint treatment to all joints, overlapping at intersections by the width of the tape. Apply 10 mm bead of sealant along the joint and embed the sealant into the entire surface of the tape with a trowel. Apply enough sealant to each exposed fastener to cover completely when trowelled smooth.

### 3.5 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. Control joints shall be supported with metal studs or furring channels on both sides of the joint. Control joints shall be provided:
  - .1 At abutting structural elements, steel columns.
  - .2 At expansion or control joints in the substrate;
  - .3 At maximum 6.0 m spacings on long partition and bulkhead runs;
  - .4 At each door jamb.

### 3.6 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.

### 3.7 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.
- .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.

3.8 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 05 41 00 Structural Metal Stud Framing
- .2 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM).
  - .1 ASTM A653/A653M-20 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 C1002-18 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.
- .3 Samples:
  - .1 Submit duplicate 300 mm long samples of non-structural metal framing.

### 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 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.
- .5 Wind bearing light weight steel stud framing for exterior wall applications is specified in Section 05 41 00.

#### 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.
- .2 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.
- .3 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.
- .4 Deflection Track: Bailey Multi-Slot Track MST 250, size to suit studs, and top deflection clips TDC 350 and TDC 587.
- .5 Horizontal Flange attachment: Bailey Horizontal Flange Attachment Clip (HFA Clip)

- .6 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: To ASTM E814 and ASTM E1966, with STC performance rating of 55 to ASTM E90.
- .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 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 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,
- .4 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .5 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.
- .6 Erect metal studding to tolerance of 1:1000.

- .7 Attach studs to bottom and ceiling track using screws.
- .8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .10 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.
- .11 Install heavy thickness single jamb studs at openings.
- .12 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.
- .13 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .14 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.
- .15 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks.
- .17 Install continuous insulating strips to isolate studs from un-insulated surfaces.
- .18 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.

### 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 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

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## 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 92 00 Joint Sealants
- .3 Section 09 21 16 Gypsum Board
- .4 Section 09 65 19 Resilient Tile Flooring
- .5 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C150/C150M-20 Standard Specification for Portland Cement
  - .2 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes
- .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 2016-2017 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.
  - .5 Waterproofing isolation membrane.
- .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 For the installation of ceramic tile, use only skilled tradesmen who are familiar with the referenced standards and with the requirements for this Work.
- .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 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.

1.7 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.

1.8 Qualifications

- .1 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.

1.9 Waste Management and Disposal

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

### 1.10 Maintenance

- .1 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.
- .6 Metal Lath: ASTM C847 corrosion resistant. 1.4 kg/m<sup>2</sup>.

### 2.2 Ceramic Tile

- .1 PCT: Porcelain Ceramic Floor Tile: Daltile, Outlander Series, 305 x 610 mm. Matte Textured Finish. Colour: #OU55 Marine Rectangle Medio. Bullnose base type #P43F9, 76 x 610mm.
- .2 CT: Ceramic Wall Tile: Daltile, Color Wheel Classic Series, bright glazed, 76 x 152 mm.
  - .1 Field Colour: Arctic White # 0190, glossy finish.
  - .2 Accent Colour 1: Sunflower # XDH50, glossy finish.
  - .3 Accent Colour 2: Electric Blue # 1194, glossy finish.

### 2.3 Mortar, Grout, Additives and Adhesives

- .1 The products of one manufacturer shall be used throughout the project to ensure compatibility of materials. Manufacturers of commercial mortar, grout and adhesive having product considered acceptable for use:
  - .1 Laticrete
  - .2 Mapei
  - .3 Flextile
- .2 Water: Potable.



- .3 Floors: (thinset) T.T.M.A. Detail #317 SP "A".
  - .1 Thinset mortar: Laticrete 4237 latex additive plus 211 Crete filler powder or Mapei Kerabond mixed with Keralastic high performance latex admixture or Flextile 52 thin set.
  - .2 Levelling Compound (if required): Laticrete 3701 latex or 226 Mapecem mortar mixed with Planicrete 50.
  - .3 Grout: Laticrete Latapoxy SP100, solid epoxy grout or Mapei Kerapoxy. Colours to Consultant's selection.
  
- .4 Walls:
  - .1 Concrete and Concrete Block: T.T.M.A.C. Detail #303W:
    - .1 Levelling Coat: Laticrete 3701 or Mapei Mapecem mixed with Planicrete 50.
    - .2 Thinset mortar: Laticrete 4237 latex additive plus 211 Crete filler powder or Mapei Kerabond mixed with Keralastic high performance latex admixture.
    - .3 Grout: Laticrete Latapoxy SP100 solid epoxy grout or Kerapoxy. Colours to Consultant's selection.
  
  - .2 Gypsum Board:T.T.M.A.C. Detail #304W:
    - .1 Levelling Coat: Laticrete 3701 or Mapei Mapecem mixed with Planicrete 50.
    - .2 Thinset mortar: Laticrete 4237 latex additive plus 211 Crete filler powder or Mapei Kerabond mixed with Keralastic high performance latex admixture.
    - .3 Grout: Flextile Polymer modified unsanded grout, Laticrete Latapoxy SP100 solid epoxy grout or Mapei Kerapoxy. Colours to Consultant's selection.

#### 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 CT wall tile;
  - .2 All outside corners of wall tile or porcelain ceramic tile base.
  
- .3 Sealant: as specified in Section 07 92 00.

### 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. Prepare existing gypsum board surfaces as recommended by TTMAC and product manufacturer to support tile installation.
- .6 Existing painted masonry or concrete wall surfaces to receive ceramic tile shall be thoroughly cleaned of all paint down to concrete or concrete block surfaces using paint stripper. Prepare painted surfaces in accordance with manufacturer's instructions and TTMAC recommendations.
- .7 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.
- .8 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.
- .9 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.
- .10 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 having tiles 300 mm or larger in any direction
  - .3 Tile having tiles with raised or textured backs
  - .4 Tile having 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 following spacings:

Environment	Minimum	Maximum	Joint Width (minimum)
Interior/Shaded	4800 mm	6100 mm	6 mm
Interior/Sunlight	2400 mm	3700 mm	6 mm
Exterior/Normal	2400 mm	3700 mm	10 mm
Exterior/Excessive	2400 mm	3000 mm	13 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 C423-17 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - .2 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .3 ASTM E1264-19 Standard Classification for Acoustical Ceiling Products
  - .4 ASTM E1414/E1414M-16 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
  - .5 ASTM E1477-98A(2017)e1 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102-2018 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.
  - .1 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
  - .2 Surface Burning Characteristics: As follows, tested per ASTM E84 and complying with ASTM E1264 Classification.
  - .3 Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

- .2 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 m<sup>2</sup> 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 Surface-Burning Characteristics: Conform to ULC S102 or ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- .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: CGC Fissured.
  - .1 Class A.
  - .2 Composition: Water Felted Mineral Fiber
  - .3 Pattern regular fissured.
  - .4 Texture: medium.
  - .5 Flame spread: ASTM E1264, Class A (U.L.C.), 25 or less.
  - .6 Smoke developed 50 or less in accordance with ULC 102.
  - .7 Noise Reduction Coefficient (NRC): ASTM C423; Classified with UL label, 0.55
  - .8 Ceiling Attenuation Class (CAC): ASTM C1414; Classified with UL label, 35
  - .9 Light Reflectance (LR) range of 0.81 to ASTM E1477.
  - .10 Dimensional Stability: Standard
  - .11 Edge Profile: Square Lay-In
  - .12 Colour: White.
  - .13 Size 610 x 1219 x 16 mm thick.
  - .14 Shape flat.
  - .15 Surface coverings: Ecolabel certified paint.
- .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
- .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

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## 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 A641/A641M-19 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .2 ASTM C635/C635M-17 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings.
  - .3 ASTM C636/C636M-19 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  - .4 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .5 ASTM E119-20 Standard Test Methods for Fire Tests of Building Construction and Materials
  - .6 ASTM E1264-19 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 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.
  - .1 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
  - .2 Surface Burning Characteristics: Tested per ASTM E84 and complying with ASTM E1264 Classification.
- .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.
- .8 Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three times design load, but not less than 2.06 mm thick.

### 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 Install hangers spaced at maximum 1219 mm centres and within 152 mm from ends of main tees. Install hanger wires plumb and straight.

- .6 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.
- .7 Ensure suspension system is coordinated with location of related components.
- .8 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles, and speakers.
- .9 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.
- .10 Interlock cross member to main runner to provide rigid assembly.
- .11 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .12 Install access splines to provide ceiling access.
- .13 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

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## 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 92 00 Joint Sealants
- .3 Section 09 21 16 Gypsum Board
- .4 Section 09 65 16.24 Resilient Slip Resistant Vinyl Sheet Flooring
- .5 Section 09 65 19 Resilient Tile Flooring
- .6 Section 09 65 36.13 Static Dissipative Resilient Flooring

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D2047-17 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
  - .2 ASTM E648-19ae1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  - .3 ASTM E662-19 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  - .4 ASTM F710-19e1 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .5 ASTM F970-17e1 Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading
  - .6 ASTM F1303-04(2014) Standard Specification for Sheet Vinyl Floor Covering with Backing
  - .7 ASTM F1869-16a Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .8 ASTM F1913-19 Standard Specification for Vinyl Sheet Floor Covering Without Backing
  - .9 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .2 Resilient Floor Covering Institute (RFCI)
  - .1 RFCI Standard Slab Moisture Test Method (Calcium Chloride Method) as a supplementary test method to ASTM F2170.
- .3 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
- .4 DIN 51130 Testing of floor coverings - Determination of the anti-slip property - Workrooms and fields of activities with slip danger - Walking method - Ramp test
- .5 American Concrete Institute (ACI)
  - .1 ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product data: Submit manufacturer's current printed product literature, specifications and installation instructions.

- .3 Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.
  - .1 Submit a diagram indicating seam locations and roll direction. Use mitered seam layouts for corners when changing directions 180 degrees (e.g. when running material down corridors which bisect at a right angle), unless approved otherwise.
- .4 Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product colour, texture, and pattern required.

#### 1.5 Quality Assurance

- .1 Select an installer who is competent in the installation of resilient sheet flooring using heat-welded seams.
- .2 Provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- .3 Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
  - .1 ASTM E648 Critical Radiant Flux of 0.45 watts per cm<sup>2</sup> or greater, Class I.
  - .2 ASTM E662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

#### 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 Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 13° C or more than 29° C.

#### 1.7 Project Conditions

- .1 Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.
- .2 Maintain ambient temperatures within range recommended by manufacturer, but not less than 18° C or more than 29° C in spaces to receive resilient products during the following time periods:
  - .1 48 hours before installation.
  - .2 During installation.
  - .3 48 hours after installation.
- .3 Maintain the ambient relative humidity between 40% and 60% during installation.
- .4 Until Substantial Performance, maintain ambient temperatures within range recommended by manufacturer, but not less than 13° C or more than 29° C.

#### 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 Resilient Sheet Flooring Materials

- .1 Vinyl sheet flooring shall meet ASTM F1913.
- .2 RSF1 & RSF2: Multi-layered, calendered and pressed Sheet Resilient Flooring.
  - .1 Taralay Premium Compact Series by Gerflor.
  - .2 Sheet standard: ASTM F 1303, [Type 1, Grade 1, Class B sheet vinyl floor covering with backing].
  - .3 Test data:
    - .1 Wear layer (ASTM F410): 0.92mm
    - .2 Total thickness (ASTM F386): 2mm
    - .3 Flexibility (ASTM F137): Passes
    - .4 Chemical resistance (ASTM F925): Passes
    - .5 Static Load Limit (ASTM F970): Passes 175 psi
    - .6 Resistance to Heat (ASTM F1514):  $\Delta E \leq 8$
    - .7 Resistance to light (ASTM F1515):  $\Delta E \leq 8$
    - .8 Residual Indentation (ASTM F1914): Passes
    - .9 Static Coefficient to Friction (ASTM D 2047): 0.97(Dry)/ 1.00 \*(Wet)
    - .10 Flamability (ASTM E648, Critical Radiant Flux): Class 1
    - .11 Limited Commercial Warranty: 10 years
  - .4 Colour:
    - .1 RSF1: Manua, #4002
    - .2 RSF2: OFU, #4001
- .3 RSF3: Multi-layered Sheet Resilient Flooring with printed designs.
  - .1 Taralay Premium Compact Series by Gerflor.
  - .2 Sheet standard: ASTM F 1303, [Type 1, Grade 1, Class B sheet vinyl floor covering with backing].
  - .3 Test data:
    - .1 Wear layer (ASTM F410): 0.7mm
    - .2 Total thickness (ASTM F386): 2mm
    - .3 Flexibility (ASTM F137): Passes
    - .4 Chemical resistance (ASTM F925): Passes
    - .5 Static Load Limit (ASTM F970): Passes 175 psi
    - .6 Resistance to Heat (ASTM F1514):  $\Delta E \leq 8$
    - .7 Resistance to light (ASTM F1515):  $\Delta E \leq 8$
    - .8 Residual Indentation (ASTM F1914): Passes
    - .9 Static Coefficient to Friction (ASTM D 2047): 0.95(Dry)/ 0.84(Wet)
    - .10 Flamability (ASTM E648, Critical Radiant Flux): Class 1
    - .11 Limited Commercial Warranty: 10 years
  - .4 Colour:
    - .1 RSF3: Walnut Brown, #1314



- .4 Provide solid colour vinyl weld rod as produced by sheet vinyl flooring manufacturer, and intended for heat welding of seams. Colour shall be compatible with field colour of flooring or as selected by Consultant to contrast with field colour of flooring. Colour selected from the manufacturer's standard range.

## 2.2 Wall Base Materials

- .1 Wall Base as specified in Section 09 65 19.

## 2.3 Adhesives

- .1 Provide high-performance epoxy flooring adhesive for field areas and flash cove adhesive at flash coving as recommended by the flooring manufacturer.
- .2 Provide seam adhesive at seams as recommended by the resilient flooring manufacturer.

## 2.4 Accessories

- .1 For patching, smoothing, and leveling monolithic subfloors, provide fast-setting cement-based patch and underlayment as recommended by the resilient flooring manufacturer.
- .2 For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- .3 Provide top edge trim caps of anodized aluminum for integral flash cove as approved by the Consultant.
- .4 Provide a fillet support strip for integral cove base with a minimum radius of 25 mm of wood or plastic.
- .5 Provide transition/reducing strips tapered to meet abutting materials.
- .6 Provide threshold of thickness and width as shown on the drawings.
- .7 Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with colour to match or contrast with the flooring, or as selected by the Consultant from standard colours available.
- .8 Provide metal edge strips of required width and thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

## PART 3 EXECUTION

### 3.1 Inspection

- .1 Remove existing sheet flooring and base clean subfloor of all adhesives and patching compounds.
- .2 Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

- .3 Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- .4 Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- .5 Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

### 3.2 Preparation

- .1 Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with fast-setting cement-based patch and underlayment as recommended by the flooring manufacturer.
- .2 Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.
- .3 Perform subfloor moisture testing in accordance 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.
- .4 Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.
- .5 Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

### 3.3 Installation of Sheet Flooring

- .1 Install flooring in strict accordance with the latest edition of manufacturer's installation instructions.
- .2 Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- .3 If required, install flooring on pan-type floor access covers. Maintain continuity of colour and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

- .4 Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- .5 Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 45.36 kilogram roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.
- .6 Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for colour shading and pattern at the seams in compliance with the manufacturer's recommendations.
- .7 Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- .8 Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with vinyl welding rod in seams. Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.
- .9 Provide integral flash cove wall base, including cove fillet support strip and top edge cap trim. Construct flash cove base in accordance with the flooring manufacturer's instructions. Heat-weld seams as specified for those on the floor.

#### 3.4 Installation of Accessories

- .1 Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- .2 Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- .3 Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- .4 Apply metal edge strips, after flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

#### 3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 10 – Cleaning.
- .2 Perform initial maintenance according to manufacturer's instructions.
- .3 Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

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 09 68 13 Carpet Tile
- .3 Section 09 65 19 Resilient Tile Flooring

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-22 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM E648-19ae1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  - .3 ASTM E662-21ae1 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  - .4 ASTM F150-06(2018) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring
  - .5 ASTM F710-21 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .6 ASTM F1066-04(2018) Standard Specification for Vinyl Composition Floor Tile
  - .7 ASTM F1861-21 Standard Specification for Resilient Wall Base
  - .8 ASTM F1869-22 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .9 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
  - .2 NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials
- .3 American National Standards Institute (ANSI)
  - .1 ANSI/ESD STM 7.1 Floor Materials—Resistive Characterization of Materials
  - .2 ANSI/ESD STM 97.1 Floor Materials and Footwear—Resistance in Combination with a Person
  - .3 ANSI/ESD STM 97.2 Floor Materials and Footwear Voltage Measurement in Combination with a Person
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 ULC-S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

### 1.4 LEED Requirements

- .1 Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System. Refer to Section 01 35 66 Sustainability Certification Procedures.

- .2 In order to meet LEED certification requirements for:
  - .1 MR credit Building Product Disclosure and Optimization – Environmental Product Declarations
  - .2 MR credit Building Product Disclosure and Optimization – Sourcing of Raw Materials
  - .3 MR credit Building Product Disclosure and Optimization – Material Ingredients
  - .4 Indoor Environmental Quality credit Low-Emitting Materials
  - .5 Innovation credit Exemplary Performance - indoor Environmental Quality credit Low-Emitting Materials.

#### 1.5 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 LEED® Requirements: Provide submittals as detailed in Section 01 35 66 – Sustainability Certification Procedures for Related LEED® credits.
- .3 Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.
- .4 Submit duplicate samples of manufacturer's full range of colours for specified products for selection of colours by the Consultant.
- .5 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 Accompanying the materials list, submit two copies of the manufacturer's current recommended method of installation for each item.
- .6 Provide maintenance data for resilient flooring for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

#### 1.6 System Description

- .1 Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.
- .2 Administrative Requirements
  - .1 Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 31 00 - Project Management and Coordination.
  - .2 Pre-installation Testing: Conduct pre-installation testing as follows:
    - .1 moisture tests
    - .2 bond test
    - .3 pH test
- .3 Test Installations/ Mock-ups: Install at the project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish colour, texture and pattern, and workmanship standards.
  - .1 Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

.2 Incorporation: Mock-up may be incorporated into the final construction with Consultant's approval.

.4 Sequencing and Scheduling

- .1 Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
- .2 Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.7 Quality Assurance

- .1 Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.
- .2 Select an installer who is experienced and competent in the installation of Armstrong resilient static dissipative vinyl composition tile flooring and the use of Armstrong Flooring subfloor preparation products.
  - .1 Engage installers certified as Armstrong Commercial Flooring Certified Installers
- .3 Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
  - .1 ASTM E648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
  - .2 ASTM E662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
  - .3 ULC S102.2 – Flame Spread Rating and Smoke Developed – Results as tested.
- .4 Provide flooring material to meet the following electrical properties when installed according to manufacturer's instructions with the required adhesive, copper strips and SDT floor finish:
  - .1 ANSI/ESD STM 7.1 Floor Materials—Resistive Characterization of Materials results between 106 and 109 ohms, point-to-point and point-to-ground.
  - .2 ASTM F150 Electrical Resistance of Flooring between 106 and 109 ohms, point-to-point and point-to-ground.
  - .3 ANSI/ESD STM 97.1: Floor Materials and Footwear—Resistance in Combination with a Person results between 106 and 109 ohms (average) with dissipative footwear and when using heel straps.
  - .4 ANSI/ESD STM 97.2: Floor Materials and Footwear Voltage Measurement in Combination with a Person – 30 volts (average) with dissipative footwear at 12% relative humidity.
  - .5 Static Dissipation @ 12% RH: Flooring in combination with a person wearing dissipative footwear – 1000 to 100 volts: 0.2 seconds maximum.

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 Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

- .4 Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

#### 1.9 Project Conditions

- .1 Maintain a minimum temperature in the spaces to receive the flooring and accessories of 18° C and a maximum temperature of 29° C for at least 48 hours before, during, and for not less than 48 hours after installation. During the service life of the floor, the temperature should never rise above 38° C nor fall below 13° C. The performance of the flooring material and adhesives can be adversely affected outside this temperature range. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

#### 1.10 Waste Management and Disposal

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

#### 1.11 Maintenance

- .1 Provide extra stock materials of resilient flooring, base and adhesives in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Provide one carton of each colour, pattern and type flooring material required for this project for maintenance use.
- .3 Provide one container of adhesive.
- .4 Extra materials to be from same production run as installed materials.
- .5 Clearly identify each container of floor tile and each container of adhesive.

#### 1.12 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 Manufacturer

- .1 Resilient tile flooring, wall base, adhesives and subfloor preparation products and accessories:
  - .1 Tarkett, 30000 Aurora Road, Solon, Ohio 44139; [www.tarkettna.com](http://www.tarkettna.com); Email: [info@johnsonite.com](mailto:info@johnsonite.com); Tel: 1-800-899-8916.

#### 2.2 Resilient Tile Flooring Materials

- .1 Static Dissipative Sheet Flooring manufactured by Tarkett, iQ Granite SD, .
  - .1 Description: Static dissipative vinyl tile composed of polyvinyl chloride resin, plasticizers, fillers, pigments, and antistatic additive with colours and texture dispersed uniformly throughout its thickness.

- .2 Pattern and Colour: Selected by Consultant from the range currently available from manufacturer.
- .3 Size: 610 x 610mm
- .4 Thickness: 3.2mm

### 2.3 Wall Base Materials

- .1 Resilient Base: As specified in Section 09 65 19.

### 2.4 Adhesives

- .1 As recommended by flooring manufacturer.

### 2.5 Accessories

- .1 Primers: non-flammable, solvent free, waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.
- .2 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.
- .3 For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- .4 Transition strips, mouldings and adaptors shall be rubber or vinyl, with lip to extend under floor tile with tapered edge, colour matched to flooring.
- .5 Provide threshold of thickness and width as shown on the drawings.
- .6 Provide resilient edge strips, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with colour to match or contrast with the flooring, or as selected by the Consultant from standard colours available.
- .7 Metal edge strips: aluminum extruded, smooth, mill finish with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

## PART 3 EXECUTION

### 3.1 Manufacturer's Instructions

- .1 Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

### 3.2 Examination

- .1 Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test, etc.)
- .2 Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.



- .3 Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- .4 Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- .5 Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- .6 Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

### 3.3 Preparation

- .1 Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with underlayment as recommended by the flooring manufacturer.
- .2 Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discolouration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material.
- .3 Perform subfloor moisture testing in accordance with ASTM F2170 and Bond Tests 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 75%. MVER shall not exceed 3 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.
- .4 Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

### 3.4 Installation

- .1 Install flooring in strict accordance with the latest edition of manufacturer's instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- .2 Install copper ground-connection strips in accordance with manufacturer's instructions.

- .3 Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- .4 If required, install flooring on pan-type floor access covers. Maintain continuity of colour and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- .5 Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

### 3.5 Installation of Accessories

- .1 Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- .2 Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- .3 Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- .4 Apply [butt-type] [overlap] metal edge strips where shown on the drawings, [before] [after] flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

### 3.6 Protection

- .1 Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

### 3.7 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Perform initial and on-going maintenance according to the latest edition of Armstrong Guaranteed Flooring Installation Systems manual, F-5061.

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 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D543-21 Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
  - .2 ASTM D2240-15(2021) Standard Test Method for Rubber Property—Durometer Hardness
  - .3 ASTM E648-19ae1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  - .4 ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .5 ASTM F970-22 Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading
  - .6 ASTM F1303-04(2021) Standard Specification for Sheet Vinyl Floor Covering with Backing
  - .7 ASTM F1869-22 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .8 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
  - .9 ASTM F2772-11(2019) Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems.
- .2 American Concrete Institute (ACI)
  - .1 ACI 302.2R-06 Guideline for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Manufacturer's promotional brochures, specifications and installation instructions.
- .3 Samples: Submit for selection and approval three (3) sets of the indoor athletic flooring, manufacturer's brochures, samples or sample boards of all of the available colours, textures and styles.
- .4 Submit maintenance instructions for Indoor Athletic Surfacing, for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00-Closeout Submittals.

### 1.5 Quality Assurance

- .1 Qualifications:
  - .1 The indoor resilient multipurpose surfacing shall be manufactured in an ISO 9001 certified plant.

- .2 The indoor resilient multipurpose surfacing supplier shall be an established firm, experienced in the field, and appointed as a distributor by the manufacturer of the indoor resilient multipurpose surfacing.
  - .3 The installer of the indoor resilient multipurpose surfacing shall have a minimum of five (5) years of experience in the field installing indoor resilient multipurpose surfacing and have worked on at least five (5) projects of similar size, type and complexity.
- .2 Certifications:
    - .1 Installer to submit the indoor resilient athletic surfacing manufacturer's certification attesting that they are an approved installer of the indoor resilient multipurpose surfacing.
    - .2 The indoor resilient multipurpose surfacing manufacturer to submit official ISO 9001 certification for the facility in which the indoor resilient multipurpose surfacing is manufactured.
  - .3 Testing:
    - .1 Tests shall be relative for multi-purpose use with certificates from independent testing resources to be made available upon request. Test results shall be no more than 5 years old and performed according to ASTM standard testing procedures.

#### 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 Site Conditions

- .1 Maintain project/site conditions acceptable for the installation of the indoor resilient multipurpose flooring.
- .2 The area in which the indoor resilient multipurpose surfacing will be installed shall be dry and weather tight. Permanent heat, light and ventilation shall be installed and operable.
- .3 All other trades shall have completed their work prior to the installation of the resilient athletic flooring. The general contractor shall maintain a secure and clean working environment before, during and after the installation. Suspension of other trades' work may be authorized providing their work will not damage the new flooring.
- .4 Maintain a stable room temperature of at least 18°C for a minimum of one (1) week prior to, during and thereafter installation.
- .5 Concrete subfloor surface pH level within the 7 to 10 range dependent upon installation type.
- .6 Concrete subfloor should be no greater than 3.0 mm within a 3.0 m diameter. This tolerance shall be measured in accordance with ASTM E1155. A specified (FF) of 50 and an (FL) of 30 should reach this degree of floor flatness and floor level. There is no numerical correlation between F numbers and the deviation from the straight edge, however the above specified numbers should achieve a flat floor with minimal deviation in the slab. Reference ACI 117 and ACI 302.1R. The general contractor should provide a certificate of compliance with the above recommendations.
- .7 Concrete subfloor must be clean and free of all foreign materials or objects including, but not limited to, curing compounds and sealers.

- .8 Fill cracks, grooves, voids, depressions, and other minor imperfections. Follow the manufacturer's directions. Moveable joints must be treated utilizing specific transitioning joint devices depending upon the Consultant's recommendations. Follow current ASTM F710 guidelines for the preparation of concrete slabs to receive resilient flooring.
- .9 Refer to ACI 302.2R "Guidelines for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials" for concrete design and construction.

1.8 Additional Materials

- .1 Furnish to the owner additional materials containing a total of at least 2% of each different colour or design of the indoor resilient athletic surfacing used on the project.

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.
- .2 The indoor resilient athletic surfacing shall be covered by the manufacturer against product defect for 10 years from the date of Substantial Performance and a 15 year wear through "wear layer" with the surface as defined in ASTM F1303.

PART 2 PRODUCTS

2.1 Materials

- .1 Gerflor, Recreation 60 - Prefabricated sport surface 6mm thickness.
  - .1 Vinyl sports floor covering over a fibreglas mat with PVC foam backing and sanitized anti-bacterial coating.
  - .2 One (1) colour will be selected from manufacturer's standard range.
- .2 Acceptable Alternative:
  - .1 Robbins Pulastic - 2000 as distributed by Gym-Con Limited.
  - .2 Polyflor
  - .3 Tarkett Omnisport
- .3 Adhesive: Two-component polyurethane as recommended by manufacturer.
- .4 Welding Rod: As supplied by the indoor resilient athletic surfacing manufacturer or supplier. Colour to blend with the indoor resilient athletic surfacing colour or design. All seams shall be welded to create a monolithic and impermeable surface.
- .5 Physical properties of the indoor resilient athletic surfacing shall conform to the following minimums:

Indentation resistance	EN 1516	≤0.5 mm
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Sliding coefficient	EN 13036-4	80-110
Ball rebound	EN12235	≤95%
Abrasion resistance	EN ISO 5470-1	≤350 mg
Impact sound insulation	EN ISO 717-2	18 dB
Impact resistance by OGI	EN 1517	≤8 N/m
Tensile strength (DIN 53571)		6.5 N/mm <sup>2</sup>
Fire	EN 13505-1	pass

### PART 3 EXECUTION

#### 3.1 Examination

- .1 Ensure that project/site conditions are acceptable for the installation of the indoor resilient athletic flooring.
- .2 Verify that the area in which the indoor resilient athletic surfacing will be installed is dry and weather tight. Verify that permanent heat, light and ventilation is installed and operable.
- .3 Verify that all other work that could cause damage, dirt and dust or interrupt the normal pace of the indoor resilient athletic flooring installation is completed or suspended.
- .4 Verify that there is a stable room temperature of at least 18°C.
- .5 Verify that there are no foreign materials or objects on the subfloor and that the subfloor is clean and ready for installation.
- .6 Moisture content less than 92% RH when tested per ASTM F2170.
- .7 Do not average the results of the tests. Report all field test results in writing to the Consultant, and Owner prior to installation.
- .8 Verify that the concrete subfloor surface pH level is within the 7 - 10 range.
- .9 Document the results indicating the slab is within manufacturer's tolerances for slab deviation.

#### 3.2 Preparation

- .1 Clean existing floor slab of all materials and adhesives.
- .2 Sand the entire surface of the concrete slab. Provide surface treatment including filler and levelling compounds as required and in accordance with manufacturer's recommendations.
- .3 Sweep the concrete slab so as to remove all dirt and dust. If a sweeping compound is to be used it must be a sweeping compound that does not contain oil or other items that may inhibit the adhesive bond.
- .4 Slab must be dust free. In the event that dust impairs adhesive bond, priming the slab prior to application of adhesive may be necessary. Follow installation guidelines.

3.3 Installation

- .1 The installation area shall be closed to all traffic. The installation shall not begin until the installer is familiar with the existing conditions.
- .2 All necessary precautions should be taken to minimize noise, smell, dust, the use of hazardous materials and any other items that may inconvenience others.
- .3 Indoor athletic surfacing shall be installed in a full bed of adhesive. Perimeter adhesive only is not permitted and will not be accepted.
- .4 Install the indoor resilient athletic surfacing in strict accordance with the manufacturer's written instructions.
- .5 Install the indoor resilient athletic surfacing minimizing cross seams.
- .6 Install appropriate threshold plates or transition strips where necessary.

3.4 Protection

- .1 Protect the indoor resilient athletic surfacing from damage using coverings approved by the manufacturer until Substantial Performance.

3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean the indoor resilient athletic surfacing in accordance with the manufacturer's instructions.

End of Section

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## 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 Specifications Manual, 2018.
  - .2 Standard GPS-1-08 and GPS-2-08 MPI Green Performance Standard for Painting and Coatings.
- .4 Society for Protective Coatings (SSPC)
  - .1 Systems and Specifications, SSPC Painting Manual 2009.
- .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.
  - .5 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 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.
- .4 Test concrete 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 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, hexavalent 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.
- .11 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.
- .12 Recycled water-borne surface coatings must not contain:
  - .1 Lead in excess of 600.0 ppm weight/weight total solids.
  - .2 Mercury in excess of 50.0 ppm weight/weight total product.
  - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
  - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
  - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- .13 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
  - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
  - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
  - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

## 2.2 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 Concrete Vertical Surfaces:
  - .1 EXT 3.1K - Latex semi-gloss finish (over alkali resistant primer).
- .2 Steel Doors, Frames and Metal Fabrications:
  - .1 EXT 5.1D – Alkyd G5 semi-gloss finish over alkyd primer.
- .3 Structural Steel at building exterior:
  - .1 EXT 5.1G Polyurethane, pigmented finish (over epoxy zinc rich primer and high build epoxy).

## 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 contaminants 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 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Consultant.
  - .4 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
  - .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
  - .6 Sand and dust between coats to remove visible defects.
  - .7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
  - .8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- 3.6 Mechanical/Electrical Equipment
- .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces.
  - .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
  - .3 Do not paint over nameplates.
- 3.7 Field Quality Control
- .1 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 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.
- 3.8 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.

3.9 Restoration

- .1 Remove protective coverings and warning signs as soon as practical after operations cease.
- .2 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

End of Section



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## 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 05 50 00 Metal Fabrications
- .5 Section 06 20 00 Finish Carpentry
- .6 Section 08 11 00 Metal Doors and Frames
- .7 Section 08 14 16 Flush Wood Doors
- .8 Section 09 21 16 Gypsum Board
- .9 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 Specifications Manual, 2018
  - .2 Standard GPS-1-08 and GPS-2-08 MPI Green Performance Standard for Painting and Coatings.
- .4 Society for Protective Coatings (SSPC)
  - .1 Systems and Specifications, SSPC Painting Manual 2009
- .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 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
- .4 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.
- .5 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Consultant.
- .6 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 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 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 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

- .6 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.
- .7 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .8 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 Concrete Horizontal Surfaces:
  - .1 INT 3.2A Latex floor enamel [gloss] [low gloss] finish.
  - .2 Concrete Floor Sealer: Refer to Section 09 67 00-Fluid Applied Flooring.
- .2 Structural Steel:
  - .1 INT 5.1X Latex G5 semi-gloss finish (over quick dry shop primer).
- .3 Metal Fabrications:
  - .1 INT 5.3A Latex G5 semi-gloss finish
- .4 Zinc Coated Metal Deck:
  - .1 INT 5.3H. Interior Latex semi-gloss, dry fog/fall type.
- .5 Galvanized Metal: interior doors, frames, railings, misc. steel, pipes, and ducts.
  - .1 INT 5.3A Latex G5 semi-gloss finish
- .6 Concrete masonry units:
  - .1 INT 4.2D High performance architectural latex G5 semi-gloss finish.
- .7 Wood Clear Polyurethane Finish:
  - .1 INT 6.3K Polyurethane varnish G6 gloss finish.
- .8 Electrical Equipment Backboards:
  - .1 INT 6.4P Fire retardant, pigmented coating. Low odour/low VOC. Semi-gloss (UL/ULC rated).
- .9 Gypsum Board: Walls.
  - .1 INT 9.2A Latex G3 eggshell finish over latex sealer.
- .10 Gypsum Board: Ceilings and Bulkheads:
  - .1 INT 9.2A Latex G2 velvet finish over latex sealer.
- .11 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. 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 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, with 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 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 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 Related Sections

- .1 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102-18 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 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.

### 1.5 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 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.

### 1.6 Waste Management and Disposal

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

### 1.7 Requirements of Regulatory Agencies

- .1 Surface burning characteristics of materials: to ULC S102.

### 1.8 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 General

- .1 The following manufacturers have been approved for the work of this Section:
  - .1 Architectural School Products Ltd.
  - .2 Broome Porcelain Company
  - .3 Egan Visual
  - .4 Global School Products
  - .5 Martack Specialties
  - .6 Steelcase Inc.
- .2 Whiteboards and tackboards shall be supplied by one manufacturer.

### 2.2 Whiteboards

- .1 Rite-On, Wipe Off, Series 3000 writing boards, white porcelain enamel on steel, factory pre-framed in clear anodized aluminum trim with chalk rail by Architectural School Products Ltd. or equivalent.
- .2 Sizes as indicated.
- .3 Provide one package of companion writing pens (3 each red, blue, green and black) for each whiteboard.

### 2.3 Tackboards

- .1 Tackboards shall be 13 mm factory pre-laminated consisting of 6.4 mm thick natural fine grained cork laminated to 6.4 mm particle board or masonite substrate under mechanical pressure in maximum panel sizes of 1220 x 2440 mm. Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.
- .2 Deluxe Series 4000, fine grain natural cork, light textured, brown with satin finished anodized aluminum frame and concealed fasteners, as manufactured by Architectural School Products Ltd. or equivalent.
- .3 Sizes as indicated.
- .4 All tackboards shall meet the minimum requirements of the applicable building code and shall have a flame spread rating of under 150 when tested in accordance with ULC 102.

### 2.4 Trim

- .1 Aluminum trim and chalk 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.
- .2 Perimeter: No. 205 trim - 19 mm exposed face and weight of approximately 0.372 kg/m.
- .3 Divider Bar No. 207 trim for adjacent panels of elevations greater than 2440 mm - 13 mm exposed face and weight of approximately 0.372 kg/m.

- .4 Maprail: No. 206 trim for whiteboard elevation only complete with integral natural fine grained cork insert, end stops and two (2) combination roller maphooks per 1.2 lineal metre or portion thereof, - 50 mm exposed face and weight of approximately 0.520 kg/m.
- .5 Tray No. 212 triangular box section for whiteboard elevations only complete with contour fitting and castings - 100 mm projection from wall and weight of approximately 1.42 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.
- .2 All whiteboards, tackboards, and aluminum trim are to be cleaned prior to 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 05 50 00 Metal Fabrications
- .2 Section 10 28 10 Toilet and Bath Accessories

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A480/A480M-20a Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
  - .2 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 CSA Group (CSA)
  - .1 CSA-B651-12 Accessible Design for the Built Environment.
- .3 American National Standards Association (ANSI)
  - .1 ANSI/NEMA LD 3-2005 High-Pressure Decorative Laminates (HPDL)
- .4 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:
  - .1 Submit manufacturer's printed product literature for toilet partitions or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit duplicate copies of manufacturer's standard colour charts for selection by the Consultant.
- .3 Shop Drawings:
  - .1 Shop drawings: Indicate partition layout.
  - .2 Show and describe in detail materials, finishes, dimensions, details of connections and fastenings, elevations, plans, sections, thicknesses, metal thickness, hardware and any other pertinent information.
- .4 Samples:
  - .1 Submit duplicate 300 x 300 mm samples of panel showing finish on both sides, two finished edges and core construction.
  - .2 Submit duplicate representative samples of each hardware item, including brackets, fastenings and trim.
- .5 Quality Control Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

- .6 Closeout Submittals:
  - .1 Provide maintenance data for plastic toilet compartments 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.
- .3 Protect finished surfaces during shipment and installation. Do not remove until immediately prior to final inspection.

1.6 Waste Management and Disposal

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

1.7 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 Approved Manufacturers

- .1 Compartments and cubicles as manufactured by the following may be used subject to approval of product specifications and details by the Consultant:
  - .1 Bobrick Washroom Equipment of Canada Ltd.
  - .2 Buddsteel Architectural Products. Teeswater Ontario
  - .3 Edwards Door Systems Ltd. Sarnia, Ontario
  - .4 ASI Watrous
  - .5 Bradley Corporation

2.2 Design

- .1 Solid phenolic core post to ceiling toilet partitions with operational full height vandal resistant hardware.
  - .1 Standard of acceptance: Bobrick Duraline Series, Model 1082.67.
- .2 Colours will be selected by the Consultant from the manufacturer's standard range of colours. Up to two (2) colours will be selected.

2.3 Materials

- .1 Materials shall meet NFPA Class B, UBC Class II, ASTM E84 Fire resistance standards as follows:
  - .1 Flame Spread Index (ASTM E84): 45 for panels and stiles.
  - .2 Smoke Developed Index (ASTM E84): 120 for panels, 95 for stiles.
  - .3 National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
  - .4 Uniform Building Code: Class II.

- .2 Solid phenolic material for stiles, panels, doors and screens.
  - .1 Phenolic Construction: Solidly fused high pressure laminate with matte-finish melamine surfaces; integrally bonded coloured face sheets and black phenolic-resin core.
  - .2 Phenolic Edges: Black; brown edges not acceptable.
- .3 Finished Thickness:
  - .1 Stiles and Doors: 19 mm
    - .1 Finished thickness of doors and stiles to ensure flush front.
  - .2 Panels and Screens: 13 mm

## 2.4 Hardware

- .1 Stiles: Floor-Anchored stiles furnished with expansion shields and threaded rods.
  - .1 Leveling Devices: 5 mm thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 10 mm diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
  - .2 Stile Shoes: One-piece, 0.8 mm, 18-8, Type 304 stainless steel, 102 mm height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 19 mm or 25 mm stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- .2 Posts: (for 1083 Series screens only) – 1 ¼" (32mm) square tubing; 18-8 S, type 304, 18-gauge (1.2mm) stainless steel with satin finish. Floor and ceiling connections are constructed of 18-8 S, type-304, heavy-gauge stainless steel. Furnished in 10ft (305cm) lengths; to be cut in field to job specification.
- .3 Compliance: Operable with one hand, without tight grasping, pinching, or twisting of the wrist, and force to operate does not exceed five pounds. Door pull: Barrier-free type suited for out-swinging doors, stainless steel. Conform to AODA and Ontario Building Code requirements.
- .4 Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment.
- .5 Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish. Chrome-plated "Zamak", aluminum, or extruded plastic hardware not acceptable.
- .6 Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
- .7 Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 680 kg per insert.
- .8 Coat hook: combination hook and rubber door bumper, stainless steel. Projecting no more than 29 mm from face of door
- .9 Mounting: Hinges, keepers, latches, clothes hooks and their fasteners concealed inside compartment. Exposed hinges, keepers, latches, clothes hooks and their fasteners on exterior of compartment not acceptable with the exception of accessible compartments.
- .10 Hardware Type: Institutional hardware (Bobrick Type .67).
  - .1 Latching: 2 mm sliding door latch, 2 mm keeper; latch slides on shock-resistant nylon track. Twist-style door latch operation not acceptable.
  - .2 Hinges: Full height, 1.6 mm stainless steel with satin finish, self-closing, 3 section hinges.
  - .3 Mounting Brackets: 1.3 mm stainless steel and extend full height of panel.
  - .4 U-Channels: Secure panels to stiles.

.5 Angle Brackets: Secure stiles-to-walls and panels-to-walls.

## 2.5 Fabrication

- .1 Shop fabricate partitions and screens. Take site measurements for areas where partitions are to be located and fabricate partitions to suit site dimensions.
- .2 Fabricate to reviewed shop drawings and manufacturer's standards.

## 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 Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
- .2 Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- .3 Do not begin installation of compartments until conditions are satisfactory.

### 3.3 Installation

- .1 Ensure supplementary anchorage is in place.
- .2 Do work in accordance with CSA-B651.
- .3 Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
  - .1 Verify blocking and supports in walls and ceilings have been installed properly at points of attachment.
  - .2 Verify location does not interfere with door swings or use of fixtures.
  - .3 Use fasteners and anchors suitable for substrate and project conditions
  - .4 Install units rigid, straight, plumb, and level.
  - .5 Conceal evidence of drilling, cutting, and fitting to room finish.
  - .6 Test for proper operation.
- .4 Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Touch-up, repair or replace damaged products.



- .3 Clean exposed surfaces of compartments, hardware, and fittings.
- .4 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

End of Section

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## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 08 80 05 Glazing
- .2 Section 09 21 16 Gypsum Board
- .3 Section 10 21 13 Compartments and Cubicles

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM A924/A924M-20 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  - .3 ASTM B456-17 Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
  - .4 ASTM D1187/D1187M-97(2018) 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-B651-12 (R2017) Accessible Design for the Built Environment.
  - .2 CSA G164-18 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 Hafele
  - .5 Richelieu
  - .6 Watrous

#### 2.3 Components

- .1 TPD: Toilet Tissue Dispenser:
  - .1 Supplied by owner, installed by contractor.
- .2 SD: Soap Dispenser: Liquid wall mounted soap dispenser
  - .1 Supplied by owner, installed by contractor.
- .3 PTD: Paper Towel Dispenser:
  - .1 Supplied by Owner, installed by contractor.
- .4 Framed Mirror: Bobrick B-165 1830.
- .5 SND: Sanitary Napkin Disposal:

- .1 Supplied by owner, installed by contractor
- .6 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
- .7 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.
- .8 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
- .9 Coat Hook: Bright polished stainless steel hook with 50 x 50 mm flange, hook 25 mm wide x 165 mm high. Concealed wall plate.
  - .1 Bobrick B-682
- .10 Baby Change Station: Koala KB200- Horizontal Wall Mounted Changing Station. White Granite finish.
- .11 M&BH: Mop and Broom Holder. 610mm long. Type 304 stainless steel, satin finish. Anti-slip mop holders with spring-loaded rubber cam to grip handles 20–30mm diameter. To hold 3 mops 85mm from wall. Height 125mm.
  - .1 Bobrick B223 x 24
- .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.
  - .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.

### 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 03 30 00 Cast-in-Place Concrete
- .2 Section 05 50 00 Metal Fabrications
- .3 Section 06 10 00 Rough Carpentry
- .4 Section 06 20 00 Finish Carpentry
- .5 Section 10 28 10 Toilet and Bath Accessories

### 1.3 Reference Standards

- .1 ASTM International (ASTM)
  - .1 ASTM A312/A312M-19 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- .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.

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## 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 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.
- .6 Clear Anodic Finish: For work specified to have clear anodic finish, provide an AA-M12C22A31 finish, unless otherwise specified.

### 2.2 Products

- .1 **Access Doors:** 1.994 mm galvanized steel for non-fire rated applications. Doors in fire rated assemblies shall be of thickness required to meet fire rating requirements. Generally, and unless noted otherwise, fire rated doors shall be UL/ULC rated for 1 ½ hour "B" label with 250 degree F temperature rise in 30 minutes. Door shall be provided with a 25 mm recess or 14 mm to suit the thickness of the drywall ceiling. The frame shall be provided with a galvanized steel drywall taping bead on all sides. The hinge shall be a concealed pivoting rod. The latch shall be a flush to the surface, screwdriver operated cam latch. The steel finish shall be 5 stage iron phosphate preparation with prime coat of greybaked enamel.
  - .1 Standard of Acceptance: Acudor, Mifab, Zurn, Watrous.
  - .2 Supply access doors to the relevant building trade to provide access in furred ceilings for the following:
    - .1 Servicing equipment
    - .2 Access to plumbing cleanouts
    - .3 Access to shut off valves.
    - .4 Inspection of life safety equipment.
    - .5 Service of operating devices
    - .6 All locations where periodic maintenance is required.
  - .3 Access door sizes shall be as follows:
    - .1 Body Entry: 600 x 600 mm
    - .2 For Hand Entry: 450 x 450 mm
    - .3 For Viewing Only: 300mm x 300mm
- .2 **Corner Guards:** Stainless steel corner guards to be by Construction Specialties Inc. Surface mounted guards to be 1.613 mm stainless steel. Model CO-8 90° stainless steel corner guard with 89 mm standard legs. Mounted with construction adhesive standard; stainless steel screws optional. All necessary fasteners to be supplied by the manufacturer. To be type 304 alloy with #4 satin finish.



- .3 **Storage Buildings:** Precast concrete storage building c/w hollow metal steel door and pressed steel frame. 1599mm wide X 2463mm long x 2007mm high. Brooklin concrete products, Model 40, 4082 kg. or approved equal.

### PART 3 EXECUTION

#### 3.1 Installation

- .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 brackets as indicated on the Drawings.
- .4 Install shelving, and accessories as indicated on the Drawings.

#### 3.2 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 50 00 Aluminum Doors, Windows and Screens

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D5116-17 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products
  - .2 ASTM D6670-18 Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 109-14 Flame Tests of Flame Resistant Fabrics and Films
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
- .4 Canadian Electrical Code.

### 1.4 Submittals

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

#### Manufacturers

- .1 Roller Shade System shall be glazing frame mounted electrical Operated Motorized & non-electrically Operated Solar Shades as manufactured by Solarfective Products Limited.
- .2 Basis of Design:
  - .1 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 Control shades and room darkening shades independently.

### 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 Blackout shade fabric: dimensionally stable blackout fabric.
  - .1 To be selected from manufacturer's full range.
- .3 Performance: fabric shall hang flat, without buckling or distortion. Edge, where trimmed, shall hang true and straight, without shifting sideways more than 3 mm in either direction due to warp distortion or weave design.
- .4 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 Fabric shall hang flat, without buckling or distortion. The edge, when trimmed, shall hang straight without raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than + 3 mm in either direction due to warp distortion, or weave design.
- .8 Adjust to provide for operation without binding.
- .9 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.
- .2 Conduct comprehensive demonstration for Owner's staff on operation and care of interior window treatments.

### 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 31 22 19 Rough Grading
- .2 Section 31 23 10 Excavating, Trenching and Backfilling
- .3 Section 32 92 19 Seeding
- .4 Section 32 92 23 Sodding

### 1.3 References

- .1 Agriculture and Agri-Food Canada (AAFC)
  - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
  - .1 PN 1340-2005 Guidelines for Compost Quality.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Quality Control Submittals: Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

### 1.5 Definitions

- .1 Compost:
  - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
  - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss on Ignition (LOI) test.
  - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 25) and contain no toxic or growth inhibiting contaminants.
  - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category A.

### 1.6 Quality Assurance

- .1 Topsoil from each source, native and imported shall be tested for N.P.K., atrazine, monor elements as well as clay and organic matter contents and acidity (PH) range. Topsoil shall be tested, and written test report received and approved by Consultant prior to delivery to site. Contractor to allow minimum three-weeks lead time for Consultant to submit samples and await laboratory test results prior to installation date.

### 1.7 Shipping, Handling and Storage

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

### 1.8 Waste Management and Disposal

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

- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Owner.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

## PART 2 PRODUCTS

### 2.1 Topsoil in Seeded and Sodded Area

- .1 Topsoil for seeded areas planting beds: mixture of particulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Topsoil shall be fertile, friable natural loam containing not less than 4% of organic matter for clay loams and not less than 2% of organic matter for sandy loams to a maximum of 10% by volume. Topsoil to have an acidity value ranging from a Ph of 6.0 to a Ph of 7.5.
  - .2 Topsoil to be capable of sustaining vigorous plant growth and to be free from subsoil, roots, vegetation, debris, toxic materials, invasive species seeds and weeds and stone over 50mm diameter.
  - .3 Topsoil to be screened prior to delivery to site.
- .2 Fertilizer: Complete commercial synthetic fertilizer as required by soil tests.
- .3 Limestone: Ground agricultural limestone containing minimum 85% of total carbonates.
  - .1 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .4 Elemental Sulphur: Sulphur comprised of ninety (90) percent sulphur and ten (10) percent Bentonite Clay.
  - .1 Consistence: friable when moist.

### 2.2 Topsoil for Tree and Ornamental Grass/Perennial Plantings

- .1 Imported topsoil: friable , neither heavy clay nor of very light sandy nature, containing a minimum of 4% organic matter for clay loam and 2% sandy loams to a maximum of 10% by volume. Free from subsoil, roots, grass, weeds, invasive species seeds, toxic materials, stones, foreign objects and with an acidity range (ph) of 6.0 to 7.5. Topsoil containing crabgrass, couch grass or noxious weeds is not acceptable.

### 2.3 Soil Amendments

- .1 All soil amendments where specified shall be thoroughly and evenly blended to provide uniform consistency of final soil mixture.
- .2 Fertilizer:
  - .1 Fertility: major soil nutrients present in following amounts:
  - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
  - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
  - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
  - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
  - .6 Ph value: 6.0 to 7.5.
- .3 Peatmoss:
  - .1 Derived from partially decomposed species of Sphagnum Mosses.

- .2 Elastic and homogeneous, brown in colour.
- .3 Free of wood and deleterious material which could prohibit growth.
- .4 Shredded particle minimum size: 5 mm.
  
- .4 Sand: washed coarse silica sand, medium to course textured.
  
- .5 Aggregate: Pea gravel 12mm dia. Round Clear.
  
- .6 Organic matter: compost Category A, in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
  
- .7 Limestone: Ground agricultural limestone.
  - .1 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
  
- .8 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

#### 2.4 Source Quality Control

- .1 Advise Consultant of sources of topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Contractor to bare all costs for testing required for initially non-conforming laboratory results requiring further soil amendments.
- .5 Testing of topsoil will be carried out by a testing laboratory approved by Consultant.
  - .1 Soil sampling, testing and analysis to be in accordance with Provincial Standards

### PART 3 EXECUTION

#### 3.1 Stockpiling of Topsoil Prior to Use

- .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .2 Stockpile in off-site location unless otherwise agreed to at pre-construction meeting.
  - .1 Stockpile height not to exceed 2 m if stockpile location on site is identified.
- .3 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill as directed by Consultant and at the expense of the Contractor.
- .4 Protect stockpiles from contamination and compaction.

#### 3.2 Preparation of Existing Grade

- .1 Verify that grades are correct.
  - .1 If discrepancies occur, notify Consultant and do not commence work until instructed by Consultant.



- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches and stones in excess of 25 mm diameter and other deleterious materials.
  - .1 Remove debris which protrudes more than 25 mm above surface.
  - .2 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100mm.
  - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### 3.3 Placing and Spreading of Topsoil/Planting Soil

- .1 Place topsoil after Consultant has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For seeded areas keep topsoil at finished grade.
- .4 Spread topsoil as indicated to following minimum depths after settlement.
  - .1 600mm minimum for ornamental grass and perennial beds and planters.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

### 3.4 Finish Grading

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Consultant.
  - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

### 3.5 Acceptance

- .1 Consultant will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

### 3.6 Surplus material

- .1 Dispose of materials not required off-site.

### 3.7 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .3 Leave all adjacent hard surfaces swept and washed clean of topsoil.

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 14 Asphalt Paving Removal
- .2 Section 03 30 00 Cast-In-Place Concrete
- .3 Section 07 13 13 Bituminous Sheet Waterproofing
- .4 Section 07 21 13 Building Insulation
- .5 Section 31 10 00 Site Clearing
- .6 Section 32 12 16 Asphalt Paving
- .7 Section 32 16 13 Concrete Curbs
- .8 Section 32 16 23 Sidewalks
- .9 Section 32 92 23 Sodding
- .10 Section 33 46 13 Foundation Drainage

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
  - .2 ASTM D1557-12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- .2 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 805 Construction Specification for Temporary Erosion and Sediment Control Measures (November 2015)
  - .2 OPSS 180 General Specification for the Management of Excess Materials (November 2011)
  - .3 OPSS 206 Construction Specification for Grading (November 2009)
  - .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 (November 2006)
  - .2 OPSD 805 Temporary Erosion and Sediment Control Measures (November 2015)
- .4 The Occupational Health and Safety Act.

### 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 No. 5370W-20-GA " dated September 28, 2020 and prepared by Toronto Inspection Ltd.w. The report is available for review at the office of the Owner and Consultant.
- .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 bench marks 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 Quality Assurance

- .1 Conform to the applicable requirements of the Ontario Provincial Standard Specifications (OPSS).

1.12 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. 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 m<sup>2</sup> area.
  - .4 Fills under Pavement or Slabs on Grade: Make three tests for every two lifts of compacted fill for each 500 m<sup>2</sup> area.
  - .5 Backfill Structural Walls: Test each different material for approximately every 30 metres of wall being backfilled at depth increments of 610 mm.

#### 1.13 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

#### 1.14 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.

#### 1.15 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.

#### 1.16 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 Crushed Stone: Crushed stone shall be composed of clean, hard, durable coarse gravel, or crushed rock fragments such that 100% of the particles pass the 18 mm sieve and not more than 10% of the particles pass the No. 4 sieve. No clay or other objectionable materials shall be present.
- .5 Pea Gravel: 10 mm diameter washed stone.
- .6 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.
- .7 Topsoil: 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 and 500 mm at all planting beds.
- .8 Rock Mulch: Rock mulch shall be 75 to 100 mm washed river rock, uniform in size. All fines shall be screened from the aggregate within a 6 mm tolerance. Rock mulch shall be composed of round rocks that may be varied in colour. The material shall be free of organic and inorganic debris and trash.
- .9 Silt fence: heavy duty geotextile, Mirafi Envirofence or equivalent.

### PART 3 EXECUTION

#### 3.1 Preparation

- .1 Clearing: Refer to Section 31 10 00 - Site Clearing.
- .2 Lines and Levels: Refer to Section 01 71 00 - Examination and Preparation.
- .3 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.

- .4 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.
- .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 Remove all concrete, masonry, rubble or other construction debris encountered during the work.
- .5 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.
- .6 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.
- .7 Excavations must not interfere with the normal 45 degree plane of bearing from the bottom of any footing.
- .8 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.
- .9 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.
- .10 If removal of earth causes displacement of adjacent earth, the earth so disturbed shall be removed at no additional cost to the Owner.
- .11 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.
- .12 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 Unders 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 Crushed Stone: around all drainage piping, minimum 200 mm thick.
- .5 Engineered Fill: All fill locations up to the underside of Type B fill and where required to fill up to design elevations.
- .6 Topsoil: at all areas to receive sod or hydraulic seeding, and in planting beds. Minimum 100 mm thickness unless noted otherwise.
- .7 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. Complete testing as described in Part 1 of this specification.

### 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 31 22 19 Topsoil Placement and Fine Grading
- .2 Section 31 23 10 Excavating, Trenching and Backfilling
- .3 Section 32 12 16 Asphalt Paving

### 1.3 References

- .1 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 206 Grading (2014)

### 1.4 Project Conditions

- .1 The Contractor shall make himself aware of all utilities prior to commencement of any works on site.

### 1.5 Protection

- .1 Prevent damage to fencing, trees, landscaping, existing pavement, surface or underground utility lines, which are to remain.
- .2 Utilize proper equipment and make good any damage to areas disturbed during construction.
- .3 Mud tracking and cleaning of roads, walkways and other surfaces both on and off the site will be the responsibility of the Contractor.

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Obtain approval of all excavated or graded material used as fill for grading work.
- .2 Include for all excavation of materials required, except as specifically provided elsewhere in the contract to the lines and grades as shown on the plans, or as directed by the Owner or Consultant.

## PART 3 EXECUTION

### 3.1 Grading

- .1 Rough grade to levels and contours as shown on the contract drawings.
- .2 Rough grade to following depth below finished grade, or as directed by Consultant:
  - .1 150 mm for sodded areas.
  - .2 600 mm for shrub beds.
  - .3 Depth for asphalt parking determined by Section 32 12 16 – Asphalt Paving.

- .4 Depth for concrete sidewalks and exterior concrete surfacing by Landscape Drawings.
- .5 Depth for concrete curbs as indicated on Drawings.
- .3 Prior to placing fill over existing ground, scarify the existing subgrade surface to a depth of 150mm.
- .4 Compact fill material to Standard Proctor density as follows:
  - .1 95% landscaped areas
  - .2 98% paved and concrete areas
- .5 Do not disturb soil within canopy spread of trees or shrubs to remain.
- .6 All work shall be in accordance with OPSS 206.

### 3.2 Testing

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by Owner. Costs of tests will be paid by Owner. Refer to Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .2 Acceptance of grades and soil compaction by is subject to final test results.
- .3 Acceptance of sub-grade by Consultant prior to topsoil or drainage installation.

### 3.3 Surplus Material

- .1 If after excavating to the elevations shown on the drawings, the material encountered should prove unacceptable to the Consultant, perform additional excavation as directed by the Owner, payment for which will be paid under this item.
- .2 Materials which are surplus to, or, unsuitable for the fill under the contract awarded shall be disposed of away from the site at the Contractor's expense at an approved location arranged by the contractor and to the satisfaction of the Owner.
- .3 The Contractor shall supply to the owner, a minimum of seventy-two hours prior to off-site disposal or reuse of excess material, a plan illustrating the proposed place of reuse or disposal.
- .4 Obtain and provide to the Owner proof that the requirements applicable to Municipal By-Laws have been complied with.

### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

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## 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 ASTM International (ASTM)
  - .1 ASTM C117-17 Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
  - .2 ASTM C131/C131M - 20 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - .3 ASTM C136/C136M-19 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
  - .4 ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
  - .5 ASTM D1557-12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
  - .6 ASTM D1883-16 Standard Test Method for California Bearing Ratio (CBR) of Laboratory Compacted Soils.
  - .7 ASTM D4318-17e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- .2 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 1010 Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material

### 1.4 Submittals

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

### 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 Granular Sub-Base Material:
  - .1 Crushed, pit run or screened stone, gravel or sand shall be supplied in accordance with OPSS 1010.

## PART 3 EXECUTION

### 3.1 Placing

- .1 Place granular sub-base after subgrade is inspected and approved by Consultant.

- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Consultant may authorize thicker lifts (layers) if specified compaction can be achieved.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace portion of layer in which material had become segregated during spreading.

### 3.2 Compaction

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Consultant before use.
- .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compact to density of not less than 100% maximum dry density in accordance with ASTM D698.
- .5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .6 Apply water as necessary during compaction to obtain specified density.
- .7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.
- .8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### 3.3 Proof Rolling

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with center to center spacing of 730 mm maximum.
- .2 Obtain approval from Consultant to use non-standard proof rolling equipment.
- .3 Proof roll at level in sub base as indicated. If non-standard proof rolling equipment is approved, Consultant to determine level of proof rolling.
- .4 Proof roll top of compacted, prepared subgrade.

- .5 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .6 Where proof rolling reveals areas of defective subgrade:
  - .1 Remove sub base and subgrade material to depth and extent as directed by Consultant.
  - .2 Backfill excavated subgrade with sub base material and compact in accordance with this section.
- .7 Where proof rolling reveals areas of defective sub base, remove and replace in accordance with this section at no extra cost.

### 3.4 Site Tolerances

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated by not uniformly high or low.

### 3.5 Protection

- .1 Maintain finished sub base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Consultant.

### 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 31 23 10 Excavating, Trenching and Backfilling
- .3 Section 32 16 13 Concrete Curbs
- .4 Section 32 16 23 Sidewalks
- .5 Section 32 17 23 Pavement Markings

### 1.3 References

- .1 Ontario Provincial Standard Specification (OPSS)
  - .1 OPSS 1003 (2013) Material Specification for Aggregates - Hot Mix Asphalt
  - .2 OPSS 1010 (2013) Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material
  - .3 OPSS 1101 (2014) Material Specification for Performance Graded Asphalt Cement
  - .4 OPSS 1103 (2012) Material Specification for Emulsified Asphalt
  - .5 OPSS 1150 (2008) Material Specification for Hot Mix Asphalt

### 1.4 Protection

- .1 Protect work of all trades and adjacent properties from damage from the work of this section.
- .2 Barricade paved areas to prevent vehicle traffic for at least 24 hours after completion.

### 1.5 Quality Assurance

- .1 All work of this Section shall be completed by a bona fide road building contractor engaged in paving work for a minimum of 5 years and having all equipment necessary to complete the work as specified.

### 1.6 Inspection and Testing

- .1 The Owner will engage an independent inspection and testing company.
- .2 The inspection and testing company shall perform the following services:
  - .1 Sample proposed sources of fill materials and advise as to acceptability, maximum densities obtainable and compaction procedures.
  - .2 Carry out density tests to ensure that the required density is achieved and report the results of such tests in writing.
- .3 The cost of employing the inspection and testing company shall be paid for by the Contractor out of the cash allowances specified in Division 00.



## PART 2 PRODUCTS

### 2.1 Engineered Fill

- .1 Compacted Granular 'B' fill or other suitable fill as approved by the Consultant to thickness required to bring subgrade to level of underside of Granular 'B' base course.

### 2.2 Granular Base Materials

- .1 Granular 'B' Base Course: Crushed or uncrushed bank or pit gravel or stone obtained from an approved source, conforming to requirements for Granular 'B' aggregate, Ontario Provincial Standard Specifications Form No. 1010.
- .2 Granular 'A' Base Course: Crushed gravel or stone, obtained from an approved source conforming to requirements for Granular 'A' aggregate, Ontario Provincial Standard Specifications Form No. 1010.

### 2.3 Asphalt Materials

- .1 Asphalt Cement: OPSS 1101
- .2 Aggregates: OPSS 1003 and OPSS 1010
- .3 Filler: OPSS 1003
- .4 Asphalt (H.L.8) conforming to OPSS Form 1150
  - .1 Bituminous First Course - shall be dense graded, hot mixed, hot laid.
- .5 Asphalt (H.L.3) conforming to OPSS Form 1150
  - .1 Asphalt surface course shall be hot mixed, hot laid.
- .6 Emulsified Asphalt OPSS 1010 or MTO primer.

### 2.4 Joint Painting Material and Asphaltic Primer

- .1 SS-1 Emulsion to OPSS 1103.

### 2.5 Cold Patch

- .1 Asphaltic patching materials in accordance with Ontario Provincial Standard Specifications.

### 2.6 Painted Line Markings

- .1 As specified in Section 32 17 23 – Pavement Markings.

## PART 3 EXECUTION

### 3.1 Surface Conditions

- .1 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.

- .2 Verify that asphalt pavement may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
- .3 Check rough grading, re-grade, re-level and re-compact as required. Soft spots, wet holes, shall be dug out and filled with granular fill placed in not over 150 mm layers and compacted. Remove surplus material from the site.
- .4 Sub-grade shall be fully stabilized, compacted to 100% of standard Proctor Density and levelled to a tolerance of not more than 13 mm measured on a 3.0 m straight edge.
- .5 In the event of discrepancy, immediately notify the Consultant.
- .6 Place and compact engineered fill in sufficient quantities to bring subgrade up to specified level of underside of Granular 'B' base course. Compact engineered fill to 95% Standard Proctor Density.

### 3.2 Placement of Granular Base

- .1 Granular material shall be placed in layers of such thickness that the equipment being used can produce the specified density.
- .2 Immediately after leveling the material shall be compacted to the specified density.
- .3 Compaction: All granular material shall be compacted to a minimum of 100% Standard Proctor Maximum Density.
- .4 Finished elevation tolerance will be to within 13 mm of the required elevation.

### 3.3 Placement of Asphaltic Surfacing

- .1 Asphalt driveway surfacing shall be placed in accordance with Ontario Provincial Standard Specification for Hot Mix Hot Laid Asphaltic Concrete. Materials, equipment and construction methods shall be in accordance with the current edition of OPSS 1010 including all amendments thereto.
- .2 Place asphalt driveway paving where indicated on the drawings.
- .3 Pavement structures including asphalt course and fill shall be as noted on the drawings.
- .4 Finished surface shall be smooth of uniform density and texture and true to established finished elevations. Paving shall be of thickness specified and when checked with a 3 m straight edge shall show no irregularity exceeding 6 mm in depth. Surface shall be sloped in order that all surface water will be drained to perimeter of asphalt.
- .5 Paint contact edges of abutting concrete paving with a thick coat of hot asphalt cement before paving mixture is placed against them.
- .6 Joints in asphalt shall be kept to a minimum. Joints in base and top asphalt shall be staggered.
- .7 Base asphalt shall be thoroughly cleaned prior to placing of top course of asphalt.

- .8 Where asphalt does not adjoin concrete paving, edges shall be trimmed and hand tamped to a clean straight line.

### 3.4 Patching Asphalt Pavement

- .1 Saw cut perimeters of areas to be patched or joined. Remove existing asphalt and base material to depth required.
- .2 Grind top surface of asphalt to depth of 38 mm for width of 300 mm from saw cut. Paint exposed edge of asphaltic joints, edge of maintenance holes and catch basin frames, curbs and similar items with SS-1 emulsified asphalt.

### 3.5 Asphalt Prime

- .1 Paint contact of curbs and like structures with thin, uniform coat of asphalt prime material.
- .2 Do not apply prime when air temperature is less than 5 ° C or when rain is forecast within 2 hours.
- .3 Where traffic is to be maintained, treat no more than one-half width of surface in one application.
- .4 Prevent overlap at junction of spreads.
- .5 Do not prime surfaces that will be visible when paving is complete.
- .6 Apply additional material to areas not sufficiently covered.
- .7 Keep traffic off primed areas until asphalt prime has cured.
- .8 Permit prime to cure before placing asphalt paving.

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 Formwork
- .2 Section 03 30 00 Cast-in-Place Concrete
- .3 Section 31 23 10 Excavating, Trenching and Backfilling
- .4 Section 32 16 23 Sidewalks

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C309-19 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .2 ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
- .2 CSA Group (CSA)
  - .1 CSA-A23.1-14/ CSA-A23.2 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete.
- .3 Ontario Provincial Standard Specifications and Details (OPSS and OPSD)
  - .1 OPSS 1010 Material Specification for Aggregates - Granular A, B, M and Select Subgrade Material.
  - .2 OPSS1308 Material Specification for Joint Filler (Concrete).
  - .3 OPSD 600.110 Concrete Barrier Curb.

### 1.4 Quality Assurance

- .1 Do concrete work in accordance with the requirements of Division 3, except where otherwise specified herein.

### 1.5 Shipping, Handling and Storage

- .1 Refer to Section 01 16 00 – Common Product Requirements.

### 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 Base: Granular "A", OPSS 1010.
- .2 Concrete: CSA-A23.1
- .3 Curing Compound: Chlorinated rubber based, ASTM C309 Type 2, suitable for exterior use.

- .4 Form Work: Steel or wood, capable of producing smooth, flat surfaces.
- .5 Joint Filler: Pre moulded, non-extruding and resilient bituminous. OPSS 1308 Type 'A' joint filler. 13 mm thick
- .6 Reinforcing Steel: Deformed billet steel bars to CSA G30.12-M, Grade 400.
- .7 Sealer: A-H anti-spalling compound by Anti-Hydro, or Sealtight CS-309 by W.R. Meadows.

## 2.2 Concrete Mix

- .1 Concrete Mixes and materials: in accordance with Section 03 30 00.

## PART 3 EXECUTION

### 3.1 Preparation

- .1 Establish lines and levels as required for completion of work.
- .2 Excavate for curbs to lines and grades required.

### 3.2 Placing Granular Base

- .1 Sub-grade must be dry and compacted to smooth surface and required grade prior to placing granular base material. Compact to minimum of 98% of Standard Proctor density.
- .2 Place Granular Base to a uniform cross-section over required area in layers not exceeding 150 mm un-compacted thickness and to total depth of 300 mm.
- .3 Finish granular base surface true to curb founding elevations and compact to minimum of 98% of Standard Proctor density, ASTM D698.

### 3.3 Placing Concrete Curbs

- .1 Align concrete curbs and gutters with curves and tangents as shown on Drawings.
- .2 Curbs shall be in accordance with OPSD 600.110
- .3 Pour concrete on prepared sub-base to required levels and dimensions. Execute work to requirements of CSA A23.1 and CSA A23.2.
- .4 Do not pour concrete when air temperature is or may fall below 5 ° C during or within 24 hours of pour, unless precautions are taken to prevent damage to concrete resulting from low temperature.
- .5 Remove and replace any concrete damaged by freezing at no extra cost.
- .6 Finish concrete with a wooden float to produce an even gritty surface.
- .7 Finish edges of concrete curbs and gutters in accordance with OPSD Standard Drawings.
- .8 Provide mountable curb along length of barrier free parking spaces and drop curbs at all pedestrian crossings, as indicated on the drawings.

- .9 Apply membrane forming curing compound as soon as surface is free of bleed water to uniformly cover exposed concrete surfaces at rate of not less than 1.0 litre/5 m<sup>2</sup>. Maintain this protection for minimum 7 days.
- .10 Apply sealer to exposed surfaces of curbs and gutters, in two coats, in accordance with manufacturer's directions. Prevent contamination of adjacent surfaces.

### 3.4 Joints

- .1 Joints between curb and gutter and any abutting sidewalk, catch basin and manhole frames, gutter outlets, or any structure, shall be formed with 13 mm thick panels of joint filler, except for control joints for extruded or formed curb and gutter, where they may be sawcut or formed with a "Guillotine" knife.

### 3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 10 – 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 92 00 Joint Sealants
- .3 Section 31 23 10 Excavating, Trenching and Backfilling
- .4 Section 32 16 13 Concrete Curbs
- .5 Section 32 17 26 Tactile Warning Surfacing

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C171-16 Standard Specification for Sheet Materials for Curing Concrete
  - .2 ASTM C309-19 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
- .2 CSA Group (CSA)
  - .1 CSA-A23.1-14/ CSA-A23.2 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete.
- .3 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 351 Construction Specification for Concrete Sidewalk
  - .2 OPSS 1010 Material Specification for Aggregates - Granular A, B, M and Select Subgrade Material
  - .3 OPSS1308 Material Specification for Joint Filler (Concrete)
- .4 Ontario Provincial Standard Details (OPSD)
  - .1 OPSD 310.010 Concrete Sidewalk

### 1.4 Waste Management and Disposal

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

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Base: Granular "A", OPSS 1010.
- .2 Concrete: CSA A23.1-M.
- .3 Curing Compound: Chlorinated rubber based, ASTM C309 Type 2, suitable for exterior use.
- .4 Joint Filler: Premoulded, non-extruding and resilient bituminous. OPSS 1308 Type A joint filler.
- .5 Form Lumber: No. 2 S.P.F., 28 x 89 mm, free of twist and warp.
- .6 Reinforcing Steel: 152 x 152 mm MW18.7/MW18.7 welded wire mesh, in flat sheets, not rolls.

.7 Polyethylene Sheeting: 0.100 mm thickness, to CGSB CAN2-53.33.

## 2.2 Concrete Mixes

.1 Concrete Mixes and materials: in accordance with Section 03 30 00.

## PART 3 EXECUTION

### 3.1 Preparation

- .1 Establish lines and levels as required for completion of work.
- .2 Check adequacy of preparations for sidewalks done under Section 31 23 10. Ensure that sub-base is compacted to 98% of Standard Proctor density ASTM D698.

### 3.2 Placing Granular Base

- .1 Sub-grade must be dry and compacted to smooth surface and required grade prior to placing granular base material.
- .2 Place Granular Base to a uniform cross-section over required area in minimum 100 mm thickness.
- .3 Finish granular base surface true to sidewalk founding elevations and compact to minimum of 98% of Standard Proctor density, ASTM D698.

### 3.3 Installation

- .1 Construct Sidewalks to OPSD 310.010
- .2 Coordinate installation of tactile warning surfacing specified in Section 32 17 26.
- .3 Erect formwork for sidewalks to achieve lines and grades shown on the drawings.
- .4 Cut expansion joint filler to full cross sectional shape of the sidewalk and place at intervals not exceeding 6.0 m. Locate expansion joints at intersections in accordance with OPSD 310.010. Refer to plans for patterns.
- .5 Place expansion joint filler between sidewalks and curbs, between sidewalks and building foundations and between sidewalk and any poured concrete bases or piers.
- .6 Pour concrete on prepared sub-base to required levels and dimensions. Execute all concrete work to CSA A23.1, and CSA A23.2.
- .7 Pour concrete sidewalks with minimum 125 mm depth, and with transverse slope of 2 mm/ 100 mm (2%). Sidewalk thickness adjacent to curbs shall be 150 mm thick.
- .8 Do not pour concrete when air temperature is or may fall below 5 ° C during or within 24 hours of pour, unless precautions are taken to prevent damage to concrete resulting from low temperature.
- .9 Remove and replace any concrete damaged by freezing at no extra cost.
- .10 Finish concrete with light broom finish, transverse to direction of travel.



- .11 Trowel smooth edges, minimum 75 mm wide.
- .12 Apply membrane forming curing compound as soon as surface is free of bleed water to uniformly cover exposed concrete surfaces at rate of not less than 1.0 litre/5 m<sup>2</sup>. Maintain this protection for minimum 7 days.
- .13 Divide sidewalk between expansion joints into lengths not exceeding 1.5 m on centre equally spaced between expansion joints, with power driven carbide tipped blade, or other device approved for use by the Consultant.
- .14 Tool contraction joints with smooth edges, 75 mm wide.

### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

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## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 32 12 16 Asphalt Paving

### 1.3 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 American Association of State and Highway Transportation Officials (AASHTO)
  - .1 AASHTO M 248-91 (2012) Standard Specification for Ready-Mixed White and Yellow Traffic Paints
- .3 United States Federal Standards
  - .1 Federal Standard 595B, Colors Used in Government Procurement
- .4 The Accessibility for Ontarians with Disabilities Act, 2005 (AODA)

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit to Consultant following material sample at least 4 weeks prior to commencing work.
  - .1 Paint colour selection.
- .3 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, reference specification number and formulation number and batch number.

### 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 Paint:
  - .1 To OPSS 1716, Water-Borne Traffic Paint
  - .2 Colour: Federal Standard FS Federal 595B, Yellow 33538.
  - .3 Provide H.C. Blue (Pantone 293 C) to OPSS standards for accessible parking spaces.
  - .4 Paint shall be non-slip.
- .2 Glass beads: Overlay type: OPSS 1750 Traffic Paint Reflectorizing Glass Beads

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## 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 Unless otherwise approved by Consultant, 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 3m<sup>2</sup> /L.
- .4 Do not thin paint unless approved by Consultant.
- .5 Symbols and letters to conform to dimensions indicated.
- .6 Paint lines to be of uniform colour and density with sharp edges.
- .7 Paint accessible parking spaces blue with a painted pavement marking in the centre of the space, in contrasting colour to the pavement, 1000mm in length, with the International Symbol of Accessibility.
- .8 Thoroughly clean distributor tank before refilling with paint of different colour.
- .9 Apply glass beads at rate of 200g/m<sup>2</sup> 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 03 30 00 Cast-in-Place Concrete
- .2 Section 32 16 23 Sidewalks

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A48/A48M-03(2016) Standard Specification for Gray Iron Castings
  - .2 ASTM A327/A327M-11(2017) Standard Test Methods for Impact Testing of Cast Irons
  - .3 ASTM C501-84(2015) Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
  - .4 ASTM C1028 - 07e1 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
  - .5 ASTM D638-14 Standard Test Method for Tensile Properties of Plastics
  - .6 ASTM D695-15 Standard Test Method for Compressive Properties of Rigid Plastics
- .2 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 literature describing products, installation procedures and routine maintenance.
- .3 Samples for Verification Purposes: Submit one plate sample that shows dome size and spacing.
- .4 Submit shop drawings showing fabrication details, fastener and anchor locations, plans of plate placement including joints, and material to be used as well as outlining installation materials and procedure.
- .5 Material Test Reports: Submit complete test reports from qualified accredited independent testing laboratories to qualify that materials proposed for use are in compliance with requirements and meet or exceed the properties indicated on the specifications. All tests shall be conducted on a Cast Iron Detectable/Tactile Warning Surface Indicator Plate as certified by a qualified independent testing laboratory.
- .6 Maintenance Instructions: Submit copies of manufacturer's specified installation and maintenance practices for each type of Detectable/Tactile Warning Surface Indicator Plate and accessory as required for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00.

### 1.5 Quality Assurance

- .1 Provide Cast Iron Detectable/Tactile Warning Surface Indicator Plates and accessories by a single supplier with a minimum of three years' experience in the supply of Cast Iron Detectable/Tactile Warning Surface Indicator Plates.

- .2 Installer's Qualifications: Engage an experienced installer certified in writing by Cast Iron Detectable/Tactile Warning Surface Indicator Plate supplier as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for the project.

#### 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 Cast Iron Detectable/Tactile Warning Surface Indicator Plates shall be suitably packaged or crated to prevent damage in shipment and handling. Detectable/Tactile Warning Surface Indicator plate type shall be identified by part number.

#### 1.7 Project Conditions

- .1 Environmental Conditions and Protection: Maintain minimum temperature of 5° C in spaces to receive Cast Iron Detectable/Tactile Warning Surface Indicator Plates for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.
- .2 The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the general public. Provide barricades or screens to protect the general public.

#### 1.8 Waste Management and Disposal

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

#### 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 Manufacturer

- .1 The Gray Cast Iron Detectable/Tactile Warning Surface Indicator Plate specified is based on Advantage Cast Iron Tactile [www.advantagetactile.com](http://www.advantagetactile.com) as distributed by Kinesik Engineered Products, 2213 North Sheridan Way Mississauga, Ontario L5K 1A3.
- .2 Provide Cast Iron Detectable/Tactile Warning Surface Indicator Plates which are in compliance with the Accessibility for Ontarians with Disabilities Act
- .3 Gray Cast Iron Detectable/Tactile Warning Surface Indicator Plates shall be according to ASTM A48M, Class 35B, and shall be bare and not coated with paint or other coatings or substances. Castings shall be sound, free from pouring faults, cracks, blowholes and other defects.
  - .1 Dimensions: The plate shall incorporate an in-line pattern of truncated domes measuring nominal 5.0 mm height, 23 mm base diameter, 11.4 mm top diameter spaced center-to-center 60 mm (+/- 1.2 mm). For wheelchair safety the field area shall consist of a series of micro texture 1.5 mm high.

- .4 Gray Cast Iron Detectable/Tactile Warning Surface Indicator Plates shall meet or exceed the following test criteria:

ASTM Reference	Test Description	Value
ASTM C1028	Static Coefficient of Friction	≥ 1.0 wet/dry
ASTM A327	Impact Resistance	No damage @ 54 J
ASTM A48	Standard Specification for Gray Iron Castings	
ASTM D695	Compressive Strength	114,000 psi
ASTM D638	Tensile Strength	35,000 psi
ASTM C501	Abrasive Wear Index	≥ 8800

- .2 Tactile warning surface tiles shall be 610 mm deep x 914 mm minimum total accumulated width unless otherwise indicated. Tile are based on Advantage Cast Iron Tactile model ADV-CI-1824.
- .3 Existing engineered and field tested products, which have been in successful service for a period of three years and in compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

## 2.2 Materials

- .1 Optional fasteners required if plates are assembled together prior to installation: Corrosion resistant, hex head bolt, 10 mm diameter x 45 mm long. Minimum two per Detectable/Tactile Warning Surface Indicator plate connection.

## PART 3 EXECUTION

### 3.1 Installation

- .1 During all surface preparation and installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- .2 Related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers.
- .3 Coordinate to ensure that the surfaces being prepared and fabricated to receive the plates are constructed correctly and adequately for plate installation. Review manufacturer and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to the Consultant.
- .4 The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 76 to 100 mm to permit solid placement of the Cast Iron Detectable/Tactile Warning Surface Indicator Plates.
- .5 When preparing to set the plate, ensure that the area to receive the plates has been finished to its final elevation. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the plate placement. Vents in the plate allow air and displaced concrete to escape during the installation process.

- .6 Lift the Detectable/Tactile Warning Surface Indicator plate and place into position onto the wet concrete. The plate shall be placed true and square to the curb edge in accordance with the contract drawings. Press into the concrete. The Cast Iron Detectable/Tactile Warning Surface Indicator Plates shall be tamped into the fresh concrete to ensure that the field level of the plate is flush to the adjacent concrete surface.
- .7 Immediately after placement, the plate elevation is to be checked to adjacent concrete, and the concrete around the perimeter of the tile should be finished. The elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates. Ensure that the field surface of the plate is flush with the surrounding concrete and back of curb so that no ponding is possible on the plate at the back side of curb, and to eliminate tripping hazards between adjacent finishes.
- .8 While concrete is workable, create a 6 mm concrete-free recess around the perimeter of the plate. Use a 9.5 mm radius edging tool to create a finished edge of concrete. A steel trowel shall be used to finish the concrete around the plate's perimeter, flush to the field level of the plate.
- .9 Clean the surface of the tile of any concrete that has protruded from the vent holes.
- .10 During and after the Detectable/Tactile Warning Surface Indicator Plate installation and the concrete curing stage, it is imperative that there is no walking, leaning or external force placed on the plate that may rock the plate causing a void between the underside of Detectable/Tactile Warning Surface Indicator Plate and concrete.
- .11 Following Detectable/Tactile Warning Surface Indicator Plate placement, review installation tolerances to contract drawings and adjust plate before the concrete sets.
- .12 Following the concrete curing stage clean the residue using a soft brass wire brush without damage to the plate surface.

### 3.2 Protection

- .1 Protect plates against damage during construction period to comply with Detectable/Tactile Warning Surface Indicator plate manufacturer's specification.
- .2 Protect plates against damage from rolling loads following installation by covering with plywood.

### 3.3 Cleaning

- .1 Proceed in accordance with Section 01 74 01 – Cleaning.
- .2 Comply with manufacturer's maintenance manual for cleaning and maintaining plate surface.

End of Section

Part 1 General

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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 SPECIFICATIONS

- .1 All work performed shall be in accordance with latest edition of the Ontario Building Code, CSA, ASHRAE, NFPA, etc. where codes/standard are present from multiple sources, the most stringent shall be utilized.
- .2 The following specifications form an essential part of the contract documents. refer and coordinate with all other divisions, sections and specifications to provide a complete and operational installation.
- .3 For the purpose of these specifications, drawings and contract documents, the word 'provide' refers to the supply, installation and testing of the respective equipment/components.
- .4 Contractor is to report all apparent discrepancies between drawings and specifications of all divisions prior to tender submission. no exceptions will be given to contractors who do not completely understand the scope of work.
- .5 All mechanical division work shall be coordinated and scheduled with all other divisions.
- .6 This contractor shall visit the site and completely investigate and understand the existing conditions and their relation to the design drawings/documents. No consideration will be given to the contractor for any hindrances to the mechanical installation from site conditions which existed prior to tender submission. As such and where required, the contractor shall provide interference drawings and shall submit them to the consultant for review.
- .7 Provide new materials and equipment of acceptable quality that are manufactured in Canada or the United States and bear the approval of recognized North American Standard Associations such as CSA, ASME, etc. the contractor shall maximize the utilization of Canadian equipment, materials, etc.
- .8 All equipment, materials, etc. shall be installed in strict accordance with the manufacturer's installation instructions and recommendations.
- .9 The mechanical drawings display a general design and installation, therefore the contractor shall obtain clarification from the consultant prior to installation.
- .10 These drawings have been prepared for the mechanical division and do not accurately display all electrical, structural and architectural elements. Refer to other division's drawings for clarification.
- .11 In no case shall these drawings be scaled. All rough-in's shall be coordinated with other divisions.
- .12 Do not proceed with work outside the scope of the design drawings and specifications without written consent from the owner. this applies to all mechanical division change notices as issued by the consultant.
- .13 In regard to mechanical division change notices, contractor shall provide a breakdown including, but not limited to, materials, labour, mark-up, etc. Quotations shall be based on Allpriser for equipment and the mechanical contractors of America, SMACNA, and National Electrical Contractors for labour rates.

- .14 Where equipment has been pre-purchased, the mechanical division shall accept all responsibility for equipment delivery, installation, testing and warranty, similar to as if the equipment was purchased by the mechanical division.
- .15 The contractor shall warranty all materials, equipment, installation and quality Of workmanship for a minimum of one (1) year unless otherwise noted.
- .16 It is the mechanical contractor's responsibility to pay for all charges and damages associated with equipment that is not provided as specified and includes not meeting the manufacturer's ratings, published data and/or the applicable governing standards.
- .17 The contractor may submit for alternate materials and equipment only when the specified are not available or will adversely impact the completion schedule. The contractor shall compensate the consultant for their time required to review the alternate submittals. Submit in accordance with this section.

## 1.2 SUBMITTALS

- .1 The contractor shall submit three (3) hard copies of mechanical shop drawings to the consultants for review. Electronic submission of shop drawings shall be deemed acceptable upon approval from consultant. The contractor shall bear all costs associated with the document submittal process.
- .2 All shop drawings submitted for review must bear the review stamp of the mechanical contractor. Shop drawings that do not bear the contractor's stamp will, without question, be rejected by the consultant.
- .3 shop drawings shall include all information required for the consultant to perform reasonable review of the submittals as the pertain to the mechanical design drawings and specifications.
- .4 Shop drawings shall have the same identifying number as noted in the mechanical drawings.
- .5 Provide shop drawings with technical submittals on all types of insulation to be installed.
- .6 The contractor shall maintain on site one (1) record of mechanical drawings that shall indicate with red lines all project conditions, locations, configurations and any other changes or deviations which may vary from the original contract documents and drawings. In addition, this set shall include revisions as a result of all addendas, change notices, site instructions, etc. Upon completion of the project, the contractor shall submit to the owner and engineer one (1) copy each of a hardcopy and electronic copy (pdf) for review. One (1) set of both copies shall also be included in the closeout document package.
- .7 Two (2) copies of operation and maintenance manuals shall be submitted to the consultant for review upon project completion. The manuals shall contain the following where applicable:
  - description of each system
  - description of each major component of system
  - all shop drawings with approval stamps

- equipment manufacturer's installation and operation
- manuals and spare parts list
- wiring diagrams
- lubrication schedule
- equipment identification list with serial numbers
- valve tag schedules and flow diagrams
- final and reviewed balancing reports (air and water)
- water treatment procedure and tests
- control drawings and sequences of operation
- as-built drawings (hardcopy and electronic)
- warranty documentation

Part 2 Products

2.1 NOT NUSED

.1 Not Used

Part 3 Execution

3.1 GENERAL PRACTICE

- .1 Periodic inspections of the work will be conducted over the course of the project. All reported deficiencies shall be rectified by the contractor in a timely fashion. Failure to do so will result in the contractor not meeting the requirements of the contract documents.
- .2 It shall be the responsibility of the contractor to coordinate all inspections with city and/or municipal officials and all other authorities having jurisdiction.
- .3 In regards to temporary services, provide, as required by the authority having jurisdiction, temporary fire protection systems. Refrain from using installed systems from the contract documents as a temporary services. This shall apply to all mechanical systems including HVAC, plumbing and drainage, etc.
- .4 This contractor shall be responsible for all cutting, patching and restoration. Where requested, the contractor shall contract the services of the base building trades at div.15 expense.
- .5 Provisions shall be made for the protection of div.15 work until the completion of the project. This may include, but not limited to, covering of equipment openings and ductwork, plumbing fixtures, floor drains, etc.

- .6 Upon completion of construction, contractor shall make all final adjustments to equipment as well as remove all protection. All installations shall be cleaned thoroughly and tested for proper operation. Change all air and water filters as required.
- .7 In regards to interruption of services, the contractor shall carry out their work in a manner that causes the least disturbance to the owner. Provide notification to the owner in writing with at least 72 hours of the scheduled interruption.
- .8 Arrange and pay for the safe disposal of removed items as specified. Provide proof of safe disposal for items such as HVAC refrigerant. Coordinate the time and method of disposal with the owner. For example, clearly indicate the route that will be taken from the inside of the building to the outdoors, as well as the storage location outdoors if applicable.
- .9 Where components are to be reused, the contractor shall clean and test the component to ensure proper operation. The consultant shall be notified in the event there is a deficiency with the component.
- .10 Perform work so as to cause minimal disturbance to owner and/or adjacent areas. Minimize dust and noise and provide temporary air filters on air handling systems affect by the area of work. All costs associated with damages as a result of the mechanical installation shall be covered by div.15. Maintain safety standards and provide adequate signage for both workers and occupants.
- .11 Where cutting or core drilling of the existing concrete structure is required, the mechanical contractor shall contract the services of an experienced and reputable company to carry out x-raying. The results shall be submitted to the base building structural engineer and not cutting or coring shall take place until written approval is received. The contractor shall provide a written request to perform x-raying with at least 72 hours in advance.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with this section.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .1            Indicate on drawings:
- .1            Mounting arrangements.
- .2            Operating and maintenance clearances.
- .2            Shop drawings and product data accompanied by:
- .1            Detailed drawings of bases, supports, and anchor bolts.
- .2            Acoustical sound power data, where applicable.
- .3            Points of operation on performance curves.
- .4            Manufacturer to certify current model production.
- .5            Certification of compliance to applicable codes.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
- .1            Operation and maintenance manual approved by, and final copies deposited with, Engineer before final inspection.
- .2            Operation data to include:
- .1            Control schematics for systems including environmental controls.
- .2            Description of systems and their controls.
- .3            Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4            Operation instruction for systems and component.
- .5            Description of actions to be taken in event of equipment failure.
- .6            Valves schedule and flow diagram.
- .7            Colour coding chart.
- .3            Maintenance data to include:
- .1            Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
- .2            Data to include schedules of tasks, frequency, tools required and task time.

- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit [2] copies of draft Operation and Maintenance Manual to Engineer for approval, including electronic form also. Submission of individual data will not be accepted unless directed by Engineer.
  - .2 Make changes as required and re-submit as directed by Engineer.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
  - .5 Make available in electronic form.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Engineer for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.
- .10 Submit as-built drawings in electronic form as well in PDF and CAD formats.

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

- 1.4 DELIVERY, STORAGE AND HANDLING
  - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .2 Storage and Handling Requirements:
    - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Store and protect materials from nicks, scratches, and blemishes.
    - .3 Replace defective or damaged materials with new.
  - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
  
- Part 2 Products
- 2.1 NOT USED
  - .1 Not Used.
  
- Part 3 Execution
- 3.1 EXAMINATION
  - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 PAINTING REPAIRS AND RESTORATION
  - .1 Prime and touch up marred finished paintwork to match original.
  - .4 Restore to new condition, finishes which have been damaged.
- 3.3 SYSTEM CLEANING
  - .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.
- 3.4 FIELD QUALITY CONTROL
  - .1 Site Tests: conduct following tests and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Manufacturer's Field Services:



- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

- .1 Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

3.6 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 21 05 00 – Common Work Results for Fire Suppression.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Submit complete plans to Authority of Jurisdiction for review and approval before commencement of work.
- .3            Indicate grooved joint couplings and fittings on drawings.
- .4            Samples:
- .1            Submit the following samples:
- .1            Firehose nozzles.
- .2            Section of hose.
- .5            Test reports:
- .1            Submit certified test reports for standpipe and hose assembly from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6            Manufacturers' Instructions:
- .1            Provide manufacturer's installation instructions.
- .7            Field Quality Control Submittals:
- .1            Manufacturer's Field Reports: manufacturer's field reports specified.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Provide maintenance data for standpipe and hose system for incorporation into manual specified in Section 21 05 00 – Common Work Results for Fire Suppression.
- 1.3            QUALITY ASSURANCE
- .1            Qualifications:
- .1            Installer: company or person specializing in standpipe and hose assembly approved by manufacturer.
- .2            Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

- 1.4 DELIVERY, STORAGE AND HANDLING
  - .1 Deliver, store and handle materials in accordance with Section 21 05 00 – Common Work Results for Fire Suppression.
  - .2 Delivery and Acceptance Requirements:
    - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
  - .3 Storage and Protection:
    - .1 Store materials indoors and in dry location.
    - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
  - .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.
  
- Part 2 Products
- 2.1 DESCRIPTION
  - .1 Design system to NFPA 14 and following parameters:
    - .1 Stand alone: hydraulic.
    - .2 Combined with sprinkler systems: hydraulic.
- 2.2 PIPE, FITTINGS AND VALVES
  - .1 Pipe:
    - .1 Ferrous: to NFPA 14
    - .2 Copper tube: to NFPA 14
  - .2 Fittings and joints to NFPA 14:
    - .1 Ferrous: screwed, welded, flanged or roll grooved.
      - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
    - .2 Copper tube: screwed, soldered, brazed.
  - .3 Valves:
    - .1 ULC listed for fire protection service
    - .2 Up to NPS 2: bronze, screwed ends, grooved, OS&Y gate.
    - .3 NPS 2 1/2 and over: cast or ductile iron, flanged, roll grooved ends, indicating butterfly valve.
    - .4 Check valves: spring actuated swing type, composition disc or seal.
  - .4 Pipe hangers:
    - .1 ULC listed for fire protection services

- .5 Drain valve: NPS 1, complete with hose end, cap and chain.
- .6 Inspector's test connections: NPS 1 gate valve.
- 2.3 CABINETS
  - .1 To NFPA 14 and ULC listed: flush, surface or semi-recessed type as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with hinge same side as water supply and latching device.
  - .2 Cabinets to maintain fire resistive rating of construction in which they occur.
  - .3 Cabinet door: with 5 mm full glass panel or 5 mm glass viewing panel, 1/3 of door area.
  - .4 Large enough to accommodate angle valve, hose rack, fire hose nozzle and spanner, fire extinguisher and NPS 2 1/2 fire department valve.
- 2.4 HOSE RACK
  - .1 ULC listed, swivel type with pins to permit hose to be hung in folds, stationary-type rack with pins designed for 180 degrees movement. Locking device shall prevent flow of water into hose until last fold is removed from rack. Complete with hose, nozzle and angle valve.
- 2.5 FIRE HOSE AND NOZZLE
  - .1 Hose: ULC listed, 38 mm nominal diameter, 23 m long, synthetic jacket, synthetic rubber lined.
  - .2 Nozzle: ULC listed, 38 mm nominal diameter, forged brass adjustable combination fog-straight stream with shut-off.
- 2.6 ANGLE VALVES
  - .1 ULC listed for fire service. NPS 1 1/2 cast or forged brass complete with hand wheel, open or drip connections, or hydrolator valve. Where water pressure exceeds 690 kPa, provide ULC listed pressure reducing device
- 2.7 SWINGING HOSE REEL
  - .1 ULC listed, designed so hose can be removed from reel when water is flowing, and with 20 mm nominal diameter hose 23 m long, and nozzle.
- 2.8 FIRE DEPARTMENT VALVE
  - .1 ULC listed, NPS 2 1/2 forged or cast brass angle valve: with thread compatible with local fire department, complete with handwheel, cap and chain. Cap to be part of ULC listing for valve
- 2.9 PUMPER CONNECTION
  - .1 To NFPA 14, ULC listed, Siamese type, location as indicated. Threads to be compatible with local fire department complete with threaded metal caps and chains.
  - .2 Polished bronze, chrome plated, recessed or surface mounted with identifying sign cast on plate.
- 2.10 PRESSURE GAUGES

- .1 90 mm diameter, to Section 23 05 19.13- Thermometers and Pressure Gauges - Piping Systems.
- 2.11 FINISHES
  - .1 In finished areas, chrome plate valves, nozzles, fittings and hose rack and spanner.
  - .2 Cabinets.
    - .1 Tub: prime coated.
    - .2 Door and frame: No. 4 satin finish stainless steel.
- Part 3 Execution
- 3.1 MANUFACTURER'S INSTRUCTIONS
  - .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.2 INSTALLATION
  - .1 Install and test to acceptance in accordance with NFPA 14
  - .2 Install pipework in accordance with Section 23 05 15 - Common installation requirements for HVAC pipework, supplemented as specified.
  - .3 Run inspectors test connections to sight glass.
  - .4 Install drain pipes and valves to drain parts of systems and so arranged that any one standpipe riser can be drained without shutting down any other parts of systems.
  - .5 Install 90 mm diameter pressure gauge in accordance with Section 23 05 19.13 - Thermometers and Pressure Gauges - Piping Systems at top of risers and in accordance with NFPA 14
  - .6 The source of the water supply shall be reliable and capable of providing the required supply for not less than 30 minutes.
  - .7 Water supply for standpipe system:
    - .1 Class I Systems:
      - .1 Receive water supply sufficient to provide 1892.50 lpm and 946.25 lpm for each additional standpipe.
      - .2 Total supply not to exceed 9462.5 lpm.
      - .3 Supply system: capable of maintaining residual pressure of 690 kPa at each topmost outlet with 1892.50 lpm flowing from most remote standpipe and 946.25 lpm flowing from each additional standpipe up to maximum of 9462.5 lpm.
    - .2 Class II Systems:
      - .1 Receive water supply sufficient to provide minimum of 378.50 lpm.
      - .2 System: capable of maintaining residual pressure of 414 kPa at topmost outlet with 378.50 lpm flowing.

- .3 Class III Systems:
  - .1 Receive water supply from source sufficient to provide 1892.50 lpm for single standpipe and 946.25 lpm for each additional standpipe.
  - .2 Total supply not to exceed 9462.5 lpm.
  - .3 System: capable of maintaining residual pressure of 690 kPa at each top most outlet with 1892.50 lpm flowing from most remote standpipe and 946.25 lpm flowing from each additional standpipe up to maximum of 9462.5 lpm flowing.
  - .4 Water Supply for Combined Standpipe and Sprinkler Risers:
    - .1 Standpipe piping may or may not be used to supply water for automatic fire sprinkler systems.
    - .2 Standpipe systems: hydraulically designed.
- 3.3 FIELD QUALITY CONTROL
  - .1 Manufacturer's Field Services:
    - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
    - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
    - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- 3.4 SITE TEST
  - .1 General:
    - .1 In accordance with NFPA 14, supplemented as specified
  - .2 Testing witnessed by the authority having jurisdiction.
  - .3 Disposal of water used in flushing and testing:
    - .1 Discuss appropriate measures with the authority having jurisdiction.
  - .4 Timing:
    - .1 Connect fire hoses when flushing out and pressure tests have been completed.
    - .2 Charge system with water when there is no possibility of freeze-up.
    - .3 Perform tests after pressure booster pumps have been tested.
  - .5 Co-ordination:
    - .1 Co-ordinate tests with performance verification of:
      - .1 Fire pumps.
      - .2 Standpipe and hose systems.
      - .3 Fire alarm systems. Co-ordinate tests with performance verification of fire pumps.
      - .4 Wet and dry pipe sprinkler systems.

- .6 Procedures:
  - .1 Verify that system is complete prior to start-up and testing procedures.
  - .2 Verify that ULC labels are visible
  - .3 Fill system with water for pressure. Record water supply pressure.
  - .4 Pressure test piping system as required by authority having jurisdiction.
  - .5 Start up fire pumps and jockey pumps.
  - .6 Verify flow switches are operational.
  - .7 Verify valves in system are visible and monitored.
  - .8 Flushing: fill with water, let stand at operating pressure for 1 week. Drain risers separately, then drain main.
  - .9 Flush buried mains and lead-in connections before making connection to indoor sprinkler system.
  - .10 Perform flow tests, including tests of pre-action systems, as required by:
    - .1 Authority having jurisdiction.
    - .2 Applicable NFPA standards such as 13, 14, 20, 1273
    - .3 Local building codes.
  - .11 Record incoming pressure to building for 10 days prior to activating system.
  - .12 Adjust PRV on pump discharge to maximum pressure of 620 kPa at top fire hose station.
  - .13 Adjust PRV's at lower fire hose stations to 550 kPa maximum.
  - .14 Fill glycol legs, confirming proper operation of backflow preventers.
  - .15 Adjust pressure switches.
- .7 Sundry checks:
  - .1 Verify that properly sized pressure restricting discs are installed where required.
- .8 Identification:
  - .1 Verify devices are properly labelled, identifying area served, etc.
- .9 Report:
  - .1 In addition to reports required by NFPA 14, include the following:
    - .1 Copy of schematic and valve schedule.
- .10 Posted Instructions:
  - .1 Prepare schematic, mount behind glare-free glass and install where directed.
  - .2 Prepare valve schedule, mount behind glare-free glass and install where directed.
- .11 Training:
  - .1 Refer to Section 01 91 13 - General Commissioning Requirements: Training of O&M Personnel.
- .12 Documentation:
  - .1 Provide written certification to the authority having jurisdiction that system was installed, flushed and tested in accordance with appropriate codes, approved plans and calculations.

- .2 Certificate to include:
  - .1 Contractors name.
  - .2 Contractors address.
  - .3 Contractors license number.
  - .4 List of approved materials and devices installed.
  - .5 Description of system test conducted.
  - .6 Dates of flushing and testing.
  - .7 Certification that connections and/or welding conform to acceptable standards.
  - .8 Certification that system is complete and in service.
  - .9 Approved signage has been provided and attached as appropriate.
  - .10 Hose threads of system and test connections match those of responding fire department.

3.5 CLEANING

- .1 Clean in accordance with Section 21 05 00 – Common Work Results for Fire Suppression.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
  - .2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION



- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 21 05 00 - Common Work Results for Fire Suppression.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .1            Indicate on drawings to indicate materials, finishes, method of anchorage, [number of anchors, dimensions, construction and assembly details and accessories.
- .4            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5            Instructions: submit manufacturer's installation instructions.
- .6            Manufacturers' Field Reports: manufacturers' field reports specified.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with 21 05 00 - Common Work Results for Fire Suppression.
- .1            Manufacturer's catalogue Data, including specific model, type, and size for:
- .1            Pipe and fittings.
- .2            Alarm valves.
- .3            Valves, including gate, check, and globe.
- .4            Water motor alarms.
- .5            Sprinkler heads.
- .6            Pipe hangers and supports.
- .7            Pressure or flow switch.
- .8            Fire department connections.
- .9            Excess pressure pump.
- .10           Mechanical couplings.
- .2            Drawings:
- .1            Sprinkler heads and piping system layout.
- .1            Prepare working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
- .2            Show data essential for proper installation of each system.
- .3            Show details, plan view, elevations, and sections of systems supply and piping.

- .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings.  
Show point to point electrical wiring diagrams.
    - .2 Electrical wiring diagrams.
  - .3 Design Data:
    - .1 Calculations of sprinkler system design.
    - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
  - .4 Field Test Reports:
    - .1 Preliminary tests on piping system.
- 1.3 QUALITY ASSURANCE
  - .1 Qualifications:
    - .1 Installer: company or person specializing in wet sprinkler systems approved by landlord.
    - .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.
- 1.4 MAINTENANCE MATERIAL SUBMITTALS
  - .1 Extra Materials:
    - .1 Provide maintenance materials in accordance manufacturers recommendations.
    - .2 Provide spare sprinklers and tools in accordance with NFPA 13.
- 1.5 DELIVERY, STORAGE AND HANDLING
  - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .2 Storage and Handling Requirements:
    - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Store and protect materials from nicks, scratches, and blemishes.
    - .3 Replace defective or damaged materials with new.
  - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2 Products
  - 2.1 DESIGN REQUIREMENTS
    - .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.

- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.
- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems
- .6 Design systems for earthquake protection for buildings in seismic zone as required.
- .7 Location of Sprinkler Heads:
  - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13.
  - .2 Uniformly space sprinklers on branch.
- .8 Water Distribution:
  - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
  - .2 Discharge from individual heads in hydraulically most remote area to be 100 % of specified density.
- .9 Density of Application of Water:
  - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
- .10 Sprinkler Discharge Area:
  - .1 Area: hydraulically most remote area as defined in NFPA 13.
- .11 Outside Hose Allowances:
  - .1 Include allowance in hydraulic calculations of for outside hose streams.
- .12 Friction Losses:
  - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.
- 2.2 ABOVE GROUND PIPING SYSTEMS
  - .1 Provide fittings for changes in direction of piping and for connections.
    - .1 Make changes in piping sizes through tapered reducing pipe fittings.
  - .2 Perform welding in shop; field welding will not be permitted.
  - .3 Conceal piping in areas with suspended ceiling.
- 2.3 PIPE, FITTINGS AND VALVES
  - .1 Pipe:
    - .1 Ferrous: to NFPA 13.

- .2 Copper tube: to NFPA 13.
  - .2 Fittings and joints to NFPA 13:
    - .1 Ferrous: screwed, welded, flanged or roll grooved.
      - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
      - .2 Copper tube: screwed, soldered, brazed, grooved.
      - .3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
      - .4 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
      - .5 Fittings: ULC approved for use in wet pipe sprinkler systems
      - .6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
      - .7 Sprinkler pipe and fittings: metal.
  - .3 Valves:
    - .1 ULC listed for fire protection service
    - .2 Gate valves: open by counterclockwise rotation.
    - .3 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.
    - .4 Provide gate valve in piping protecting elevator hoistways, machine rooms, and machinery spaces.
  - .4 Pipe hangers:
    - .1 ULC listed for fire protection services in accordance with NFPA.
- 2.4 SPRINKLER HEADS
- .1 General: to NFPA 13 and ULC listed for fire services
  - .2 Sprinkler Head Type:
    - .1 As specified on drawings.
  - .3 Provide nominal 1.2 cm orifice sprinkler heads.
    - .1 Release element of each head to be of ordinary temperature rating or higher as suitable for specific application.
    - .2 Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings.
    - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
    - .4 Provide number of sprinkler heads as indicated.
    - .5 Deflector: not more than 75 mm below suspended ceilings.
    - .6 Ceiling plates: not more than 25 mm deep.

- 2.5 ALARM CHECK VALVE
  - .1 Alarm check valve to NFPA 13 and ULC listed for fire service
  - .2 Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gauges, accessories, and appurtenances for proper operation of system.
  - .3 Provide valve complete with internal components that are replaceable without removing the valve from the installed position.
- 2.6 WATER MOTOR ALARMS
  - .1 Provide alarms approved weatherproof and guarded type, to sound locally on flow of water in each corresponding sprinkler system.
  - .2 Mount alarms on outside of outer walls of each building at location as directed.
  - .3 Provide separate drain piping directly to exterior of building.
- 2.7 SUPERVISORY SWITCHES
  - .1 General: to NFPA 13 and ULC listed for fire service
  - .2 Valves:
    - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
  - .3 Pressure or flow switch type:
    - .1 With normally open and normally closed contacts and supervisory capability.
    - .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
    - .3 Connect into building fire alarm system.
    - .4 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.
  - .4 Pressure alarm switch:
    - .1 With normally open and normally closed contacts and supervisory capability.
- 2.8 WATER GONG
  - .1 To NFPA 13 and ULC listed for fire service. Location as indicated
- 2.9 FIRE DEPARTMENT CONNECTION
  - .1 Provide connections approximately 1.5 m above finish grade, location as indicated.
  - .2 To NFPA 13 and ULC listed, Siamese type.
  - .3 Approved two-way type with 2.5 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.
  - .4 Thread specifications: compatible with local fire department.
  - .5 Install a 90-degree elbow with drain connection at the low-point near each fire department connection to allow for system drainage to prevent freezing.

- 2.10 EXCESS PRESSURE PUMP
- .1 Provide pumps on each sprinkler piping riser.
  - .2 Pumps:
    - .1 Pumps: positive displacement, gear type rated at 1 lpm, integrally mounted with motor.
    - .2 Double acting displacement type, open cylinder design, direct drive, ULC listed, complete with relief valve
  - .3 Pump and motor unit:
    - .1 Approved for automatic wet pipe fire extinguishing sprinkler systems; complete with pilot light panel, differential motor control switch, high pressure switch, and low pressure switch.
    - .2 EEMAC Class B squirrel cage induction 1725 rpm, continuous duty, drip proof, ball bearing, maximum temperature rise 50 degrees C, 0.25 kW, 120/1/60.
    - .3 Capacity: 7.6 L/min.
  - .4 Provide electrical power supply connections for pump and pilot light panel at supply side of building service panel.
  - .5 Provide separate fused safety-type switch with locked lever for each connection.
  - .6 Provide pressure pump sensing piping in supply piping upstream of fire pump.
  - .7 Pump operation switch: to operate excess pressure pump with pressure differential of 103 kPa.
  - .8 Shut-off valve and strainer on pump inlet. Relief valve, check valve and shut-off valve on discharge connections.
- 2.11 PRESSURE GAUGES
- .1 Maximum limit of not less than twice normal working pressure at point where installed.
- 2.12 BURIED WATER PIPING SYSTEM
- .1 Pipe and Fittings:
    - .1 Provide outside-coated, cement-mortar lined, ductile-iron pipe, and fittings, in accordance with NFPA 24, for piping under building and outside of building walls
    - .2 Anchor joints in accordance with NFPA 24.
    - .3 Provide concrete thrust block at elbow where pipe turns up toward the floor, and restrain pipe riser with steel rods from elbow to flange above floor.
    - .4 Minimum pipe size: 150 mm.
    - .5 Minimum depth of cover: 1.0 metre at finish grade.
    - .6 Piping beyond 1.5 metre outside of building walls.
    - .7 Fittings: painted with tar epoxy resin paint.
  - .2 Valves:
    - .1 In accordance with NFPA 24.
    - .2 Gate valves: ULC listed and opened by counterclockwise rotation

- .3 Post Indicator Valves:
  - .1 Provide with operating nut located about 1.5 m above finish grade.
  - .2 Gate valves for use with indicator post, ULC listed
  - .3 Indicator posts: ULC listed.
  - .4 Provide each indicator post with 1 coat of primer and two coats of red enamel paint.
- .4 Valve Boxes:
  - .1 Except where indicator posts are provided, for each buried valve, provide valve box of suitable size.
  - .2 Provide cover for valve box with word English wording for "WATER" cast on cover.
  - .3 Minimum box shaft diameter: 13.3 cm.
  - .4 Coat cast-iron and ductile-iron boxes with bituminous paint applied to minimum dry-film thickness of 10 ml.
- .5 Buried Utility Warning and Identification Tape:
  - .1 Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping detectable by electronic detection instrument.
  - .2 Provide tape in rolls, 7.6 cm minimum width, colour coded in accordance with local utility, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length.
  - .3 Warning and identification: to read "CAUTION BURIED WATER PIPING BELOW".
  - .4 Use permanent code and letter colouring unaffected by moisture and other substances contained in trench backfill material.
- 2.13 PIPE SLEEVES
  - .1 Provide pipe sleeves where piping passes through walls, floors, and roofs.
  - .2 Secure sleeves in position and location during construction.
  - .3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.
  - .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
    - .1 Firmly pack space with mineral wool insulation.
    - .2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.
    - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material
  - .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
    - .1 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
  - .6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:

- .1 Provide 0.61 mm thick galvanized steel sheet.
- 2.14 ESCUTCHEON PLATES
  - .1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.
  - .2 Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces.
  - .3 Provide paint finish on metal plates in unfinished spaces.
- 2.15 INSPECTOR'S TEST CONNECTION
  - .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
  - .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
  - .3 Provide discharge orifice of same size as corresponding sprinkler orifice.
- 2.16 SIGNS
  - .1 Attach properly lettered and approved metal signs to each valve and alarm device to NFPA 13.
  - .2 Permanently fix hydraulic design data nameplates to riser of each system.
- 2.17 ANTIFREEZE
  - .1 Antifreeze loops to NFPA 13, locations as indicated
- 2.18 SPARE PARTS CABINET
  - .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.
- Part 3 Execution
  - 3.1 MANUFACTURER'S INSTRUCTIONS
    - .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
  - 3.2 INSTALLATION
    - .1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.
  - 3.3 PIPE INSTALLATION
    - .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.



- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.
- 3.4 ELECTRICAL CONNECTIONS
  - .1 Provide fire alarm system under Section [28 31 00 - Fire Detection and Alarm].
  - .2 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.
  - .3 Provide wiring in rigid metal conduit or intermediate metal conduit.
- 3.5 DISINFECTION
  - .1 Disinfect new piping and existing piping.
  - .2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.
  - .3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.
  - .4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.
- 3.6 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS
  - .1 Notify Contracting Officer in writing at least 15 days prior to connection date.
  - .2 Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure.
  - .3 Bolt sleeves around main piping.
  - .4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.
  - .5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.
- 3.7 BURIED PIPING SYSTEM
  - .1 Bury tape with printed side up at depth of 30 cm below the top surface of earth or top surface of subgrade under pavements.
- 3.8 FIELD PAINTING
  - .1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
  - .2 Apply coatings to clean, dry surfaces, using clean brushes.
  - .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.
  - .5 Shield sprinkler heads with protective covering while painting is in progress.
  - .6 Upon completion of painting, remove protective covering from sprinkler heads.
  - .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
  - .8 Provide primed surfaces with following:
    - .1 Piping in Finished Areas:
      - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
      - .2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
      - .3 Provide piping with self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.
    - .2 Piping in Unfinished Areas:
      - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
      - .2 Provide piping with self-adhering red plastic bands spaced at maximum of 6 m intervals.
- 3.9 FIELD QUALITY CONTROL
- .1 Site Test, Inspection:
    - .1 Test, inspect, and approve piping before covering or concealing.
    - .2 Preliminary Tests:
      - .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
      - .2 Flush piping with potable water in accordance with NFPA 13.
      - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
      - .4 Test alarms and other devices.
      - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
    - .3 Formal Tests and Inspections:
      - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
      - .2 Submit written request for formal inspection at least 15 days prior to inspection date.
      - .3 Repeat required tests as directed.

- .4 Correct defects and make additional tests until systems comply with contract requirements.
  - .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
  - .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- .2 Manufacturer's Field Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .3 Site Tests:
- .1 Field test each fire pump, driver and controllers in accordance with NFPA 20. Testing shall include:
    - .1 Verification of proper installation, system initiation, adjustment and fine tuning.
    - .2 Verification of the sequence of operations and alarm systems.
  - .2 Testing to be witnessed by authority having jurisdiction.
- 3.10 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with this section.
- .1            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .2            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Indicate on drawings:
- .1            Mounting arrangements.
- .2            Operating and maintenance clearances.
- .3            Shop drawings and product data accompanied by:
- .1            Detailed drawings of bases, supports, and anchor bolts.
- .2            Acoustical sound power data, where applicable.
- .3            Points of operation on performance curves.
- .4            Manufacturer to certify current model production.
- .5            Certification of compliance to applicable codes.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
- .1            Operation and maintenance manual approved by, and final copies deposited with, Engineer before final inspection.
- .2            Operation data to include:
- .1            Control schematics for systems including environmental controls.
- .2            Description of systems and their controls.
- .3            Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4            Operation instruction for systems and component.
- .5            Description of actions to be taken in event of equipment failure.
- .6            Valves schedule and flow diagram.
- .7            Colour coding chart.
- .3            Maintenance data to include:
- .1            Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
- .2            Data to include schedules of tasks, frequency, tools required and task time.

- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit [2] copies of draft Operation and Maintenance Manual to Engineer for approval, including electronic form also. Submission of individual data will not be accepted unless directed by Engineer.
  - .2 Make changes as required and re-submit as directed by Engineer.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
  - .5 Make available in electronic form.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Engineer for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.
- .10 Submit as-built drawings in electronic form as well in PDF and CAD formats.

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass.

- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.
- 1.4 DELIVERY, STORAGE AND HANDLING
  - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .2 Storage and Handling Requirements:
    - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Store and protect materials from nicks, scratches, and blemishes.
    - .3 Replace defective or damaged materials with new.
  - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2 Products
  - 2.1 NOT USED
    - .1 Not used.
- Part 3 Execution
  - 3.1 EXAMINATION
    - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing installation in accordance with manufacturer's written instructions.
      - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
      - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
  - 3.2 PAINTING REPAIRS AND RESTORATION
    - .1 Prime and touch up marred finished paintwork to match original.
    - .2 Restore to new condition, finishes which have been damaged.
  - 3.3 SYSTEM CLEANING
    - .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.
  - 3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- 3.5 DEMONSTRATION
  - .1 Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
  - .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
  - .3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.
  - .4 Instruction duration time requirements as specified in appropriate sections.
- 3.6 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.7 INSULATION
  - .1 Refer to Section 23 07 19 – HVAC Piping Insulation for application of insulation to Plumbing Systems.
- 3.8 PROTECTION
  - .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 22 05 00 - Common Work Results for Plumbing.
  - .2            Product Data:
    - .1            Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
  - .3            Shop Drawings:
    - .1            Submit drawings stamped and signed by the contractor including initials, date and status.
    - .1            Indicate on drawings to indicate materials, finishes, method of anchorage, [number of anchors, dimensions, construction and assembly details and accessories.
  - .4            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .5            Instructions: submit manufacturer's installation instructions.
  - .6            Manufacturers' Field Reports: manufacturers' field reports specified.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with 22 05 00 - Common Work Results for Plumbing.
  - .2            Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
    - .1            Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
    - .2            Details of operation, servicing and maintenance.
    - .3            Recommended spare parts list.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .2            Storage and Handling Requirements:
    - .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2            Store and protect materials from nicks, scratches, and blemishes.
    - .3            Replace defective or damaged materials with new.
  - .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.



- Part 2 Products
- 2.1 FLOOR DRAINS
- .1 Floor Drains and Trench Drains: to CSA B79.
  - .2 Refer to Plumbing Fixture Schedule on mechanical drawings for equipment specifications.
- 2.2 ROOF DRAINS
- .1 Refer to Plumbing Fixture Schedule on mechanical drawings for equipment specifications.
- 2.3 CLEANOUTS
- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
  - .2 Access Covers:
    - .1 Wall Access: face or wall type, polished nickel bronze round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
    - .2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:
      - .1 Plugs: bolted bronze with neoprene gasket.
      - .2 Cover for Unfinished Concrete Floors: nickel bronze round, gasket, vandal-proof screws.
      - .3 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
      - .4 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.
- 2.4 NON-FREEZE WALL HYDRANTS
- .1 Refer to Plumbing Fixture Schedule on mechanical drawings for equipment specifications.
- 2.5 NON-FREEZE GROUND HYDRANT
- .1 Refer to Plumbing Fixture Schedule on mechanical drawings for equipment specifications.
- 2.6 WATER HAMMER ARRESTORS
- .1 Provide equal to Zurn 1260XL low lead model.
- 2.7 BACK FLOW PREVENTERS
- .1 Preventers: to CSA-B64 Series, application as indicated Backflow Device Schedule and mechanical drawings.
- 2.8 VACUUM BREAKERS
- .1 Breakers: to CSA-B64 Series, vacuum breaker, atmospheric, where indicated.
- 2.9 PRESSURE REGULATORS
- .1 Capacity: as indicated on drawings.

- .2 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62.
  - .3 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.
  - .4 Semi-steel spring chambers with bronze trim.
- 2.10 BACKWATER VALVES
- .1 Coated extra heavy cast iron or Galvanized body with bronze seat, revolving bronze flapper and threaded cover.
  - .2 Access:
    - .1 Surface access.
    - .2 Access pipe with cover: maximum 300 mm depth.
    - .3 Steel housing with gasketed steel cover.
    - .4 Concrete access pit with cover, as indicated.
- 2.11 HOSE BIBBS AND SEDIMENT FAUCETS
- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.
- 2.12 WATER MAKE-UP ASSEMBLY
- .1 Complete with backflow preventer and pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.
- 2.13 WATER METERS
- .1 Accessories: remote readout device.
- 2.14 TRAP SEAL PRIMERS
- .1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection. Provide as indicated on mechanical drawings.
- 2.15 STRAINERS
- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
  - .2 NPS2 and under, bronze body, screwed ends, with brass cap.
  - .3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.
- 2.16 GREASE INTERCEPTORS
- .1 Capacity: as indicated in plumbing fixture schedule.
  - .2 Refer to Plumbing Fixture Schedule on mechanical drawings for equipment specifications.
- 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 data sheet.
- 3.2 INSTALLATION
  - .1 Install in accordance with the Ontario Building Code (OBC) and local authority having jurisdiction.
  - .2 Install in accordance with manufacturer's instructions and as specified.
- 3.3 CLEANOUTS
  - .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
  - .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
  - .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.
- 3.4 NON-FREEZE WALL HYDRANTS
  - .1 Install 600 mm above finished grade or as indicated.
- 3.5 NON-FREEZE GROUND HYDRANT
  - .1 Install with top of box flush with ground or deck and with drainage connection to discharge as indicated.
- 3.6 WATER HAMMER ARRESTORS
  - .1 Install on branch supplies to fixtures or group of fixtures where fast-closing valves are present, such as water closet and urinal flush valves.
- 3.7 BACK FLOW PREVENTERS
  - .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code
    - .1 Drains.
    - .2 Backwater Valves.
    - .3 Water Make-up Assembly.
    - .4 Grease Interceptors.
  - .2 Pipe discharge to terminate over nearest drain or service sink.
- 3.8 BACKWATER VALVES
  - .1 Install where indicated.
- 3.9 HOSE BIBBS AND SEDIMENT FAUCETS
  - .1 Install at bottom of risers, at low points to drain systems, and as indicated.
- 3.10 TRAP SEAL PRIMERS
  - .1 Install for floor drains and elsewhere, as indicated.

- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.
- .3 Install plastic tubing to floor drain.
- 3.11 STRAINERS
  - .1 Install with sufficient room to remove basket for maintenance.
- 3.12 GREASE INTERCEPTORS
  - .1 Install with sufficient space, as indicated, for maintenance.
- 3.13 WATER METERS
  - .1 Install water metre provided by local water authority.
  - .2 Install water metre as indicated.
- 3.14 WATER MAKE-UP ASSEMBLY
  - .1 Install on valved bypass.
  - .2 Pipe discharge from relief valve to nearest floor drain.
- 3.15 START-UP
  - .1 Timing: start-up only after:
    - .1 Pressure tests have been completed.
    - .2 Disinfection procedures have been completed.
    - .3 Certificate of static completion has been issued.
    - .4 Water treatment systems operational.
  - .2 Provide continuous supervision during start-up.
- 3.16 TESTING AND ADJUSTING
  - .1 Timing:
    - .1 After start-up deficiencies rectified.
    - .2 After certificate of completion has been issued by authority having jurisdiction.
  - .2 Application tolerances:
    - .1 Pressure at fixtures: +/- 70 kPa.
    - .2 Flow rate at fixtures: +/- 20%.
  - .3 Adjustments:
    - .1 Verify that flow rate and pressure meet design criteria.
    - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
  - .4 Floor drains:
    - .1 Verify operation of trap seal primer.
    - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.

- .3 Check operations of flushing features.
- .4 Check security, accessibility, removability of strainer.
- .5 Clean out baskets.
- .5 Vacuum breakers, backflow preventers, backwater valves:
  - .1 Test tightness, accessibility for O&M of cover and of valve.
  - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
  - .3 Verify visibility of discharge from open ports.
- .6 Roof drains:
  - .1 Check location at low points in roof.
  - .2 Check security, removability of dome.
  - .3 Adjust weirs to suit actual roof slopes, meet requirements of design.
  - .4 Clean out sumps.
  - .5 Verify provisions for movement of roof systems.
- .7 Access doors:
  - .1 Verify size and location relative to items to be accessed.
- .8 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .9 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .10 Wall, ground hydrants:
  - .1 Verify complete drainage, freeze protection.
  - .2 Verify operation of vacuum breakers.
- .11 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .12 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.
- .13 Grease interceptors:
  - .1 Activate, using manufacturer's recommended procedures and materials.
- .14 Hose bibbs, sediment faucets:
  - .1 Verify that flow and pressure meet design criteria.
  - .2 Check for leaks, replace compression washer if required.
- .15 Hydronic system water Make-up Assembly:
  - .1 Verify flow, pressure, and connection.

- .16 Water meters:
  - .1 Verify location and accessibility.
  - .2 Test metre reading accuracy.
- 3.17 CLOSEOUT ACTIVITIES
  - .1 Commissioning Reports: in accordance with 22 05 00 - Common Work Results for Plumbing.
  - .2 Training: provide training in accordance with 22 05 00 - Common Work Results for Plumbing.
- 3.18 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.19 PROTECTION
  - .1 Protect installed products and components from damage during construction.
  - .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

- Part 1            General
  - 1.1            ACTION AND INFORMATIONAL SUBMITTALS
    - .1            Submittals in accordance with Section 22 05 00 - Common Work Results for Plumbing.
    - .2            Product Data
      - .1            Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish, and limitations.
    - .3            Closeout Submittals:
      - .1            Submit maintenance and engineering data for incorporation into manual specified in Section 22 05 00 - Common Work Results for Plumbing:
  - 1.2            DELIVERY, STORAGE AND HANDLING
    - .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .2            Storage and Handling Requirements:
      - .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .2            Store and protect materials from nicks, scratches, and blemishes.
      - .3            Replace defective or damaged materials with new.
    - .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
  - 2.1            PIPING
    - .1            Domestic hot, cold and recirculation systems, within building.
      - .1            Above ground:
        - .1            Copper tube, hard drawn, type L: to ASTM B88M.
      - .2            Buried or embedded:
        - .1            Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints
  - 2.2            FITTINGS
    - .1            Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
    - .2            Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
    - .3            Cast copper, solder type: to ANSI/ASME B16.18.
    - .4            Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

- .5 NPS 2 and larger:
  - .1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242
- .6 NPS 1 ½ and smaller:
  - .1 Wrought copper to ANSI/ASME B16.22 or cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.
- 2.3 JOINTS
  - .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
  - .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
  - .3 Solder: 95/5 tin copper alloy lead-free.
  - .4 Teflon tape: for threaded joints.
  - .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket. Gasket to be classified in accordance with ANSI/NSF 61 for potable water service. Couplings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.
  - .6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.
- 2.4 GATE VALVES
  - .1 NPS 2 and under, soldered:
    - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze
  - .2 NPS 2 and under, screwed:
    - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze
  - .3 NPS 2-1/2 and over, in mechanical rooms, flanged:
    - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron
  - .4 NPS 2-1/2 and over, other than mechanical rooms, flanged:
    - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check
- 2.5 GLOBE VALVES
  - .1 NPS2 and under, soldered:
    - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves - Bronze



- .2 Lockshield handles.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 Lockshield handles.
- 2.6 SWING CHECK VALVES
  - .1 NPS 2 and under, soldered:
    - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2 and under, screwed:
    - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.
  - .3 NPS 2-1/2 and over, flanged:
    - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, regrind or renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.
- 2.7 BALL VALVES
  - .1 NPS 2 and under, screwed:
    - .1 Class 150.
    - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2 and under, soldered:
    - .1 To ANSI/ASME B16.18, Class 150.
    - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.
- 2.8 BUTTERFLY VALVES
  - .1 NPS 2-1/2 and over:
    - .1 To MSS-SP-67, Class 200.
    - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
  - .2 NPS 2-1/2 and over, grooved ends:
    - .1 Class 300, bubble tight shut-off, bronze body.
    - .2 Operator:
      - .1 NPS [4] and under: lever handle.
      - .2 NPS [6] and over: gear operated.

- Part 3 Execution
- 3.1 APPLICATION
- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- 3.2 INSTALLATION
- .1 Install in accordance with Ontario Building Code (OBC) and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
- .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding
- .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .7 Valves
- .1 Isolate equipment, fixtures and branches with ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.
- 3.3 PRESSURE TESTS
- .1 Conform to requirements of Section 22 05 00 - Common Work Results for Plumbing.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.
- 3.4 FLUSHING AND CLEANING
- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Ontario potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.
- 3.5 PRE-START-UP INSPECTIONS
- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

- 3.6 DISINFECTION
  - .1 Flush out, disinfect and rinse system to AWWA C651, the requirements of authority having jurisdiction and the approval of the engineer.
  - .2 Upon completion, provide laboratory test reports on water quality to the engineer for approval.
- 3.7 START-UP
  - .1 Timing: Start up after:
    - .1 Pressure tests have been completed.
    - .2 Disinfection procedures have been completed.
    - .3 Certificate of static completion has been issued.
    - .4 Water treatment systems operational.
  - .2 Provide continuous supervision during start-up.
  - .3 Start-up procedures:
    - .1 Establish circulation and ensure that air is eliminated.
    - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
    - .3 Bring HWS storage tank up to design temperature slowly.
    - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
    - .5 Check control, limit, safety devices for normal and safe operation.
  - .4 Rectify start-up deficiencies.
- 3.8 PERFORMANCE VERIFICATION
  - .1 Timing:
    - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
  - .2 Procedures:
    - .1 Verify that flow rate and pressure meet Design Criteria.
    - .2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
    - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
    - .4 Sterilize HWS and HWC systems for Legionella control.
    - .5 Verify performance of temperature controls.
    - .6 Verify compliance with safety and health requirements.
    - .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

- .8 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.
- .4 Reports:
  - .1 Provide testing in accordance with the Ontario Building Code and industry best practices.
  - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.
- 3.9 OPERATION REQUIREMENTS
  - .1 Co-ordinate operation and maintenance requirements including cleaning and maintenance of specified materials and products with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.
  - .5 Operational requirements to include:
    - .1 Cleaning materials and schedules.
    - .2 Repair and maintenance materials and instructions.
- 3.10 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1 General
  - 1.1 ACTION AND INFORMATIONAL SUBMITTALS
    - .1 Provide submittals in accordance with Section 22 05 00 - Common Work Results for Plumbing.
    - .2 Product Data:
      - .1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
  - 1.2 DELIVERY, STORAGE AND HANDLING
    - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .2 Storage and Handling Requirements:
      - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .2 Store and protect materials from nicks, scratches, and blemishes.
      - .3 Replace defective or damaged materials with new.
    - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2 Products
  - 2.1 COPPER TUBE AND FITTINGS
    - .1 Above ground sanitary, storm and vent piping Type DWV to: ASTM B306.
      - .1 Fittings.
        - .1 Cast brass: to CAN/CSA-B125.
        - .2 Wrought copper: to CAN/CSA-B125.
      - .2 Solder: lead free, tin-95:5, type TA, to ASTM B32.
  - 2.2 CAST IRON PIPING AND FITTINGS
    - .1 Buried sanitary, storm and vent minimum NPS 2 to CAN/CSA-B70, with one layer of protective coating of bituminous.
      - .1 Mechanical joints:
        - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
        - .2 Stainless steel clamps.
      - .2 Hub and spigot:
        - .1 Neoprene gasket: to CSA B70.
        - .2 Cold caulking compounds.

- .2 Above ground sanitary, storm and vent to CAN/CSA-B70:
  - .1 Joints:
    - .1 Mechanical joints: Neoprene or butyl rubber compression gaskets with stainless steel clamps.
  
- Part 3 Execution
  
- 3.1 APPLICATION
  - .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
  
- 3.2 INSTALLATION
  - .2 In accordance with Section 23 05 15 - Common installation requirements for HVAC pipework.
  - .3 Install in accordance with The Ontario Building Code and the local authority having jurisdiction.
  
- 3.3 TESTING
  - .1 Pressure test buried systems before backfilling.
  - .2 Hydraulically test to verify grades and freedom from obstructions.
  
- 3.4 PERFORMANCE VERIFICATION
  - .1 Cleanouts:
    - .1 Ensure accessible and that access doors are correctly located.
    - .2 Open, cover with linseed oil and re-seal.
    - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
  - .2 Test to ensure traps are fully and permanently primed.
  - .3 Storm water drainage:
    - .1 Verify domes are secure.
    - .2 Ensure weirs are correctly sized and installed correctly.
    - .3 Verify provisions for movement of roof system.
  - .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
  - .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).
  
- 3.5 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1 General
  - 1.1 ACTION AND INFORMATIONAL SUBMITTALS
    - .1 Provide submittals in accordance with Section 22 05 00 - Common Work Results for Plumbing.
    - .2 Product Data:
      - .1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
  - 1.2 DELIVERY, STORAGE AND HANDLING
    - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .2 Storage and Handling Requirements:
      - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .2 Store and protect materials from nicks, scratches, and blemishes.
      - .3 Replace defective or damaged materials with new.
    - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2 Products
  - 2.1 PIPING AND FITTINGS
    - .1 For buried and above ground DWV piping to:
      - .1 CAN/CSA B1800
  - 2.2 JOINTS
    - .1 Solvent weld for PVC: to ASTM D2564
    - .2 Solvent weld for ABS: to ASTM D2235
- Part 3 Execution
  - 3.1 APPLICATION
    - .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
  - 3.2 INSTALLATION



- .2 In accordance with Section 23 05 15 - Common installation requirements for HVAC pipework.
- .3 Install in accordance with The Ontario Building Code and the local authority having jurisdiction.
- 3.3 TESTING
  - .1 Pressure test buried systems before backfilling.
  - .2 Hydraulically test to verify grades and freedom from obstructions.
- 3.4 PERFORMANCE VERIFICATION
  - .1 Cleanouts:
    - .1 Ensure accessible and that access doors are correctly located.
    - .2 Open, cover with linseed oil and re-seal.
    - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
  - .2 Test to ensure traps are fully and permanently primed.
  - .3 Storm water drainage:
    - .1 Verify domes are secure.
    - .2 Ensure weirs are correctly sized and installed correctly.
    - .3 Verify provisions for movement of roof system.
  - .4 Ensure fixtures are properly anchored, connected to system and effectively vented.
  - .5 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).
- 3.5 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 22 05 00 - Common Work Results for Plumbing.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Provide maintenance data in accordance with Section 22 05 00 - Common Work Results for Plumbing.
- .2            Include:
- .1            Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
- .2            Details of operation, servicing, maintenance.
- .3            List of recommended spare parts.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- 1.4            WARRANTY
- .1            Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.
- Part 2            Products
- 2.1            GAS (ATMOSPHERIC) WATER HEATER
- .1            To ANSI Z21.10.1/CSA 4.1 and ANSI Z21.10.3/CSA 4.3.
- .2            Refer to gas Hot Water Heater Schedule on mechanical drawings for equipment specifications.

- .3 3 year warranty certificate.
- 2.2 DHW HEATER AND STORAGE TANK
  - .1 DHW heater:
    - .1 General: packaged unit to ASME standards, stamped for 1100 kPa WP. Provide CGA certification
    - .2 Refer to Electric Hot Water Heater Schedule on mechanical drawings for equipment specifications.
  - .2 Storage tank:
    - .1 Refer to Storage Tank Schedule on mechanical drawings for equipment specifications.
    - .2 Extended warranty: [10] years. Provide certificate.
- 2.3 TRIM AND INSTRUMENTATION
  - .1 Drain valve: NPS 1 with hose end.
  - .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
  - .3 Pressure gauge: 75 mm dial type with red pointer, and shut-off cock.
  - .4 Thermowell filled with conductive paste for control valve temperature sensor.
  - .5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
  - .6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.
- Part 3 Execution
  - 3.1 APPLICATION
    - .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
  - 3.2 INSTALLATION
    - .1 Install in accordance with the Ontario Building Code and the local authority having jurisdiction.
    - .2 Install in accordance with manufacturer's instructions and as specified.
  - 3.3 FIELD QUALITY CONTROL
    - .1 Manufacturer's factory trained, certified Engineer to start up DHW heaters.
  - 3.4 CLEANING
    - .1 Progress Cleaning: leave Work area clean at end of each day.
    - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1 General
  - 1.1 ACTION AND INFORMATIONAL SUBMITTALS
    - .1 Submittals in accordance with Section 22 05 00 - Common Work Results for Plumbing.
    - .2 Product Data
      - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish, and limitations.
      - .3 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
        - .1 Indicate fixtures and trim:
          - .1 Dimensions, construction details, roughing-in dimensions.
          - .2 Factory-set water consumption per flush at recommended pressure.
          - .3 (For water closets, urinals): minimum pressure required for flushing.
  - 1.2 CLOSEOUT SUBMITTALS
    - .1 Closeout Submittals:
      - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 22 05 00 - Common Work Results for Plumbing:
  - 1.3 DELIVERY, STORAGE AND HANDLING
    - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .2 Storage and Handling Requirements:
      - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .2 Store and protect materials from nicks, scratches, and blemishes.
      - .3 Replace defective or damaged materials with new.
    - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2 Products
  - 2.1 MANUFACTURED UNITS
    - .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series
    - .2 Trim, fittings: manufacture in accordance with CSA B125.3
    - .3 Exposed plumbing brass to be chrome plated.
    - .4 Number, locations: as indicated.

- .1 Water closets:
  - .1 As indicated on plumbing fixture schedule.
- .2 Water Closet Flush Valves:
  - .1 As indicated on plumbing fixture schedule.
- .3 Electronic Water Closet Flush Valves:
  - .1 As indicated on plumbing fixture schedule.
- .4 Water Closet Seats.
  - .1 As indicated on plumbing fixture schedule.
- .5 Urinals:
  - .1 As indicated on drawings
- .6 Urinal Electronic Flush Valves:
  - .1 As indicated on plumbing fixture schedule.
- .7 Washroom Lavatories:
  - .1 As indicated on plumbing fixture schedule.
- .8 Washroom Lavatory Trim
  - .1 As indicated on plumbing fixture schedule.
- .9 Washroom Lavatory Electronic Trim:
  - .1 As indicated on plumbing fixture schedule.
- .10 Fixture piping:
  - .1 Hot and cold water supplies to fixtures:
    - .1 Chrome plated flexible supply pipes with handwheel stop, reducers, escutcheon.
  - .2 Waste:
    - .1 Brass P trap with clean out on fixtures not having integral trap.
    - .2 Chrome plated in exposed places.
- .11 Chair carriers:
  - .1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.

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 damper installation in accordance with manufacturer's written instructions.
  - .1 Inform Engineer of unacceptable conditions immediately upon discovery.

- .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

### 3.2 INSTALLATION

#### .1 Mounting heights:

- .1 Standard: in accordance with the Ontario Building Code and architectural drawings, measured from finished floor.
- .2 Wall-hung fixtures: in accordance with the Ontario Building Code and architectural drawings, measured from finished floor.
- .3 Barrier-free: in accordance with CSA B651.

### 3.3 ADJUSTING

- .1 Conform to water conservation requirements specified this section.

#### .2 Adjustments:

- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Adjust flush valves to suit actual site conditions.
- .4 Adjust urinal flush timing mechanisms.
- .5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.

#### .3 Checks:

- .1 Water closets, urinals: flushing action.
- .2 Aerators: operation, cleanliness.
- .3 Vacuum breakers, backflow preventers: operation under all conditions.

#### .4 Thermostatic controls:

- .1 Verify temperature settings, operation of control, limit and safety controls.

### 3.4 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1          Provide submittals in accordance with Section 22 05 00 - Common Work Results for Plumbing.
- .2          Product Data:
- .1          Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.2            CLOSEOUT SUBMITTALS
- .1          Provide maintenance data in accordance with Section 22 05 00 - Common Work Results for Plumbing.
- .2          Include:
- .1          Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
- .2          Details of operation, servicing, maintenance.
- .3          List of recommended spare parts.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1          Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2          Storage and Handling Requirements:
- .1          Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2          Store and protect materials from nicks, scratches, and blemishes.
- .3          Replace defective or damaged materials with new.
- .3          Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            MANUFACTURED UNITS
- .1          Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2          Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3          Exposed plumbing brass to be chrome plated.
- .4          Number, locations: architectural drawings to govern.
- .5          Fixtures to be product of one manufacturer.
- .6          Trim to be product of one manufacturer.



- .1 Service sinks:
    - .1 As indicated on plumbing fixture schedule.
  - .2 Mop sinks:
    - .1 As indicated on plumbing fixture schedule.
  - .3 Stainless steel counter top sinks.
    - .1 As indicated on plumbing fixture schedule.
  - .4 Laundry tubs:
    - .1 As indicated on plumbing fixture schedule.
  - .5 Group wash fountains:
    - .1 As indicated on plumbing fixture schedule.
  - .6 Fixture piping:
    - .1 Hot and cold water supplies to each fixture:
      - .1 Chrome plated flexible supply pipes each with handwheel stop, reducers, escutcheon.
      - .2 Waste:
        - .1 Brass P trap with clean out on each fixture not having integral trap.
        - .2 Chrome plated in all exposed places.
  - .7 Chair carriers:
    - .1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.
- Part 3 Execution
- 3.1 APPLICATION
    - .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
  - 3.2 INSTALLATION
    - .1 Mounting heights:
      - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
      - .2 Wall-hung fixtures: as per the Ontario Building Code and architectural drawings, measured from finished floor.
      - .3 Barrier-free: to comply with the Ontario Building Code and CAN/CSA-B651.
  - 3.3 ADJUSTING
    - .1 Conform to water conservation requirements specified this section.
    - .2 Adjustments:

- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:
  - .1 Aerators: operation, cleanliness.
  - .2 Vacuum breakers, backflow preventers: operation under all conditions.
  - .3 Wash fountains: operation of flow-actuating devices.
- .4 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.
- 3.4 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
  - 1.1            USE OF SYSTEMS
    - .1            Use of existing permanent heating and ventilating systems for supplying temporary heat and ventilation is permitted only under following conditions:
      - .1            There is no possibility of damage.
      - .2            Supply ventilation systems are protected by 60 % filters, inspected daily, changed every week, or more frequently as required.
      - .3            Return systems have approved filters over openings, inlets, outlets.
      - .4            Systems will be:
        - .1            Operated as per manufacturer's recommendations and instructions.
        - .2            Operated by Contractor.
        - .3            Monitored continuously by Contractor.
      - .5            Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense.
      - .6            Clean internally and externally, restore to "existing" condition, replace filters in air systems.
    - .2            Filters specified in this Section are over and above those specified in other Sections of this project.
    - .3            Exhaust systems are not included in approvals for temporary heating ventilation.
- 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            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .2            Shop Drawings:
- .1            Indicate on drawings:
- .1            Mounting arrangements.
- .2            Operating and maintenance clearances.
- .2            Shop drawings and product data accompanied by:
- .1            Detailed drawings of bases, supports, and anchor bolts.
- .2            Acoustical sound power data, where applicable.
- .3            Points of operation on performance curves.
- .4            Manufacturer to certify current model production.
- .5            Certification of compliance to applicable codes.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
- .1            Operation and maintenance manual approved by, and final copies deposited with, Engineer before final inspection.
- .2            Operation data to include:
- .1            Control schematics for systems including environmental controls.
- .2            Description of systems and their controls.
- .3            Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4            Operation instruction for systems and component.
- .5            Description of actions to be taken in event of equipment failure.
- .6            Valves schedule and flow diagram.
- .7            Colour coding chart.
- .3            Maintenance data to include:
- .1            Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
- .2            Data to include schedules of tasks, frequency, tools required and task time.
- .4            Performance data to include:
- .1            Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
- .2            Equipment performance verification test results.

- .3 Special performance data as specified.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit [2] copies of draft Operation and Maintenance Manual to Engineer for approval, including electronic form also. Submission of individual data will not be accepted unless directed by Engineer.
  - .2 Make changes as required and re-submit as directed by Engineer.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
  - .5 Make available in electronic form.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Engineer for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.
- .10 Submit as-built drawings in electronic form as well in PDF and CAD formats.

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One head gasket set for each heat exchanger.
  - .4 One glass for each gauge glass.
  - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.
- 1.4 DELIVERY, STORAGE AND HANDLING
  - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .2 Storage and Handling Requirements:
    - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Store and protect materials from nicks, scratches, and blemishes.
    - .3 Replace defective or damaged materials with new.
  - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2 Products
  - 2.1 MATERIALS
    - .1 HVAC and R Equipment:
      - .1 Refrigerant:
        - .1 HCFC based refrigerant.
        - .2 HFC based refrigerant.
- Part 3 Execution
  - 3.1 EXAMINATION
    - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
      - .1 Visually inspect substrate in presence of Engineer.
      - .2 Inform Engineer 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 Engineer.
  - 3.2 PAINTING REPAIRS AND RESTORATION
    - .1 Prime and touch up marred finished paintwork to match original.
    - .2 Restore to new condition, finishes which have been damaged.
  - 3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.
- 3.4 FIELD QUALITY CONTROL
  - .1 Manufacturer's Field Services:
    - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
    - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- 3.5 DEMONSTRATION
  - .1 Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
  - .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
  - .3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.
  - .4 Instruction duration time requirements as specified in appropriate sections.
  - .5 Engineer will record these demonstrations on video tape for future reference.
- 3.6 CLEANING
  - .1 Progress Cleaning: Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.7 PROTECTION
  - .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submittals: in accordance with Section 23 05 00 Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.
- .3            Quality Control:
- .1            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2            Instructions: submit manufacturer's installation instructions.
- .4            Closeout Submittals
- .1            Provide maintenance data for motors, drives and guards for incorporation into manual in accordance with Section 23 05 00 Common Work Results for HVAC.
- 1.2            DELIVERY, STORAGE, AND HANDLING
- .1            Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements:
- .1            Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            GENERAL
- .1            Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.
- 2.2            MOTORS
- .1            Provide motors for mechanical equipment as specified.
- .2            Motors under 373 W [1/2 HP]: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3            Motors 373 W [1/2 HP] and larger: Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise [40] degrees C, 3 phase, 575 V, unless otherwise indicated.
- 2.3            TEMPORARY MOTORS



- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Engineer for temporary use. Work will only be accepted when specified motor is installed.
- 2.4 BELT DRIVES
- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
  - .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
  - .3 For motors under 7.5 kW [10 HP]: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
  - .4 For motors 7.5 kW [10 HP] and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
  - .5 Correct size of sheave determined during commissioning.
  - .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
  - .7 Motor slide rail adjustment plates to allow for centre line adjustment.
  - .8 Supply one set of spare belts for each set installed in accordance with Section 23 05 00 Common Work Results for HVAC.
- 2.5 DRIVE GUARDS
- .1 Provide guards for unprotected drives.
  - .2 Guards for belt drives:
    - .1 Expanded metal screen welded to steel frame.
    - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
    - .3 [38] mm dia holes on both shaft centres for insertion of tachometer.
    - .4 Removable for servicing.
  - .3 Provide means to permit lubrication and use of test instruments with guards in place.
  - .4 Install belt guards to allow movement of motors for adjusting belt tension.
  - .5 Guard for flexible coupling:
    - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
    - .2 Securely fasten in place.
    - .3 Removable for servicing.
  - .6 Unprotected fan inlets or outlets:
    - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
    - .2 Net free area of guard: not less than 80% of fan openings.
    - .3 Securely fasten in place.
    - .4 Removable for servicing.

- Part 3 Execution
- 3.1 MANUFACTURER'S INSTRUCTIONS
- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.2 INSTALLATION
- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.
- 3.3 FIELD QUALITY CONTROL
- .1 Site Tests: conduct tests and submit report as described in Section 23 05 00 Common Work Results for HVAC.
- .2 Manufacturer's Field Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Section 23 05 00 Common Work Results for HVAC.
- .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 Section 23 05 00 Common Work Results for HVAC.
- 3.4 CLEANING
- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 23 05 00 Common Work Results for HVAC.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.2            DELIVERY, STORAGE AND HANDLING
- .3            Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .4            Delivery and Acceptance Requirements:
- .1            Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .5            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            MATERIAL
- .1            Paint: zinc-rich to CAN/CGSB-1.181
- .1            Primers, paints and coatings: in accordance with manufacturer's recommendations for surface conditions.
- .2            Primer: maximum VOC limit [250] g/L.
- .3            Paints: maximum VOC limit [150] g/L.
- .2            Sealants:
- .1            Sealants: maximum VOC limit SCAQMD Rule 1168.
- .3            Sealants: maximum VOC limit SCAQMD Rule 1168.
- .4            Adhesives: maximum VOC limit SCAQMD Rule 1168.
- .5            Fire Stopping: in accordance ULC, NFPA and the Ontario Building Code.
- Part 3            Execution
- 3.1            APPLICATION
- .1            Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- 3.2            CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
  - .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
  - .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.
- 3.3 CLEARANCES
- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
  - .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.
- 3.4 DRAINS
- .1 Install piping with grade in direction of flow except as indicated.
  - .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
  - .3 Pipe each drain valve discharge separately to above floor drain.
    - .1 Discharge to be visible.
  - .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.
- 3.5 AIR VENTS
- .1 Install manual air vents to CAN/CSA B139at high points in piping systems.
  - .2 Install isolating valve at each automatic air valve.
  - .3 Install drain piping to approved location and terminate where discharge is visible.
- 3.6 DIELECTRIC COUPLINGS
- .1 General: compatible with system, to suit pressure rating of system.
  - .2 Locations: where dissimilar metals are joined.
  - .3 NPS 2 and under: isolating unions or bronze valves.
  - .4 Over NPS 2: isolating flanges.
- 3.7 PIPEWORK INSTALLATION
- .1 Install pipework to CAN/CSA B139.
  - .2 Screwed fittings jointed with Teflon tape.
  - .3 Protect openings against entry of foreign material.
  - .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
  - .5 Assemble piping using fittings manufactured to ANSI standards

- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
    - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
  - .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
  - .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
  - .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
  - .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
  - .11 Group piping wherever possible [and as indicated].
  - .12 Ream pipes, remove scale and other foreign material before assembly.
  - .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
  - .14 Provide for thermal expansion as indicated.
  - .15 Valves:
    - .1 Install in accessible locations.
    - .2 Remove interior parts before soldering.
    - .3 Install with stems above horizontal position unless indicated.
    - .4 Valves accessible for maintenance without removing adjacent piping.
    - .5 Install globe valves in bypass around control valves.
    - .6 Use gate, ball or butterfly valves at branch take-offs for isolating purposes except where specified.
    - .7 Install butterfly valves on chilled water and related condenser water systems only.
    - .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
    - .9 Install ball valves for glycol service.
    - .10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
  - .16 Check Valves:
    - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
    - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.
- 3.8 SLEEVES
- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
  - .2 Material: schedule 40 black steel pipe.
  - .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
  - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
  - .2 Other floors: terminate 25 mm above finished floor.
  - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
  - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
  - .2 Elsewhere:
    - .1 Provide space for fire stopping.
    - .2 Maintain the fire-resistance rating integrity of the fire separation.
  - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
  - .4 Ensure no contact between copper pipe or tube and sleeve.
- 3.9 ESCUTCHEONS
  - .6 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
  - .7 Construction: one piece type with set screws.
    - .1 Chrome or nickel plated brass or type 302 stainless steel.
  - .8 Sizes: outside diameter to cover opening or sleeve.
    - .1 Inside diameter to fit around pipe or outside of insulation if so provided.
- 3.10 PREPARATION FOR FIRE STOPPING
  - .1 Coordinate the installation of fire stopping around pipes, insulation and adjacent fire separation.
  - .2 Pipes subject to movement: conform to fire stop system design listing to ensure pipe movement without damaging fire stopping material or installation.
  - .3 Insulated pipes: ensure integrity of insulation and vapour barriers.
- 3.11 FLUSHING OUT OF PIPING SYSTEMS
  - .1 Flush system in accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.
  - .2 Before start-up, clean interior of piping systems supplemented as specified in relevant mechanical sections.
  - .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
- 3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Engineer 48 hours minimum prior to performance of pressure tests.
  - .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
  - .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
  - .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
  - .5 Conduct tests in presence of Engineer.
  - .6 Pay costs for repairs or replacement, retesting, and making good. Engineer to determine whether repair or replacement is appropriate.
  - .7 Insulate or conceal work only after approval and certification of tests by Engineer.
- 3.13 EXISTING SYSTEMS
- .1 Connect into existing piping systems at times approved by building personnel.
  - .2 Request written approval by building personnel 10 days minimum, prior to commencement of work.
  - .3 Be responsible for damage to existing plant by this work.
- 3.14 CLEANING
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
  - .2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 23 05 00 Common Work Results for HVAC.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- .1            Manufacturer, model number, line contents, pressure and temperature rating.
- .2            Movement handled, axial, lateral, angular and the amounts of each.
- .3            Nominal size and dimensions including details of construction and assembly.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Provide maintenance and operation data including servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements:
- .1            Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            SLIP TYPE EXPANSION JOINTS
- .1            Application: for axial pipe movement, as indicated.
- .2            Repacking: under full line pressure.
- .3            Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with [raised face [slip-on] [weld neck] flanges to match pipe] [ends for welding].
- .4            Slip or traverse sleeves: carbon steel pipe to ATM A53/A53M, Grade B.
- .5            Anchor base: construction steel, welded to body.
- .6            Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.
- .7            Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.



- .8 Packing rings: 6 minimum, PTFE or graphite impregnated non-asbestos.
  - .9 Thermal plastic packing: PTFE or graphite impregnated non-asbestos slug supplied loose.
  - .10 Lubricating fittings: pet cocks with grease nipple.
  - .11 Plunger body and plunger:
    - .1 Plunger body: heavy wall carbon steel welded to body.
    - .2 Plunger: carbon steel with hex head for use with socket wrench.
  - .12 Lubricant: to manufacturer's recommendations.
  - .13 Lubricant gun: complete with hose assembly.
- 2.2 BELLOWS TYPE EXPANSION JOINTS
- .1 For axial, lateral or angular movements, as indicated.
  - .2 Maximum operating pressure: 1034 kPa.
  - .3 Maximum operating temperature: 260 degrees C.
  - .4 Type A: controlled, free flexing, factory tested to 1 ½ times maximum working pressure. Provide test certificates.
  - .5 Bellows:
    - .1 Multiple bellows, hydraulically formed, two ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.
  - .6 Reinforcing or control rings:
    - .1 2 piece nickel iron.
  - .7 Ends:
    - .1 Raised face, flanges to match pipe.
  - .8 Liner:
    - .1 Austenitic stainless steel in direction of flow.
  - .9 Shroud:
    - .1 Carbon steel, painted.
- 2.3 GROOVED END EXPANSION JOINTS
- .1 Packless, Gasketed, Slip, Expansion Joints:
    - .1 2413 kPa maximum working pressure.
    - .2 Steel pipe fitting consisting of telescoping body and slip-pipe sections.
    - .3 PTFE modified polyphenylene sulfide coated slide section.
    - .4 Suitable for axial end movement to 75 mm.
  - .2 Expansion joint consisting of series of grooved end pipe nipples joined in tandem with flexible couplings. Total joint movement dependent on number of couplings and nipples used.

- 2.4 FLEXIBLE CONNECTION
  - .3 Application: to suit motion.
  - .4 Minimum length in accordance with manufacturer's recommendations to suit offset.
  - .5 Inner hose: stainless steel corrugated.
  - .6 Braided wire mesh stainless steel.
  - .7 Diameter and type of end connection: to match pipe diameter.
  - .8 Operating conditions:
    - .1 Working pressure: 1034 kPa.
    - .2 Working temperature: 260 degrees C.
    - .3 To match system requirements.
  - .9 Three flexible grooved couplings placed in close proximity to vibration source for vibration attenuation and stress relief.
- 2.5 ANCHORS AND GUIDES
  - .1 Anchors:
    - .1 Provide as indicated.
  - .2 Alignment guides:
    - .1 Provide as indicated.
    - .2 To accommodate specified thickness of insulation.
    - .3 Vapour barriers, jackets to remain uninterrupted.
- Part 3 Execution
- 3.1 APPLICATION
  - .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- 3.2 INSTALLATION
  - .1 Install expansion joints with cold setting. Make record of cold settings.
  - .2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
- 3.3 PIPE CLEANING AND START-UP
  - .1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.
- 3.4 PERFORMANCE VERIFICATION
  - .1 In accordance with Section 23 08 13 - Performance Verification HVAC Systems.
- 3.5 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .1            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish, and limitations.
- .2            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .1            Certificates:
- .1            Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.2            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            GENERAL
- .1            Design point to be at mid-point of scale or range.
- .2            Ranges: as required.
- 2.2            DIRECT READING THERMOMETERS
- .1            Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4 and ASME B40.200.
- .1            Resistance to shock and vibration.
- 2.3            REMOTE READING THERMOMETERS

- .1 100 mm diameter mercury-free, liquid filled activated dial type: to CAN/CGSB-14.5 and ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass or stainless steel case for wall mounting.
- 2.4 THERMOMETER WELLS
  - .1 Copper pipe: copper or bronze.
  - .2 Steel pipe: brass or stainless steel.
- 2.5 PRESSURE GAUGES
  - .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel, phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.
  - .2 Provide:
    - .1 Siphon for steam service.
    - .2 Snubber for pulsating operation.
    - .3 Diaphragm assembly for corrosive service.
    - .4 Gasketed pressure relief back with solid front.
    - .5 Bronze stop cock.
    - .6 Oil filled for high vibration applications.
- 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 HVAC fan installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 GENERAL
  - .1 Install thermometers and gauges so they can be easily read from floor or platform.
    - .1 If this cannot be accomplished, install remote reading units.
  - .2 Install between equipment and first fitting or valve.
- 3.3 THERMOMETERS
  - .1 Install in wells on piping. Include heat conductive material inside well.
  - .2 Install in locations as indicated and on inlet and outlet of:
    - .1 Heat exchangers.
    - .2 Water heating and cooling coils.

- .3 Water boilers.
- .4 Chillers.
- .5 Cooling towers.
- .6 DHW tanks.
- .3 Install wells as indicated for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.
- 3.4 PRESSURE GAUGES
  - .1 Install in locations as follows:
    - .1 Suction and discharge of pumps.
    - .2 Upstream and downstream of PRV's.
    - .3 Upstream and downstream of control valves.
    - .4 Inlet and outlet of coils.
    - .5 Inlet and outlet of liquid side of heat exchangers.
    - .6 Outlet of boilers.
    - .7 In other locations as indicated.
  - .2 Install gauge cocks for balancing purposes and elsewhere as indicated.
  - .3 Use extensions where pressure gauges are installed through insulation.
- 3.5 NAMEPLATES
  - .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53 - Identification For HVAC Piping and Equipment, identifying medium.
- 3.6 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.7 PROTECTION
  - .1 Protect installed products and components from damage during construction.
  - .2 Repair damage to adjacent materials caused by thermometer and gauge installation.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .1            Submit data for valves specified in this Section.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Provide maintenance data for incorporation into manual specified in Section 23 05 00 - Common Work Results for HVAC.
- 1.3            MAINTENANCE MATERIAL SUBMITTALS
- .1            Extra Materials/Spare Parts:
- .1            Furnish following spare parts:
- .1            Valve seats: one for every 10 valves each size, minimum 1.
- .2            Discs: one for every 10 valves, each size. Minimum 1.
- .3            Stem packing: one for every 10 valves, each size. Minimum 1.
- .4            Valve handles: 2 of each size.
- .5            Gaskets for flanges: one for every 10 flanged joints.
- .2            Tools:
- .1            Furnish special tools for maintenance of systems and equipment.
- .2            Include following:
- 1.4            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.

- Part 2 Products
- 2.1 MATERIALS
- .4 Valves:
- .1 Except for specialty valves, to be single manufacturer.
- .2 Products to have CRN registration numbers.
- .5 End Connections:
- .1 Connection into adjacent piping/tubing:
- .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
- .2 Copper tube systems: solder ends or grooved ends to ANSI/ASME B16.18.
- .6 Lockshield Keys:
- .1 Where lockshield valves are specified, provide [10] keys of each size: malleable iron cadmium plated.
- .7 Gate Valves:
- .1 Requirements common to gate valves, unless specified otherwise:
- .1 Standard specification: MSS SP-80.
- .2 Bonnet: union with hexagonal shoulders.
- .3 Connections: screwed with hexagonal shoulders.
- .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic
- .5 Packing: non-asbestos.
- .6 Handwheel: non-ferrous.
- .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
- .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
- .2 Operator: Handwheel.
- .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
- .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
- .2 Operator: handwheel.
- .4 NPS 2 and under, rising stem, split wedge disc, Class 125:
- .1 Body: with long disc guides, screwed bonnet.
- .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem
- .3 Operator: handwheel.
- .5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
- .1 Body: with long disc guides, screwed bonnet.
- .2 Operator: handwheel.
- .6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
- .1 Body: with long disc guides, screwed bonnet.
- .2 Operator: handwheel.
- .8 Globe Valves:



- .1 Requirements common to globe valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: union with hexagonal shoulders.
  - .3 Connections: screwed with hexagonal shoulders.
  - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic
  - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
  - .6 Handwheel: non-ferrous.
  - .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, composition disc, Class 125:
  - .1 Body and bonnet: screwed bonnet.
  - .2 Disc and seat: renewable rotating PTFE disc composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
  - .3 Operator: handwheel.
- .3 NPS 2 and under, composition disc, Class 150:
  - .1 Body and bonnet: union bonnet.
  - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
  - .3 Operator: handwheel.
- .4 NPS 2 and under, plug disc, Class 150, screwed ends:
  - .1 Body and bonnet: union bonnet.
  - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem
  - .3 Operator: handwheel.
- .5 Angle valve, NPS 2 and under, composition disc, Class 150:
  - .1 Body and bonnet: union bonnet.
  - .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
  - .3 Operator: [handwheel] [lockshield].
- .9 Check Valves:
  - .1 Requirements common to check valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Connections: screwed with hexagonal shoulders.
  - .2 NPS 2 and under, swing type, bronze disc, Class 125:
    - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
    - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
  - .3 NPS 2 and under, swing type, bronze disc:

- .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
- .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
- .4 NPS 2 and under, swing type, composition disc, Class 200:
  - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
  - .2 Disc: renewable rotating disc of number [6] composition to suit service conditions, bronze two-piece hinge disc construction.
- .5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
  - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
  - .2 Disc: renewable PTFE no. 6 composition rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
- .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
  - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
- .10 Silent Check Valves:
  - .1 NPS 2 and under:
    - .1 Body: cast high tensile bronze to ASTM B62 with integral seat
    - .2 Pressure rating: Class 125.
    - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders
    - .4 Disc and seat: renewable rotating disc.
    - .5 Stainless steel spring, heavy duty.
    - .6 Seat: regrindable.
- .11 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: Class125, 2760-kPa CWP.
    - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders.
    - .4 Stem: tamperproof ball drive.
    - .5 Stem packing nut: external to body.
    - .6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.
    - .7 Stem seal: TFE with external packing nut.
    - .8 Operator: removable lever handle.
- .12 Butterfly Valves:
  - .1 NPS 2 1/2 through NPS 6, 2068 kPa with grooved ends.
    - .1 Body: cast bronze, with copper-tube dimensioned grooved ends.
    - .2 Disc: elastomer coated ductile iron with integrally cast stem.
    - .3 Operator: handwheel.

Part 3 Execution

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit maintenance data for incorporation into manual specified in Section 23 05 00 - Common Work Results for HVAC.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- 1.4            MAINTENANCE MATERIAL SUBMITTALS
- .4            Extra Materials/Spare Parts:
- .5            Furnish following spare parts:
- .1            Valve seats: one for every 10 valves each size, minimum 1.
- .2            Discs: one for every 10 valves, each size, minimum 1.
- .3            Stem packing: one for every 10 valves, each size, minimum 1.
- .4            Valve handles: 2 of each size.
- .5            Gaskets for flanges: one for every 10 flanged joints.
- .6            Tools:
- .1            Furnish special tools for maintenance of systems and equipment.
- .2            Include following:

.1 Lubricant gun for expansion joints.

Part 2 Products

2.1 MATERIAL

.7 Valves:

.1 Except for specialty valves, to be of single manufacturer.

.8 Standard specifications:

.1 Gate valves: MSS SP-70

.2 Globe valves: MSS SP-85

.3 Check valves: MSS SP-71

.9 Requirements common to valves, unless specified otherwise:

.1 Body, bonnet: cast iron to ASTM B209 Class B.

.2 Connections: flanged ends plain face with 2 mm raised face with serrated finish and grooved ends to ANSI B16.1.

.3 Inspection and pressure testing: to MSS SP-82.

.4 Bonnet gasket: non-asbestos.

.5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.

.7 Gland packing: non-asbestos.

.8 Handwheel: die-cast aluminum alloy to ASTM B85/B85M or malleable iron to ASTM A49. Nut of bronze to ASTM B62.

.9 Identification tag: with catalogue number, size, other pertinent data.

.10 All products to have CRN registration numbers.

2.2 GATE VALVES

.11 NPS 2 1/2 - 8, non rising stem, inside screw, [bronze] [iron] trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62.

.3 Seat rings: renewable bronze to ASTM B62, screwed into body

.4 Stem: bronze to ASTM B62

.5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem

.6 Seat: integral with body.

.7 Stem: wrought steel.

.8 Operator: handwheel.

.9 Bypass: complete with union and gate as Section 23 05 23.01 - Valves – Bronze.

.12 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:

- .1 Body and multiple-bolted bonnet: with [bosses in body and bonnet for taps and drains,] full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.
- .2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection
- .3 Seat rings: renewable bronze screwed into body.
- .4 Stem: [nickel-plated steel] [manganese-bronze].
- .5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.
- .6 Seat rings: integral with body.
- .7 Stem: nickel-plated steel.
- .8 Pressure-lubricated operating mechanism.
- .9 Operator: handwheel.
- .10 Bypass: complete with union and gate as Section 23 05 23.01 - Valves – Bronze.

## 2.3 UNDERWRITERS APPROVED GATE VALVE

### .13 NPS 2 1/2 - 14, OS&Y:

- .1 Approvals: UL and FM approved for fire service
- .2 UL and FM Label: on valve yoke
- .3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC C-262 (B), ductile iron to ASTM A536 Grade 65-45-12.
- .4 Bonnet bushing, yoke sleeve: bronze, to FM requirements
- .5 Packing gland: bronze.
- .6 Stem: manganese bronze. Diameter to ULC C-262 (B). Brass, ASTM B16.
- .7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B)
- .8 Bosses for bypass valve, drain: on NPS 4 and over.
- .9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: EPDM coated cast iron with bronze disc rings.
- .10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
- .11 Pressure rating:
  - .1 NPS 2-1/2 - 12: 1.7 Mpa CWP.
  - .2 NPS 14-1.2: 1.2 MPa CWP.
- .12 Operator: handwheel.
- .13 Bypass: complete with union and gate valve as Section 23 05 23.01 - Valves – Bronze.

## 2.4 GLOBE VALVES

### .1 NPS 2 1/2 - 10, OSY:

- .1 Body: with multiple-bolted bonnet.
- .2 WP: 860 kPa steam, 1.4 MPa CWP.
- .3 Bonnet-yoke gasket: non-asbestos.

- .4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc
- .5 Seat ring: renewable, regrindable, screwed into body.
- .6 Stem: bronze to ASTM B62
- .7 Operator: handwheel.
- .8 Bypass: complete with union and gate valve as Section 23 05 23.01 - Valves – Bronze.

## 2.5 BYPASSES FOR GATE AND GLOBE VALVES

- .1 Locations: on valves as indicated.
- .2 Size of bypass valve:
  - .1 Main valve up to NPS 8: NPS 3/4.
  - .2 Main valve NPS 10 and over: NPS 1.
- .3 Type of bypass valves:
  - .1 On gate valve: globe, with composition bronze] disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.
  - .2 On globe valve: globe, with composition bronze disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.

## 2.6 VALVE OPERATORS

- .14 Install valve operators as follows:
  - .1 Handwheel: on valves except as specified.
  - .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

## 2.7 CHECK VALVES

- .1 Swing check valves, Class 125:
  - .1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Grooved or flanged ends: plain faced with smooth finish.
    - .1 Up to NPS 16: cast iron to ASTM A126 Class B.
    - .2 NPS 18 and over: cast iron to ASTM A126 Class C
  - .2 Ratings:
    - .1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.
    - .2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.
    - .3 NPS 18 and over: 1.03 MPa CWP.
  - .3 Disc: rotating for extended life.
    - .1 Up to NPS 6: bronze to ASTM B62.
    - .2 NPS 8 and over: bronze-faced cast iron.
  - .4 Seat rings: renewable bronze to ASTM B62 screwed into body
  - .5 Hinge pin, bushings: renewable bronze to ASTM B62.
  - .6 Disc: A126 Class B, secured to stem, rotating for extended life.

- .7 Seat: cast iron, integral with body.
- .8 Hinge pin: exelloy; bushings: malleable iron.
- .9 Identification tag: fastened to cover.
- .10 Hinge: galvanized malleable iron.
- .2 Swing check valves, NPS 2 1/2 - 8 Class 250:
  - .1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin
  - .2 Flanged ends: 2 mm raised face with serrated finish.
  - .3 Rating: 250 psi steam; 500 psi CWP.
  - .4 Disc: rotating for extended life.
    - .1 Up to NPS 3: bronze to ASTM B61
    - .2 NPS 4 - 8: iron faced with ASTM B61 bronze
  - .5 Seat rings: renewable bronze to ASTM B61, screwed into body
  - .6 Hinge pin, bushings: renewable, bronze to ASTM B61
  - .7 Hinge: galvanized malleable iron.
  - .8 Identification tag: fastened to cover.
- 2.8 SILENT CHECK VALVES
  - .1 Construction:
    - .1 Body: ductile iron with integral seat.
    - .2 Pressure rating: Class 125, WP = 860 kPa.
    - .3 Connections: grooved ends.
    - .4 Disc: bronze renewable rotating disc.
    - .5 Seat: renewable, EPDM.
    - .6 Stainless steel spring, heavy duty.
- Part 3 Execution
- 3.1 INSTALLATION
  - .1 Install rising stem valves in upright position with stem above horizontal.
- 3.2 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION



- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit shop drawings for:
- .1            Bases, hangers and supports.
- .2            Connections to equipment and structure.
- .3            Structural assemblies.
- .4            Certificates:
- .1            Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5            Manufacturers' Instructions:
- .1            Provide manufacturer's installation instructions.
- 1.2            CLOSEOUT SUBMITTALS
- .6            Provide maintenance data for incorporation into manual in accordance with Section 23 05 00 - Common Work Results for HVAC.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            SYSTEM DESCRIPTION
- .1            Design Requirements:

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

## 2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58 and ANSI B31.1.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

## 2.3 PIPE HANGERS

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized, painted with zinc-rich paint after manufacture.
  - .2 Use [electro-plating galvanizing process] [hot dipped galvanizing process].
  - .3 Ensure steel hangers in contact with copper piping are [copper plated] [epoxy coated].
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
  - .2 Rod: 9 mm ULlisted.
  - .3 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed MSS-SP58 andMSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:
  - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed MSS SP69.
- .5 Shop and field-fabricated assemblies:

- .1 Trapeze hanger assemblies:
- .2 Steel brackets:
- .6
- .7 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 22 mm or 28 mm rod.
- .8 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel [black] [galvanized].
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .9 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .10 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .11 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: black.
  - .2 Finishes for copper, glass, brass or aluminum pipework: black.
- .12 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.
- 2.4 RISER CLAMPS
  - .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.
  - .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
  - .3 Bolts: to ASTM A307.
  - .4 Nuts: to ASTM A563.
- 2.5 INSULATION PROTECTION SHIELDS
  - .1 Insulated cold piping:
    - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span
  - .2 Insulated hot piping:
    - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.
- 2.6 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR)
  - .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
  - .3 Provide upper and lower factory set travel stops.
  - .4 Provide load adjustment scale for field adjustments.
  - .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
  - .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.
- 2.7 VARIABLE SUPPORT SPRING HANGERS
- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
  - .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with [2] springs in series in single casing.
  - .3 Variable spring hanger complete with factory calibrated travel stops. [Provide certificate of calibration for each hanger].
  - .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR
- 2.8 EQUIPMENT SUPPORTS
- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.
- 2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES
- .1 Provide templates to ensure accurate location of anchor bolts.
- 2.10 HOUSE-KEEPING PADS
- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- 2.11 OTHER EQUIPMENT SUPPORTS
- .1 Fabricate equipment supports from structural grade steel.
  - .2 Submit structural calculations with shop drawings.
- Part 3 Execution
- 3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.2 INSTALLATION
  - .1 Install in accordance with:
    - .1 Manufacturer's instructions and recommendations.
  - .2 Vibration Control Devices:
    - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
  - .3 Clamps on riser piping:
    - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
    - .2 Bolt-tightening torques to industry standards.
    - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
    - .4 Cast iron pipes: install below joint.
  - .4 Clevis plates:
    - .1 Attach to concrete with 4 minimum concrete inserts, [one] at each corner.
  - .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
  - .6 Use approved constant support type hangers where:
    - .1 Vertical movement of pipework is 13 mm or more,
    - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
  - .7 Use variable support spring hangers where:
    - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
    - .2 Variation in supporting effect does not exceed 25 % of total load.
- 3.3 HANGER SPACING
  - .1 Plumbing piping: to the Ontario Building Code and the authority having jurisdiction.
  - .2 Fire protection: to applicable fire code.
  - .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
  - .4 Copper piping: up to NPS 1/2: every 1.5 m.
  - .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
  - .6 Within 300 mm of each elbow.
  - .7 Pipework greater than NPS 12: to MSS SP69.
- 3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
  - .2 Adjust hangers to equalize load.
  - .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- 3.5 HORIZONTAL MOVEMENT
- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
  - .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.
- 3.6 FINAL ADJUSTMENT
- .1 Adjust hangers and supports:
    - .1 Ensure that rod is vertical under operating conditions.
    - .2 Equalize loads.
  - .2 Adjustable clevis:
    - .1 Tighten hanger load nut securely to ensure proper hanger performance.
    - .2 Tighten upper nut after adjustment.
  - .3 C-clamps:
    - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
  - .4 Beam clamps:
    - .1 Hammer jaw firmly against underside of beam.
- 3.7 FIELD QUALITY CONTROL
- .1 Manufacturer's Field Services:
    - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
    - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
    - .3 Schedule site visits, to review Work.
- 3.8 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Product Data:
- .1            Submit manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.
- .2            Submittals: in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product data to include paint colour chips, other products specified in this section.
- .3            Samples:
- .1            Submit samples for approval.
- .2            Samples to include nameplates, labels, tags, lists of proposed legends.
- 1.2            DELIVERY, STORAGE, AND HANDLING
- .1            Packing, shipping, handling and unloading:
- .1            Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2            Waste Management and Disposal:
- .1            Waste Management and Disposal: separate waste materials for reuse and recycling.
- .2            Dispose of unused paint and coating material at official hazardous material collections site approved by the authority having jurisdiction.
- .3            Do not dispose of unused paint and coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.
- Part 2            Products
- 2.1            MANUFACTURER'S EQUIPMENT NAMEPLATES
- .1            Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2            Lettering and numbers raised or recessed.
- .3            Information to include, as appropriate:
- .1            Equipment: manufacturer's name, model, size, serial number, capacity.
- .2            Motor: voltage, Hz, phase, power factor, duty, frame size.
- 2.2            SYSTEM NAMEPLATES
- .1            Colours:
- .1            Hazardous: red letters, white background.
- .2            Elsewhere: black letters, white background (except where required otherwise by applicable codes).



- .2 Construction:
  - .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

- .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.

.4 Locations:

- .1 Terminal cabinets, control panels: use size # 5.
- .2 Equipment in Mechanical Rooms: use size # 9.

.5 Identification for PSPC Preventive Maintenance Support System (PMSS):

- .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
- .2 Equipment in Mechanical Room:
  - .1 Main identifier: size #9.
  - .2 Source and Destination identifiers: size #6.
  - .3 Terminal cabinets, control panels: size #5.
- .3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Consultant.

2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
  - .1 Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.
  - .2 Propane gas: to CSA/CGA B149.1 and authority having jurisdiction.
  - .3 Sprinklers: to NFPA 13.
  - .4 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend, direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise
- .2 Pictograms:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 Other pipes: pressure sensitive plastic-coated cloth, vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Engineer.
  - .2 Colours for legends, arrows: to following table:

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Raw water	Green	RAW WATER
River water	Green	RIVER WATER
Sea water	Green	SEA WATER
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Brine	Green	BRINE
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN

Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam [_____]kPa	Yellow	[_____] kPa STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR
Drinking water return	Green	CH. DRINK WTR. CIRC
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Contaminated lab waste	Yellow	CONT. LAB WASTE
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
No. [_____] fuel oil suction	Yellow	# [_____] FUEL OIL
No. [_____] fuel oil return	Yellow	# [_____] FUEL OIL
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Gasoline	Yellow	GASOLINE
Natural gas	to Codes	
Propane	to Codes	
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR
Demineralized water	Green	DEMIN. WATER
Chlorine	Yellow	CHLORINE
Nitrogen	Yellow	NITROGEN
Oxygen	Yellow	OXYGEN
Compressed air (<700kPa)	Green	COMP. AIR [_____] kPa
Compressed air (>700kPa)	Yellow	COMP. AIR [_____] kPa
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Carbon dioxide	Red	CO2
Instrument air	Green	INSTRUMENT AIR

- 2.6 IDENTIFICATION DUCTWORK SYSTEMS
  - .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
  - .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.
- 2.7 VALVES, CONTROLLERS
  - .1 Brass tags with 12 mm stamped identification data filled with black paint.
  - .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.
- 2.8 CONTROLS COMPONENTS IDENTIFICATION
  - .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
  - .2 Inscriptions to include function and (where appropriate) fail-safe position.
- 2.9 LANGUAGE
  - .1 Identification in English.
- Part 3 Execution
  - 3.1 MANUFACTURER'S INSTRUCTIONS
    - .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
  - 3.2 TIMING
    - .1 Provide identification only after painting has been completed.
  - 3.3 INSTALLATION
    - .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise
    - .2 Provide ULC and/or CSA registration plates as required by respective agency
    - .3 Identify systems, equipment to conform to PWGSC PMSS.
  - 3.4 NAMEPLATES
    - .1 Locations:
      - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
    - .2 Standoffs:
      - .1 Provide for nameplates on hot and/or insulated surfaces.
    - .3 Protection:

- .1 Do not paint, insulate or cover.

### 3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### 3.6 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

### 3.7 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section 01 33 29 - Sustainable Design Reporting, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

3.8 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            QUALIFICATIONS OF TAB PERSONNEL
- .1            Submit names of personnel to perform TAB to Engineer within 90 days of award of contract.
  - .2            Provide documentation confirming qualifications, successful experience.
  - .3            TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
    - .1            Associated Air Balance Council, (AABC National Standards for Total System Balance, MN-1-2002.
    - .2            National Environmental Balancing Bureau (NEBB) TABES Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
    - .3            Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
  - .4            Recommendations and suggested practices contained in the TAB Standard: mandatory.
  - .5            Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
  - .6            Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
  - .7            Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
  - .8            TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
    - .1            For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
    - .2            Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.
- 1.2            PURPOSE OF TAB
- .1            Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
  - .2            Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
  - .3            Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.
- 1.3            EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.
- 1.4 CO-ORDINATION
  - .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
  - .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.
- 1.5 PRE-TAB REVIEW
  - .1 Review Contract Documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
  - .2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.
  - .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.
- 1.6 START-UP
  - .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
  - .2 Follow special start-up procedures specified elsewhere in Division 23.
- 1.7 OPERATION OF SYSTEMS DURING TAB
  - .1 Operate systems for length of time required for TAB and as required by Engineer for verification of TAB reports.
- 1.8 START OF TAB
  - .1 Notify Engineer 7 days prior to start of TAB.
  - .2 Start TAB when building is essentially completed, including:
  - .3 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .4 Application of weatherstripping, sealing, and caulking.
  - .5 Pressure, leakage, other tests specified elsewhere Division 23.
  - .6 Provisions for TAB installed and operational.
  - .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
    - .1 Proper thermal overload protection in place for electrical equipment.
    - .2 Air systems:
      - .1 Filters in place, clean.
      - .2 Duct systems clean.
      - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.



- .4 Correct fan rotation.
- .5 Fire, smoke, volume control dampers installed and open.
- .6 Coil fins combed, clean.
- .7 Access doors, installed, closed.
- .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.
- 1.9 APPLICATION TOLERANCES
  - .1 Do TAB to following tolerances of design values:
    - .1 Other HVAC systems: plus 5 %, minus 5 %.
    - .2 Hydronic systems: plus or minus 10 %.
- 1.10 ACCURACY TOLERANCES
  - .1 Measured values accurate to within plus or minus 2 % of actual values.
- 1.11 INSTRUMENTS
  - .1 Prior to TAB, submit to Engineer list of instruments used together with serial numbers.
  - .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
  - .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Engineer.
- 1.12 ACTION AND INFORMATIONAL SUBMITTALS
  - .1 Submit, prior to commencement of TAB:
  - .2 Proposed methodology and procedures for performing TAB if different from referenced standard.
- 1.13 PRELIMINARY TAB REPORT
  - .1 Submit for checking and approval of Engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
    - .1 Details of instruments used.
    - .2 Details of TAB procedures employed.
    - .3 Calculations procedures.
    - .4 Summaries.
- 1.14 TAB REPORT

- .1 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .2 Submit an electronic copy of TAB Report to Engineer for verification and approval.
- 1.15 VERIFICATION
  - .1 Reported results subject to verification by Engineer.
  - .2 Provide personnel and instrumentation to verify up to 30 % of reported results.
  - .3 Pay costs to repeat TAB as required to satisfaction of Engineer.
- 1.16 SETTINGS
  - .1 After TAB is completed to satisfaction of Engineer, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
  - .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.
- 1.17 COMPLETION OF TAB
  - .1 TAB considered complete when final TAB Report received and approved by Engineer.
- 1.18 AIR SYSTEMS
  - .1 Standard: TAB to most stringent of this section, TAB standards of AABC, NEBB, SMACNA, and ASHRAE.
  - .2 Do TAB of systems, equipment, components, controls specified Division 23.
  - .3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB, qualified to standards of AABC or NEBB.
  - .4 Quality assurance: perform TAB under direction of supervisor qualified by the standards of AABC or NEBB.
  - .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
  - .6 Locations of equipment measurements: to include as appropriate:
    - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
    - .2 At controllers, controlled device.
  - .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).
- 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            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Provide submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
- .1            Description of equipment giving manufacturer's name, type, model, year and capacity.
- .2            Details of operation, servicing and maintenance.
- .3            Recommended spare parts list.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .4            Manufacturers' Instructions:
- .1            Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, and cleaning procedures.
- 1.2            QUALITY ASSURANCE
- .1            Qualifications:
- .1            Installer: specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards and a member of TIAC.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC/CSA markings.
- .2            Waste Management and Disposal:
- .1            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            FIRE AND SMOKE RATING
- .1            To CAN/ULC-S102:
- .1            Maximum flame spread rating: 25.
- .2            Maximum smoke developed rating: 50.
- 2.2            INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
  - .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
  - .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this section).
  - .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 without factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this section).
    - .1 Mineral fibre: to ASTM C553
    - .2 Jacket: to CGSB 51-GP-52 Ma
    - .3 Maximum "k" factor: to ASTM C553
- 2.3 JACKETS
- .1 Aluminum:
    - .1 Equal to 3M VentureClad Insulation Jacketing System for indoor and outdoor installation.
    - .2 To ASTM B209 with and without moisture barrier as scheduled in PART 3 of this section.
    - .3 Thickness: 0.50 mm sheet.
    - .4 Finish: Natural aluminum smooth.
    - .5 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
  - .2 Stainless steel:
    - .1 Type: 304 for indoor installation and 316 for outdoor installation.
    - .2 Thickness: 0.40 mm sheet.
    - .3 Finish: Stucco embossed.
    - .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
- 2.4 ACCESSORIES
- .1 Vapour retarder lap adhesive:
    - .1 Water based, fire retardant type, compatible with insulation.
  - .2 Indoor Vapour Retarder Finish:
    - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
  - .4 ULC Listed Canvas Jacket:
    - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .5 Outdoor Vapour Retarder Mastic:
    - .1 Vinyl emulsion type acrylic, compatible with insulation.
    - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
  - .6 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.

- .7 Contact adhesive: quick-setting
- .8 Canvas adhesive: washable.
- .9 Tie wire: .5] mm stainless steel.
- .10 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on both faces of insulation.
- .12 Fasteners: 4 mm diameter pins with 35 mm diameter square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use [2] layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

Type	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Round cold and dual temperature supply air ducts (concealed)	C-2	yes	50
Rectangular warm air ducts (exposed)	C-1	no	25
Round warm air ducts (exposed)	C-1	no	25
Rectangular cold and dual temperature supply air ducts (concealed)	C-2	Yes	25
Round cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Rectangular warm air ducts (concealed)	C-2	No	25
Round warm air ducts (concealed)	C-2	No	25
Supply, return and exhaust ducts exposed in space being served			none
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	25
Exhaust duct between dampers and louvers	C-1	no	50
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50

- .2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
  - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct

- .3 Finishes: conform to following table:

Location	TIAC Code		Insulation Thickness
	Rectangular	Round	
Indoor, concealed	none	none	-
Indoor, exposed within mechanical room	CRF/1	CRD/2	25mm (1")
Indoor, exposed elsewhere	CRF/2	CRD/3	25mm (1")
Outdoor, exposed to precipitation	CRF/3	CRD/4	75mm (3")
Outdoor, elsewhere	CRF/4	CRD/5	75mm (3")

- .4 All outdoor air intake ductwork from outside louvers to mixing plenum of air handling unit or to motorized damper in other systems in 50mm (2") thickness.
- .5 All exhaust and relief ductwork from outside louvers back 1.5m (5 ft) upstream of motorized dampers or where there are no motorized dampers, from louver to fan discharge in 50mm (2") thickness.
- .6 Mixed air plenums in 50mm (2") thickness.
- .7 Behind unused portion of louvers in 50mm (2") thickness.

### 3.5 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.

Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION



- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Product Data:
- .1            Submit manufacturer's printed product literature, specifications, and datasheet in in accordance with Section 23 05 00 - Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.
- .2            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .1            Quality assurance submittals: submit manufacturer's installation instructions.
- 1.2            QUALITY ASSURANCE
- .3            Qualifications:
- .1            Installer: specialist in performing work of this section and have at least 3 years successful experience in this size and type of project, qualified to standards and a member of TIAC.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Packing, shipping, handling and unloading:
- .1            Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2            Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Protection:
- .1            Protect from weather, construction traffic.
- .2            Protect against damage.
- .3            Store at temperatures and conditions required by manufacturer.
- .3            Waste Management and Disposal:
- .1            Place excess or unused insulation and insulation accessory materials in designated containers.
- .2            Dispose of unused adhesive material at official hazardous material collections site as per municipal standards.
- Part 2            Products
- 2.1            FIRE AND SMOKE RATING
- .1            In accordance with CAN/ULC-S102.
- .1            Maximum flame spread rating: 25.
- .2            Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
  - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52 Ma
  - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C547.
- .5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C547.
- .6 TIAC Code A-6: flexible unicellular tubular elastomer
  - .1 Insulation: with vapour retarder jacket.
  - .2 Jacket: to CGSB 51-GP-52 Ma
  - .3 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
- .7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements
  - .1 Insulation: to ASTM C533.
  - .2 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

- 2.6 INDOOR VAPOUR RETARDER FINISH
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- 2.7 OUTDOOR VAPOUR RETARDER FINISH
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: fibrous glass, untreated 305 g/m<sup>2</sup>.
- 2.8 JACKETS
  - .1 Polyvinyl Chloride (PVC):
    - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required
    - .2 Colours: to match adjacent finish paint.
    - .3 Minimum service temperatures: -20 degrees C.
    - .4 Maximum service temperature: 65 degrees C.
    - .5 Moisture vapour transmission: 0.02 perm.
    - .6 Fastenings:
      - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
      - .2 Tacks.
      - .3 Pressure sensitive vinyl tape of matching colour.
    - .7 Special requirements:
      - .1 Indoor: standard.
      - .2 Outdoor: UV rated material at least 0.5 mm thick.
    - .8 Locations:
      - .1 Indoor exposed installations; not required for concealed installation including return air plenums and ceiling spaces.
  - .2 ABS Plastic:
    - .1 One-piece moulded type and sheet with pre-formed shapes as required.
    - .2 Colours: to match adjacent finish paint where applicable.
    - .3 Minimum service temperatures: -40 degrees C.
    - .4 Maximum service temperature: 82 degrees C.
    - .5 Moisture vapour transmission: 0.012 perm.
    - .6 Thickness: [0.75] mm.
    - .7 Fastenings:
      - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
      - .2 Tacks.
      - .3 Pressure sensitive vinyl tape of matching colour.
    - .8 Locations:
      - .1 For outdoor use ONLY.

- .3 Canvas:
    - .1 220 and 120 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C921.
    - .2 Lagging adhesive: compatible with insulation.
  - .4 Aluminum:
    - .1 To ASTM B209.
    - .2 Thickness: 0.50 mm sheet.
    - .3 Finish: stucco embossed.
    - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
    - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
    - .6 Metal jacket banding and mechanical seals: stainless steel, 9] mm wide, 0.5mm thick at 300 mm spacing.
  - .5 Stainless steel:
    - .1 Type: 316.
    - .2 Thickness: 0.25 mm.
    - .3 Finish: stucco embossed.
    - .4 Joining: longitudinal and circumferential slip joints with [50] mm laps.
    - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
    - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.
- Part 3 Execution
- 3.1 MANUFACTURER'S INSTRUCTIONS
    - .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
  - 3.2 PRE-INSTALLATION REQUIREMENT
    - .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
    - .2 Surfaces clean, dry, free from foreign material.
  - 3.3 INSTALLATION
    - .1 Install in accordance with TIAC National Standards
    - .2 Apply materials in accordance with manufacturer's instructions and this specification.
    - .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- 3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES
  - .1 Application: at expansion joints, valve, primary flow measuring elements, flanges and unions at equipment.
  - .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
  - .3 Insulation:
    - .1 Insulation, fastenings and finishes: same as system.
    - .2 Jacket: PVC.
- 3.5 INSTALLATION OF ELASTOMERIC INSULATION
  - .1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
  - .2 Provide vapour retarder as recommended by manufacturer.
- 3.6 PIPING INSULATION SCHEDULES
  - .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
  - .2 TIAC Code: A-1.
    - .1 Securements: Tape at 300 mm on centre.
    - .2 Seals: lap seal adhesive, lagging adhesive.
    - .3 Installation: TIAC Code 1501-H.
  - .3 TIAC Code: A-3.
    - .1 Securements: Tape at 300 mm on centre.
    - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
    - .3 Installation: TIAC Code: 1501-C.
  - .4 TIAC Code: A-6.
    - .1 Seals: lap seal adhesive, lagging adhesive.
  - .5 TIAC Code: C-2 with vapour retarder jacket.
    - .1 Seals: lap seal adhesive, lagging adhesive.
    - .2 Installation: TIAC Code: 1501-C.
  - .6 TIAC Code: A-2.
    - .1 Seals: lap seal adhesive, lagging adhesive.
    - .2 Installation: TIAC Code: 1501-H.
  - .7 Thickness of insulation as listed in following table.

- .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
- .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Steam	up to 175	[A-1]	38	50	65	75	90	90
Steam, Saturated and Super heated	over 175	[A-1]	38	65	65	75	90	90
Condensate Return	60 - 94	[A-1]	25	38	38	38	38	38
Pumped Condensate return	up to 94	[A-1]	25	38	38	38	38	38
Boiler Feed Water		[A-1]	25	25	25	25	25	25
Hot Water Heating	60 - 94	[A-1]	25	38	38	38	38	38
Hot Water Heating	up to 59	[A-1]	25	25	25	25	38	38
Glycol Heating	60 - 94	[A-1]	25	38	38	38	38	38
Glycol Heating	up to 59	[A-1]	25	25	25	25	38	38
Domestic HWS		[A-1]	25	25	25	38	38	38
Chilled Water	4 - 13	[A-3]	25	25	25	25	25	25
Chilled Water or Glycol	below 4	[A-3]	25	25	38	38	38	38
Chilled Water Pump Casing		[A-3]	25	25	25	25	25	25
Condenser Water Outdoors			25	25	25	25	25	38
Condenser Water Indoors			-	-	-	-	-	-
Refrigerated Drinking Water		[A-3]	25	25	25	25	25	25
Domestic CWS		[A-3]	25	25	25	25	25	25
Domestic CWS with vapour retarder		[C-2]	25	25	25	25	25	25
Refrigerant [hot gas] [liquid] [suction]	4 - 13	[A-6]	25	25	25	25	25	25
Refrigerant [hot gas] [liquid] [suction]	below 4	[A-6]	25	25	38	38	38	38
RWL and RWP		[C-2]	25	25	25	25	25	25
Cooling Coil cond. drain		[C-2]	25	25	25	25	25	25
Diesel generator exhaust system		[A-2]	38	65	65	75	90	90

.8 Finishes:

- .1 Exposed indoors: PVC jacket.
- .2 Exposed in mechanical rooms: PVC jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation
- .5 Outdoors: water-proof aluminum jacket.
- .6 Finish attachments: SS bands, at 50 mm on centre. Seals: closed.
- .7 Installation: to appropriate TIAC code CRF/1 through CPF/5

3.7 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1 General
  - 1.1 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS
    - .1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.
  - 1.2 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)
    - .1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.
    - .2 When systems are operational, perform following tests:
      - .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
      - .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
        - .1 Pump operation.
        - .2 Boiler and/or chiller operation.
        - .3 Pressure bypass open/closed.
        - .4 Control pressure failure.
        - .5 Maximum heating demand.
        - .6 Maximum cooling demand.
        - .7 Boiler and/or chiller failure.
        - .8 Cooling tower (and/or industrial fluid cooler) fan failure.
        - .9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.
  - 1.3 HYDRONIC SYSTEM CAPACITY TEST
    - .1 Perform hydronic system capacity tests after:
      - .1 TAB has been completed
      - .2 Verification of operating, limit, safety controls.
      - .3 Verification of primary and secondary pump flow rates.
      - .4 Verification of accuracy of temperature and pressure sensors and gauges.
    - .2 Calculate system capacity at test conditions.
    - .3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.
    - .4 When capacity test is completed, return controls and equipment status to normal operating conditions.
    - .5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.



- .6 Heating system capacity test:
  - .1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:
    - .1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures to ensure that coils are not subjected to freezing conditions) or
    - .2 Reducing space temperature by turning of heating system for sufficient period of time before starting testing.
  - .2 Test procedures:
    - .1 Open fully heat exchanger, heating coil and radiation control valves.
    - .2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.
    - .3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.
  
- 1.4 POTABLE WATER SYSTEMS
  - .1 When cleaning is completed, and system filled:
    - .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
    - .2 Check for proper operation of water hammer arrestors. Run [one] outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
    - .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.
  
- 1.5 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS
  - .1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.
  - .2 Verification of controls, detection devices, alarm devices is specified Division 26.
  - .3 Demonstrate that fire hose will reach to most remote location regardless of partitions, and obstructions.
  - .4 Verify operation of interlocks between HVAC systems and fire alarm systems.
  
- 1.6 SANITARY AND STORM DRAINAGE SYSTEMS
  - .1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.
  - .2 Ensure that traps are fully and permanently primed.
  - .3 Ensure that fixtures are properly anchored, connected to system.
  - .4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.
  - .5 Cleanouts: refer to Section 22 05 15 - Plumbing Specialities and Accessories.
  - .6 Roof drains:

- .1 Refer to Section 22 05 15 - Plumbing Specialities and Accessories.
- .2 Remove caps as required.

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            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Product Data:
- .1            Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 - Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.
- 1.2            DELIVERY, STORAGE, AND HANDLING
- .1            Packing, shipping, handling and unloading:
- .1            Deliver, store and handle in accordance with manufacturer's written instructions.
- .2            Waste Management and Disposal:
- .1            Waste Management and Disposal: separate waste materials for reuse and recycling.
- Part 2            Products
- 2.1            CLEANING SOLUTIONS
- .1            Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2            Sodium carbonate: 0.40 kg per 100 L water in system.
- .3            Low-foaming detergent: 0.01 kg per 100 L water in system.
- Part 3            Execution
- 3.1            MANUFACTURER'S INSTRUCTIONS
- .1            Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.2            CLEANING HYDRONIC AND STEAM SYSTEMS
- .1            Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2            Cleaning Agency:
- .1            Retain qualified water treatment specialist to perform system cleaning.
- .3            Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete [by water treatment specialist].
- .4            Cleaning procedures:
- .1            Provide detailed report outlining proposed cleaning procedures at least [4] weeks prior to proposed starting date. Report to include:
- .1            Cleaning procedures, flow rates, elapsed time.

- .2 Chemicals and concentrations used.
  - .3 Inhibitors and concentrations.
  - .4 Specific requirements for completion of work.
  - .5 Special precautions for protecting piping system materials and components.
  - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
- .1 Systems: free from construction debris, dirt and other foreign material.
  - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
  - .3 Strainers: clean prior to initial fill.
  - .4 Install temporary filters on pumps not equipped with permanent filters.
  - .5 Install pressure gauges on strainers to detect plugging.
- .6 Report on Completion of Cleaning:
- .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .7 Hydronic Systems:
- .1 Fill system with water, ensure air is vented from system.
  - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
  - .3 Use water metre to record volume of water in system to +/- 0.5%.
  - .4 Add chemicals under direct supervision of chemical treatment supplier.
  - .5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
  - .6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
  - .7 Add chemical solution to system.
  - .8 Establish circulation, raise temperature slowly to [maximum design] [82 degrees C minimum]. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 hours at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).
- 3.3 START-UP OF HYDRONIC SYSTEMS
- .1 After cleaning is completed and system is filled:
- .1 Establish circulation and expansion tank level, set pressure controls.
  - .2 Ensure air is removed.

- .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
- .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
- .5 Clean out strainers repeatedly until system is clean.
- .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment.
- .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
- .8 Repeat with water at design temperature.
- .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
- .10 Bring system up to design temperature and pressure slowly.
- .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .12 Adjust pipe supports, hangers, springs as necessary.
- .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.
- .15 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .16 Check operation of drain valves.
- .17 Adjust valve stem packings as systems settle down.
- .18 Fully open balancing valves (except those that are factory-set).
- .19 Check operation of over-temperature protection devices on circulating pumps.
- .20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

#### 3.4 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .1            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Indicate on manufacturers catalogue literature the following: valves.
- .3            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.
- .3            Submit hardcopy and electronic form of operation and maintenance manual.
- 1.3            MAINTENANCE MATERIAL SUBMITTALS
- .1            Extra Materials:
- .1            Furnish following spare parts:
- .1            Valve seats: one for every ten valves, each size. Minimum one.
- .2            Discs: one for every ten valves, each size. Minimum one.
- .3            Stem packing: one for every ten valves, each size. Minimum one.
- .4            Valve handles: two of each size.
- .5            Gaskets for flanges: one for every ten flanges.
- 1.4            QUALITY ASSURANCE
- .1            Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.
- 1.5            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:

- .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
  - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2 Products
- 2.1 TUBING
    - .1 Type A or B hard drawn copper tubing: to ASTM B88M
  - 2.2 FITTINGS
    - .1 Cast bronze threaded fittings: to ANSI/ASME B16.15
    - .2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22
    - .3 Cast iron threaded fittings: to ANSI/ASME B16.4
    - .4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18
  - 2.3 FLANGES
    - .1 Brass or bronze: threaded.
    - .2 Cast iron: threaded.
    - .3 Orifice flanges: slip-on, raised face, 2100 kPa.
  - 2.4 JOINTS
    - .1 Solder, tin-antimony, 95:5: to ASTM B32
    - .2 Silver solder BCUP: to ANSI/AWS A5.8
    - .3 Brazing: as indicated.
  - 2.5 VALVES
    - .1 Connections:
      - .1 NPS 2 and smaller: ends for soldering.
      - .2 NPS 2 1/2 and larger: flanged or grooved ends.
    - .2 Gate Valves: application: isolating equipment, control valves, pipelines:
      - .1 NPS 2 and under:
        - .1 Mechanical Rooms: Class 125, non-rising stem split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
        - .2 Elsewhere: Class 25, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
      - .2 NPS 2 1/2 and over:

- .1 Mechanical Rooms: non-rising stem, split wedge disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .2 Elsewhere: Non-rising stem, solid wedge disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .3 Butterfly valves: application: isolating each cell or section of multiple component equipment:
  - .1 NPS 2 1/2 and over: lug type or grooved ends: as specified Section 23 05 17 - Pipe Welding.
- .4 Globe valves: [application: throttling, flow control, emergency bypass]:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2 1/2 and over:
    - .1 With composition bronze disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .5 Balancing, for TAB:
  - .1 Sizes: calibrated balancing valves, as specified.
  - .2 NPS 2 and under:
    - .1 Mechanical rooms: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
- .6 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .7 Swing check valves:
  - .1 NPS 2 and under:
    - .1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 NPS 2 1/2 and over:
- .8 Silent check valves:
  - .1 NPS 2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2 1/2 and over:
    - .1 Flanged or grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.
- .9 Ball valves:
  - .1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.



- 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 HVAC fan installation in accordance with manufacturer's written instructions.
- .1 Inform Engineer of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 MANUFACTURER'S INSTRUCTIONS
- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.3 PIPING INSTALLATION
- .1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .3 Slope piping in direction of drainage and for positive venting.
- .4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .6 Assemble piping using fittings manufactured to ANSI standards
- 3.4 VALVE INSTALLATION
- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install gate, ball or butterfly valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .3 Install globe valves for balancing and in by-pass around control valves as indicated.
- .4 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .5 Install swing check valves in horizontal lines on discharge of pumps and] as indicated.
- .6 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Mechanical Equipment Rooms.
- .7 Install plug cocks or ball valves for glycol service.
- 3.5 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated.
  - .2 Remove handwheel after installation and TAB is complete.
  - .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.
- 3.6 FLUSHING AND CLEANING
- .1 Flush after pressure test for a minimum of 4 hours.
  - .2 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hours.
  - .3 Refill system with clean water. Circulate for at least 4 hours. Clean out strainer screens/baskets regularly. Then drain.
  - .4 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.
  - .5 Drainage to include drain valves, dirt pockets, strainers, low points in system.
  - .6 Re-install strainer screens/baskets only after obtaining Engineer's approval.
- 3.7 FILLING OF SYSTEM
- .1 Refill system with clean water adding water treatment as specified.
- 3.8 FIELD QUALITY CONTROL
- .1 Testing:
    - .1 Test system in accordance with Section 23 05 00 - Common Work Results for HVAC.
  - .2 Balancing:
    - .1 Balance water systems to within plus or minus 5% of design output.
- 3.9 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .1            Indicate on drawings:
- .1            Components and accessories.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with 23 05 00 - Common Work Results for HVAC.
- .2            Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.
- .3            Submit hardcopy and electronic form of operation and maintenance manual.
- 1.3            EXTRA STOCK MATERIALS
- .1            Supply spare parts as follows:
- .1            Valve seats: 1 minimum for every ten valves, each size. Minimum one.
- .2            Discs: 1 minimum for every ten valves, each size. Minimum one.
- .3            Stem packing: 1 minimum for every ten valves, each size. Minimum one.
- .4            Valve handles: 2 minimum of each size.
- .5            Gaskets for flanges: 1 minimum for every ten flanges.
- 1.4            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.

- Part 2            Products
- 2.1            PIPE
- .1            Steel pipe: to ASTM A53/A53M, Grade B, as follows:
- .1            To NPS 6: Schedule 40.
- 2.2            PIPE JOINTS
- .1            NPS 2 and under: screwed fittings with PTFE tape or lead-free pipe dope.
- .2            NPS 2-1/2 and over: welding fittings and flanges to CSA W48.
- .3            Roll grooved: rigid coupling to CSA B242
- .4            Flanges: plain, slip-On or weld neck to ANSI/AWWA C111/ A21.11.
- .5            Orifice flanges: slip-on raised face, 2100 kPa.
- .6            Flange gaskets: to ANSI/AWWA C111/ A21.11.
- .7            Pipe thread: taper.
- .8            Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .9            Roll grooved coupling gaskets: type EPDM.
- 2.3            FITTINGS
- .1            Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2            Pipe flanges and flanged fittings:
- .1            Cast iron: to ASME B16.1, Class 125.
- .2            Steel: to ASME B16.5
- .3            Butt-welding fittings: steel, to ASME B16.9
- .4            Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.
- .5            Fittings for roll grooved piping: malleable iron to ASTM A47/A47M or ductile iron to ASTM A536.
- 2.4            VALVES
- .1            Connections:
- .1            NPS 2 and smaller: screwed ends.
- .2            NPS 2-1/2 and larger: flanged or grooved ends.
- .2            Gate valves: to MSS-SP-70 or MSS-SP-80, application: isolating equipment, control valves, pipelines:
- .1            NPS 2 and under:
- .1            Mechanical Rooms: Class 125, non-rising stem, split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .2            Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

- .2 NPS 2-1/2 and over:
  - .1 Mechanical Rooms: non-rising stem, split wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
  - .2 Elsewhere: non-rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .3 Butterfly valves: to MSS-SP-67, application: isolating cells or section of multiple component equipment:
  - .1 NPS 2-1/2 and over: lug type or grooved ends: as specified Section 23 05 17 - Pipe Welding.
- .4 Globe valves: to MSS-SP80/85, application: throttling, flow control, emergency bypass:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2-1/2 and over:
    - .1 With composition lead free bronze disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .5 Balancing, for TAB:
  - .1 Sizes: calibrated balancing valves, as specified this section.
  - .2 NPS 2 and under:
    - .1 Mechanical Rooms: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
- .6 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .7 Swing check valves: to MSS-SP-71.
  - .1 NPS 2 and under:
    - .1 Class 125, swing, with [composition] disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2-1/2 and over:
    - .1 Flanged and grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.
- .8 Silent check valves:
  - .1 NPS 2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2-1/2 and over:
    - .1 Flanged and grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron.

- .9 Ball valves:
  - .1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.
- .10 Lubricated Plug Valves
  - .1 NPS 2-1/2 and over:
    - .1 As specified Section 23 05 23.02 - Valves - Cast Iron.
- 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 HVAC fan installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 PIPING INSTALLATION
  - .1 Install pipework in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.
- 3.3 CIRCUIT BALANCING VALVES
  - .1 Install flow measuring stations and flow balancing valves as indicated.
  - .2 Remove handwheel after installation and when TAB is complete.
  - .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.
- 3.4 CLEANING, FLUSHING AND START-UP
  - .1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.
- 3.5 TESTING
  - .1 Test system in accordance with Section 23 05 00 - Common Work Results for HVAC.
- 3.6 BALANCING
  - .1 Balance water systems to within plus or minus 5 % of design output.
  - .2 In accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.
- 3.7 GLYCOL CHARGING
  - .1 Include mixing tank and positive displacement pump for glycol charging.
  - .2 Retest for concentration to ASTM E202 after cleaning
- 3.8 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 13 - Performance Verification HVAC Systems.

3.9 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by hydronic systems installation.

END OF SECTION

- Part 1            General
  - 1.1            ACTION AND INFORMATIONAL SUBMITTALS
    - .1            Product Data:
      - .1            Submit manufacturer's instructions, printed product literature and data sheets for expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish and limitations.
      - .2            Shop Drawings:
        - .1            Submit drawings stamped and signed by the contractor including initials, date and status.
  - 1.2            CLOSEOUT SUBMITTALS
    - .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
    - .2            Operation and Maintenance Data: submit operation and maintenance data for hydronic specialties for incorporation into manual.
    - .3            Submit 2 copies of operation and maintenance manual.
  - 1.3            DELIVERY, STORAGE AND HANDLING
    - .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .2            Storage and Handling Requirements:
      - .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .2            Store and protect hydronic specialties from nicks, scratches, and blemishes.
      - .3            Replace defective or damaged materials with new.
    - .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
  - 2.1            CLOSED EXPANSION TANK
    - .1            Provide as indicated in Expansion Tank Schedule.
  - 2.2            DIAPHRAGM TYPE EXPANSION TANK
    - .1            Provide as indicated in Expansion Tank Schedule.
  - 2.3            AUTOMATIC AIR VENT
    - .1            Standard float vent: brass body and NPS 1/8 connection and rated at 310 kPa working pressure.



- .2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.
- 2.4 AIR SEPARATOR - IN-LINE
  - .1 Provide as indicated in Air Separator Schedule.
- 2.5 PIPE LINE STRAINER
  - .1 NPS 1/2 to 2: bronze body to ASTM B62, screwed connections, Y pattern.
  - .2 NPS 2 1/2 to 12: cast steel body to ASTM A278/A278M, Class 30, cast iron body to ASTM A278/A278M, Class 30, flanged connections.
  - .3 NPS 2 to 12: T type with ductile iron body to ASTM A536, malleable iron body to ASTM A47M, grooved ends.
  - .4 Blowdown connection: NPS 1.
  - .5 Screen: stainless steel with 1.19 mm perforations.
  - .6 Working pressure: 860 kPa.
- 2.6 SUCTION DIFFUSER
  - .1 Body: cast iron with flanged connections.
  - .2 Strainer: with built-in, disposable 1.19 mm mesh, low pressure drop screen and NPS 1 blowdown connection.
  - .3 Permanent magnet particle trap.
  - .4 Full length straightening vanes.
  - .5 Pressure Grey tappings.
  - .6 Adjustable support leg.
- Part 3 Execution
  - 3.1 EXAMINATION
    - .3 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic specialties installation in accordance with manufacturer's written instructions.
      - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
      - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
  - 3.2 APPLICATION
    - .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.
  - 3.3 GENERAL

- .1 Run drain lines and blow off connections] to terminate above nearest drain.
  - .2 Maintain adequate clearance to permit service and maintenance.
  - .3 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.
  - .4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.
- 3.4 STRAINERS
- .1 Install in horizontal or down flow lines.
  - .2 Ensure clearance for removal of basket.
  - .3 Install ahead of each pump.
  - .4 Install ahead of each automatic control valve larger than NPS 1, radiation and as indicated.
- 3.5 AIR VENTS
- .1 Install at high points of systems.
  - .2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.
- 3.6 EXPANSION TANKS
- .1 Adjust expansion tank pressure as indicated to suit design criteria.
  - .2 Install lockshield type valve at inlet to tank.
- 3.7 PRESSURE SAFETY RELIEF VALVES
- .1 Run discharge pipe to terminate above nearest drain.
- 3.8 SUCTION DIFFUSERS
- .1 Install on inlet to pumps having suction size greater than [50] [75].
- 3.9 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for pump, circulator, and equipment and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.
- .1
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Operation and Maintenance Data: submit operation and maintenance data for hydronic pumps for incorporation into manual.
- .3            Submit 2 copies of operation and maintenance manual.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect hydronic specialties from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            EQUIPMENT
- .1            Size and select components to: CAN/CSA-B214.

- 2.2 IN-LINE CIRCULATORS
  - .1 Provide as indicated in Pump Schedule.
- 2.3 VERTICAL IN-LINE CIRCULATORS
  - .1 Provide as indicated in Pump Schedule.
- 2.4 SINGLE SUCTION CENTRIFUGAL PUMP
  - .1 Provide as indicated in Pump Schedule.
- 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 hydronic specialties installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 APPLICATION
  - .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- 3.3 INSTALLATION
  - .1 Install hydronic pumps to: CAN/CSA-B214.
  - .2 In line circulators: install as indicated by flow arrows.
    - .1 Support at inlet and outlet flanges or unions.
    - .2 Install with bearing lubrication points accessible.
  - .3 Base mounted type: supply templates for anchor bolt placement.
    - .1 Include anchor bolts with sleeves. Place level, shim unit and grout.
    - .2 Align coupling in accordance with manufacturer's recommended tolerance.
    - .3 Check oil level and lubricate. After run-in, tighten glands.
  - .4 Ensure that pump body does not support piping or equipment.
    - .1 Provide stanchions or hangers for this purpose.
    - .2 Refer to manufacturer's installation instructions for details.
  - .5 Pipe drain tapping to floor drain.
  - .6 Install volute venting pet cock in accessible location.
  - .7 Check rotation prior to start-up.
  - .8 Install pressure gauge test cocks.

- 3.4 START-UP
  - .1 General:
    - .1 In accordance with manufacturer's recommendations.
  - .2 Procedures:
    - .1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.
    - .2 After starting pump, check for proper, safe operation.
    - .3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
    - .4 Check base for free-floating, no obstructions under base.
    - .5 Run-in pumps for 12 continuous hours minimum.
    - .6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
    - .7 Eliminate air from scroll casing.
    - .8 Adjust water flow rate through water-cooled bearings.
    - .9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.
    - .10 Adjust alignment of piping and conduit to ensure true flexibility.
    - .11 Eliminate cavitation, flashing and air entrainment.
    - .12 Adjust pump shaft seals, stuffing boxes, glands.
    - .13 Measure pressure drop across strainer when clean and with flow rates as finally set.
    - .14 Replace seals if pump used to degrease system or if pump used for temporary heat.
    - .15 Verify lubricating oil levels.
- 3.5 PERFORMANCE VERIFICATION (PV)
  - .1 Verify that manufacturer's performance curves are accurate.
  - .2 Ensure valves on pump suction and discharge provide tight shut-off.
  - .3 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.
- 3.6 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .1 Shop Drawings:
  - .1 Submit drawings stamped and signed by the contractor including initials, date and status.
- .3 Test and Evaluation Reports:
  - .1 Certification of Ratings:
    - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
  - .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	[C]
250	[C]
125	[C]
125	[Unsealed]

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.
  - .3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.
  - .4 Unsealed seams and joints.
  
- 2.2 SEALANT
  - .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.
  
- 2.3 TAPE
  - .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
  
- 2.4 DUCT LEAKAGE
  - .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.
  
- 2.5 FITTINGS
  - .1 Fabrication: to SMACNA.
  - .2 Radiused elbows:
    - .1 Rectangular: standard radius: 1.5 times width of duct.
    - .2 Round: smooth radius, five-piece, centerline radius: 1.5 times diameter.
  - .3 Mitered elbows, rectangular:
    - .1 To 407 mm: with single thickness turning vanes.
    - .2 Over 407 mm: with double thickness turning vanes.
  - .4 Branches:
    - .1 Rectangular main and branch: with [radius on branch 1.5 times width of duct, 45 degrees entry on branch.
    - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
    - .3 Provide volume control damper in branch duct near connection to main duct.
    - .4 Main duct branches: with splitter damper.
  - .5 Transitions:
    - .1 Diverging: 20 degrees maximum included angle.
    - .2 Converging: 30 degrees maximum included angle.
  - .6 Offsets:
    - .1 Full-radiused elbows.
  - .7 Obstruction deflectors: maintain full cross-sectional area.

- .1 Maximum included angles: as for transitions.
- 2.6 FIRE STOPPING
  - .1 Retaining angles around duct, on both sides of fire separation in accordance with NFPA and the authorities having jurisdiction.
  - .2 Coordinate to ensure fire stopping materials and installation does not distort duct.
- 2.7 GALVANIZED STEEL
  - .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
  - .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
  - .3 Joints: to ASHRAE and SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.
- 2.8 STAINLESS STEEL
  - .1 To ASTM A480/A480M, Type 304.
  - .2 Finish: number 4.
  - .3 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
  - .4 Joints: to ASHRAE and SMACNA.
- 2.9 ALUMINUM
  - .1 To ASHRAE and SMACNA. Aluminum type: 3003-H-14.
  - .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
  - .3 Joints: to ASHRAE and SMACNA.
- 2.10 BLACK STEEL
  - .1 To ASTM A635/A635M.
  - .2 Thickness: 1.2 mm or as indicated.
  - .3 Fabrication: ducts and fittings to ASHRAE and SMACNA.
  - .4 Reinforcement: as indicated.
  - .5 Joints: continuous weld.
- 2.11 KITCHEN EXHAUST SYSTEMS
  - .1 Construct in accordance with NFPA 96.
  - .2 Material: stainless steel.
  - .3 Thickness: to ASHRAE and SMACNA
  - .4 Fabrication: to ASHRAE and SMACNA
  - .5 Reinforcement: to ASHRAE and SMACNA
  - .6 Grease filters: to Section 23 38 13 - Commercial Kitchen Hoods.



2.12 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: black galvanized steel angle with black galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp with steel plate washer.

.3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fan installation in accordance with manufacturer's written instructions.

.1 Inform Engineer of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 GENERAL

.1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, SMACNA as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct] [Ensure diffuser is fully seated.

.3 Support risers in accordance with ASHRAE, SMACNA as indicated.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

### 3.3 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE and SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

### 3.4 WATERTIGHT DUCT

- .1 Provide watertight duct for:
  - .1 Dishwasher exhaust.
  - .2 Fresh air intake.
  - .3 Minimum 3000 mm from duct mounted humidifier in all directions.
  - .4 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams.
  - .1 Solder or weld joints of bottom and side sheets.
  - .2 Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards hoods served.
  - .1 Slope header ducts down toward risers.
- .4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and discharging to open funnel drain or as indicated.

### 3.5 KITCHEN EXHAUST SYSTEMS

- .1 Install to NFPA 96 and as indicated.

### 3.6 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

### 3.7 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
  - 1.1            ACTION AND INFORMATIONAL SUBMITTALS
    - .1            Provide submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.
    - .1            Product Data:
      - .1            Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
    - .2            Shop Drawings:
      - .1            Submit drawings stamped and signed by the contractor including initials, date and status.
    - .2            Test and Evaluation Reports:
      - .1            Certification of Ratings:
        - .1            Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
  - 1.2            DELIVERY, STORAGE AND HANDLING
    - .1            Deliver, store and handle materials in accordance with manufacturer's written instructions.
    - .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .3            Storage and Handling Requirements:
      - .1            Store materials off ground, indoors and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .1            Store and protect metal ducts from nicks, scratches, and blemishes.
      - .2            Replace defective or damaged materials with new.
    - .4            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
  - 2.1            DUCTWORK
    - .1            Material:
      - .1            Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
      - .2            Thickness: to SMACNA.
    - .2            Construction: round.
      - .1            Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.

- .2 Transverse joints up to [900] mm: slip type with tape and sealants.
- .3 Transverse joints over [900] mm: Vanstone.
- .4 Fittings:
  - .1 Elbows: [smooth radius] [[5] piece (for 90 degrees)] [[3] piece (for 45 degrees)]. Centreline radius: [1.5] x diameter.
  - .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.
- .3 Construction: rectangular:
  - .1 Ducts: to SMACNA
  - .2 Transverse joints: proprietary duct joints to SMACNA seal Class A and B.
  - .3 Fittings:
    - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.
    - .2 Branches: with conical branch at 45 degrees and 45 degrees elbow.
- .4 Fire stopping:
  - .1 Retaining angles around duct, on both sides of fire separation in accordance with Section.
  - .2 Ensure fire stopping materials and installation does not distort duct.

2.2 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
2500	[A]
1500	[A]
1000	[A]
750	[B]

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets, sealant, tape or combination thereof.

2.3 SEALANT

- .1 Sustainability Characteristics:
  - .1 Adhesives and sealants: VOC limit 30 g/L maximum to SCAQMD Rule 1168 GS-36.
- .2 Oil resistant, water-borne polymer type flame resistant high velocity duct sealing compound.
  - .1 Temperature range of minus 30 degrees C to plus 93 degrees C.

2.4 TAPE

- .1 Tape: polyvinyl treated, open weave fibre glass, 50 mm wide.

2.5 HANGERS AND SUPPORTS

- .1 Hangers and supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.
  - .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.
  - .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to ASHRAE and SMACNA.
  - .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA. Refer to the following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamp or steel plate washer.
  - .3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.
  - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 GENERAL

- .1 Do work in accordance with ASHRAE and SMACNA as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate band hangers 100 mm beyond insulated duct.
  - .2 Ensure diffuser is fully seated.
- .3 Support risers in accordance with ASHRAE and SMACNA as indicated.
- .4 Install breakaway joints in ductwork on sides of fire separation.

3.3 HANGERS

- .1 Band hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.

- .3 Hanger spacing: in accordance with ASHRAE and SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.  
.2 Bed tape in sealant and recoat with minimum of [one] coat of sealant to manufacturer's recommendations.

3.5 LEAKAGE TESTS

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.  
.2 In accordance with SMACNA and HVAC Duct Leakage Test Manual.  
.3 Perform leakage tests in sections.  
.4 Perform trial leakage tests, as instructed to demonstrate quality of work.  
.5 Do not install additional ductwork until trial tests have been achieved.  
.6 Test section minimum of 30 m long with not less than 3 branch takeoffs and two 90 degrees elbows.  
.7 Complete tests before performing insulation or concealment Work.

3.6 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.  
.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.].  
.3 Waste Management: separate waste materials for reuse and recycling.  
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .2            Indicate:
- .1            Flexible connections.
- .2            Duct access doors.
- .3            Turning vanes.
- .4            Instrument test ports.
- 1.2            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            GENERAL
- .1            Manufacture in accordance with SMACNA – HVAC Duct Construction Standards.
- 2.2            FLEXIBLE CONNECTIONS
- .1            Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2            Material:
- .1            Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m<sup>2</sup>.
- 2.3            ACCESS DOORS IN DUCTS
- .1            Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.



- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
  - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
  - .2 301 to 450 mm: four sash locks complete with safety chain.
  - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
  - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
  - .5 Hold open devices.
- 2.4 TURNING VANES
  - .1 Factory or shop fabricated, single thickness with trailing edge, to recommendations of SMACNA and as indicated
- 2.5 INSTRUMENT TEST
  - .1 1.6 mm thick steel zinc plated after manufacture.
  - .2 Cam lock handles with neoprene expansion plug and handle chain.
  - .3 28 mm minimum inside diameter. Length to suit insulation thickness.
  - .4 Neoprene mounting gasket.
- 2.6 SPIN-IN COLLARS
  - .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
  - .2 Sheet metal thickness to co-responding round duct standards.
- Part 3 Execution
- 3.1 EXAMINATION
  - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic specialties installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 INSTALLATION
  - .1 Flexible Connections:
    - .1 Install in following locations:
      - .1 Inlets and outlets to supply air units and fans.
      - .2 Inlets and outlets of exhaust and return air fans.

- .3 As indicated.
  - .2 Length of connection: 100 mm.
  - .3 Minimum distance between metal parts when system in operation: 75 mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on sides of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
  - .2 Access Doors and Viewing Panels:
    - .1 Size:
      - .1 Provide in accordance with best practices.
    - .2 Locations:
      - .1 Fire and smoke dampers.
      - .2 Control dampers.
      - .3 Devices requiring maintenance.
      - .4 Required by code.
      - .5 Reheat coils.
      - .6 Elsewhere as indicated.
  - .3 Instrument Test Ports:
    - .1 General:
      - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions
    - .2 Locate to permit easy manipulation of instruments.
    - .3 Install insulation port extensions as required.
    - .4 Locations:
      - .1 For traverse readings:
      - .2 For temperature readings:
  - .4 Turning Vanes:
    - .1 Install in accordance with recommendations of SMACNA and as indicated
- 3.3 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for dampers and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            GENERAL
- .1            Manufacture to SMACNA standards
- 2.2            SPLITTER DAMPERS
- .1            Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2            Single thickness construction.
- .3            Control rod with locking device and position indicator.
- .4            Rod configuration to prevent end from entering duct.
- .5            Pivot: piano hinge.
- .6            Folded leading edge.

2.3 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

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 damper installation in accordance with manufacturer's written instructions.
  - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.

3.3 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for fire and smoke dampers and include product characteristics, performance criteria, physical size, finish and limitations.
- .2            Indicate the following:
- .1            Fire dampers.
- .2            Smoke dampers.
- .3            Firestop flaps.
- .4            Operators.
- .5            Fusible links.
- .6            Design details of break-away joints.
- .3            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Operation and Maintenance Data: submit operation and maintenance data for fire and smoke dampers for incorporation into manual.
- 1.3            MAINTENANCE MATERIAL SUBMITTALS
- .1            Extra Materials:
- .1            Submit maintenance materials in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Provide:
- .1            6 fusible links of each type.
- 1.4            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.

- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.

Part 2 Products

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type A listed and bear label of ULC, meet requirements of the Ontario Building Code, NFPA 90A, and the authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
  - .1 Fire dampers: provide in accordance with fire ratings as listed on architectural drawings.
  - .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
- .3 Top hinged: offset single damper, round or square; interlocking guillotine type, sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA, and install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 SMOKE DAMPERS

- .1 Smoke Dampers: to be ULC or UL listed and labelled
- .2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, and/or from remote alarm signalling device actuated by an electro thermal link as indicated. Two flexible stainless steel blade edge seals to provide required constant sealing pressure.

- .3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel to provide required constant sealing pressure. Provide stainless steel negator springs with locking devices to ensure positive closure for units mounted horizontally in vertical ducts.
  - .4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled
  - .5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74 degrees C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled
- 2.3 COMBINATION FIRE AND SMOKE DAMPERS
- .1 Damper: similar to smoke dampers specified above.
  - .2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.
- 2.4 FIRE STOP FLAPS
- .1 Fire smoke flaps: ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.2
  - .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges
  - .3 Flaps held open with fusible link conforming to ULC-S505 and close at 74 degrees C or as indicated.
- Part 3 Execution
- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire damper installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 INSTALLATION
- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing
  - .2 Maintain integrity of fire separation.
  - .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
  - .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
  - .5 Coordinate installation of fire stopping with general contractor.



.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for flexible ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .2            Indicate:
- .1            Thermal properties.
- .2            Friction loss.
- .3            Acoustical loss.
- .4            Leakage.
- .5            Fire rating.
- .3            Test and Evaluation Reports:
- .1            Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- 1.2            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            GENERAL
- .1            Factory fabricated to CAN/ULC-S110.
- .2            Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3            Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.
- 2.2            METALLIC - UNINSULATED

- .1 Type 1: spiral wound flexible aluminum, equal to Flexmaster Triple Lock aluminum ductwork.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.
- 2.3 METALLIC - INSULATED
  - .1 Type 2: spiral wound flexible aluminum with factory applied, 37 mm thick flexible glass fibre thermal insulation with vapour barrier.
  - .2 Performance:
    - .1 Factory tested to 2.5 kPa without leakage.
    - .2 Maximum relative pressure drop coefficient: 3.
    - .3 Thermal loss/gain: Refer to Section 23 07 13 – Duct Insulation.
- 2.4 NON-METALLIC - UNINSULATED
  - .1 Type 3: non-collapsible, coated [mineral base fabric] [aluminum foil mylar] type, mechanically bonded to, and helically supported by, external [steel] wire, as indicated.
  - .2 Performance:
    - .1 Factory tested to 2.5 kPa without leakage.
    - .2 Maximum relative pressure drop coefficient: 3.
- 2.5 NON-METALLIC - INSULATED
  - .1 Type 4: non-collapsible, coated [mineral base fabric] [aluminum foil/mylar] type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible mineral fibre thermal insulation with vapour barrier.
  - .2 Performance:
    - .1 Factory tested to 2.5 kPa without leakage.
    - .2 Maximum relative pressure drop coefficient: 3.
    - .3 Thermal loss/gain: Refer to Section 23 07 13 – Duct Insulation.
- 2.6 METALLIC ACOUSTIC INSULATED - MEDIUM PRESSURE
  - .1 Type 5: spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible mineral fibre thermal insulation and sleeved by aluminum foil/mylar laminate and Type M vapour barrier, as indicated.
  - .2 Performance:
    - .1 Factory tested to 2.5 kPa without leakage.
    - .2 Maximum relative pressure drop coefficient: 3.
    - .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000

100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.7 METALLIC - ACOUSTIC INSULATED - HIGH PRESSURE

.1 Type 6: spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible mineral fibre thermal insulation and encased in spiral wound flexible aluminum jacket.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Acoustical performance: minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.8 NON-METALLIC - ACOUSTIC INSULATED

.1 Type 7: non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to steel wire with factory applied flexible mineral fibre acoustic insulation and encased in aluminum foil/mylar laminate and Type M vapour barrier.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for flexible ducts installation in accordance with manufacturer's written instructions.

- .1 Inform Engineer of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 DUCT INSTALLATION

- .1 Install in accordance with: CAN/ULC-S110, UL 181, NFPA 90A, NFPA 90B and SMACNA.

3.3 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for [duct liners] and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC .
- .2            Operation and Maintenance Data: submit operation and maintenance data for duct liners for incorporation into manual.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            DUCT LINER
- .1            General:
- .1            Mineral Fibre duct liner: air surface coated mat facing.
- .2            Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102, NFPA 90A, and NFPA 90B.
- .3            Fungi resistance: to ASTM C1338 and ASTM G21.
- .2            Rigid:
- .1            Use on flat surfaces, or where indicated.
- .2            25 mm thick, to ASTM C107, Type 2, fibrous glass rigid board duct liner.
- .3            Density: 48 kg/m<sup>3</sup>minimum.
- .4            Thermal resistance to be minimum:

- .1 0.76 (m<sup>2</sup>.degrees C)/W for 25 mm thickness
  - .2 1.15 (m<sup>2</sup>.degrees C)/W for 38 mm thickness
  - .3 1.53 (m<sup>2</sup>.degrees C)/W for 50 mm thickness
  - .4 For all options above: when tested in accordance with ASTM C177, at 24 degrees C mean temperature
  - .5 Maximum velocity on faced air side: 20.3] m/s.
  - .6 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C423.
- .3 Flexible:
- .1 Use on round or oval surfaces, unless otherwise noted.
  - .2 25 mm thick, to ASTM C1071 Type 1, fibrous glass blanket duct liner.
  - .3 Density: 24 kg/m<sup>3</sup> minimum.
  - .4 Thermal resistance to be minimum:
    - .1 0.37 (m<sup>2</sup>.degrees C)/W for 12 mm thickness
    - .2 0.74 (m<sup>2</sup>.degrees C)/W for 25 mm thickness
    - .3 1.11 (m<sup>2</sup>.degrees C)/W for 38 mm thickness
    - .4 1.41 (m<sup>2</sup>.degrees C)/W to 50 mm thickness
    - .5 For all options above: when tested in accordance with ASTM C177, at 24 degrees C mean temperature
  - .5 Maximum velocity on coated air side: 25.4 m/s.
  - .6 Minimum NRC of 0.65 at 25 mm thickness based on Type A mounting to ASTM C423.
- 2.2 ADHESIVE
- .1 Adhesive: to NFPA 90A, NFPA 90B and ASTM C916.
  - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.
  - .3 Water-based fire-retardant type.
- 2.3 FASTENERS
- .1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.
- 2.4 JOINT TAPE
- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.
- 2.5 SEALER
- .1 Meet requirements of NFPA 90A and NFPA 90B.
  - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

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 duct liner installation in accordance with manufacturer's written instructions.
  - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 GENERAL

- .1 Do work in accordance with SMACNA HVAC Duct Construction Standard, except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

3.3 DUCT LINER

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 90% coverage of adhesive ASTM C916.
    - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
    - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres, impact driven mechanical fasteners to compress duct liner sufficiently to hold it firmly in place.
      - .1 Spacing of mechanical fasteners in accordance with SMACNA HVAC Duct Construction Standard.
  - .2 In systems, where air velocities exceed 20.3 m/s, install galvanized sheet metal nosing to leading edges of duct liner.

3.4 JOINTS

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply 2 coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of the Engineer.
- .3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

3.5 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.



- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .1            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.
- .2            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Provide:
- .1            Fan performance curves showing point of operation, bhp/kW, and efficiency.
- .2            Sound rating data at point of operation.
- .3            Provide:
- .1            Motors, sheaves, bearings, shaft details.
- .2            Minimum performance achievable.
- 1.2            MAINTENANCE MATERIAL SUBMITTALS
- .1            Extra Materials:
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            SYSTEM DESCRIPTION
- .1            Performance Requirements:

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
- .2 Capacity: flow rate, static pressure, bhp/W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
- .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

## 2.2 FANS GENERAL

- .1 Motors:
  - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
  - .2 For use with variable speed controllers.
  - .3 Sizes as indicated.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment, inlet and outlet dampers and vanes and as indicated.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

## 2.3 CENTRIFUGAL FANS

- .1 Fan wheels:
  - .1 Welded aluminum construction.
  - .2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.
  - .3 Backward inclined] blades, as indicated.
- .2 Bearings: regreaseable bearings in a cast iron pillow block housing, rated at 200,000 hours average life.
- .3 Housings:
  - .1 All aluminum.

- 2.4 CABINET FANS - GENERAL PURPOSE
  - .1 Fan characteristics and construction: as centrifugal fans.
  - .2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, direct drive with variable speed controls where indicated.
  - .3 Fabricate casing of corrosion resistant galvanized steel fan housing.
- 2.5 UTILITY SETS
  - .1 Characteristics and construction: for centrifugal fans.
  - .2 Preassemble single width centrifugal fan with removable protective hood with vents, back draft dampers and 12 mm mesh birdscreens.
  - .3 Provide belt driven sets with adjustable motor bed plate [and variable pitch driver sheave].
- 2.6 AXIAL FLOW FANS (TUBE-AXIAL OR VANE-AXIAL)
  - .1 Casings: welded steel with welded motor support, hinged access plates, streamlined inlet cone and discharge bell sections and integral silencer casing.
  - .2 Blade material: steel. Hub material: steel.
  - .3 Supports:
    - .1 Floor mounted units: reinforced legs.
    - .2 Ceiling suspended units: support brackets welded to side of casing. Extend grease lubrication facilities to outside of casing.
  - .4 Bearings: ball or roller with extension tubes to outside of casing.
  - .5 Direct drive:
    - .1 Fixed blade wheels: totally-enclosed, air over motors.
    - .2 Diameter of wheel hub: at least equal to that of motor frame.
  - .6 Belt drive:
    - .1 Drive fixed blades by externally mounted motors through V-belt drive. Provide internal belt fairing, external belt guards and adjustable motor mounts.
    - .2 Adjust blades for varying range of volume and pressure. Hubs to facilitate indexing of blade angle. Provide manual adjustment stops to avoid overloading motor.
- 2.7 IN-LINE CENTRIFUGAL FANS
  - .1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct drive.
  - .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.
- 2.8 PROPELLER FANS

- .1 Fabricate multibladed propellers of steel or aluminum of airfoil shape within bell mouth entrance on integral mounts, with grease lubricated ball bearings, with extended lubrication fittings, suited for operating in any position, direct or belt driven, complete with motor as indicated.
  - .2 Provide blade guards, bird screen and back draft dampers on discharge.
- 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 HVAC fan installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 FAN INSTALLATION
- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
  - .2 Provide sheaves and belts required for final air balance.
  - .3 Bearings and extension tubes to be easily accessible.
  - .4 Access doors and access panels to be easily accessible.
- 3.3 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for roof and wall exhausters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Include:
- .1            Fan performance curves showing specified point of operation, bhp/kW, and efficiency.
- .2            Sound rating data at point of operation.
- 1.2            MAINTENANCE MATERIAL SUBMITTALS
- .1            Extra Materials:
- .1            Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.
- Part 2            Products
- 2.1            SYSTEM DESCRIPTION
- .1            Performance Requirements:
- .1            Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force. Provide confirmation of testing.

- .2 Capacity: flow rate, static pressure, bhp/W, model and size and sound ratings as indicated on schedule.
  - .2 Statically and dynamically balanced. Constructed to ANSI/AMCA Standard 99.
  - .3 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Unit shall bear AMCA certified sound rating seal.
  - .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210, unit to bear AMCA certified rating seal.
  - .5 Bearings: sealed lifetime oilite ball bearings, heavy duty grease lubricated ball or roller bearings of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 200,000 hours.
- 2.2 ROOF EXHAUSTERS
- .1 Make, model no., flow rate, static pressure, bhp/W, size, controls, accessories and sound ratings as indicated on schedule.
- 2.3 WALL EXHAUSTERS
- .1 Make, model no., flow rate, static pressure, bhp/W, size, controls, accessories and sound ratings as indicated on schedule.
- 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 roof and wall exhausters installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 INSTALLATION
- .1 Install in accordance with manufacturer's instructions.
- 3.3 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for heat pumps and include product characteristics, performance criteria, physical size, finish and limitations.
- .1            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Indicate the following:
- .1            Capacity.
- .2            Pressure drop.
- .3            Noise rating.
- .4            Leakage.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2            Operation and Maintenance Data: submit operation and maintenance data for heat pumps for incorporation into manual.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2            Storage and Handling Requirements:
- .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect materials from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
- 2.1            VARIABLE VOLUME BOXES
- .1            Pressure independent, reset to air flow between minimum and maximum air volume.
- .2            Sizes and capacities: as indicated on schedule.



- .3 Differential pressure not to exceed 25 Pa at inlet air velocity of 10 m/s.
- .4 Complete with:
  - .1 Operator and controller.
  - .2 Sound attenuator.
  - .3 Reheat coil: as indicated.
- .5 Minimum 35 kPa reset span.
- .6 Adjustable reset start point.
- .7 Adjustable reset span to maximum 70 kPa when supplied with minimum 140 kPa main control air.
- .8 No control air bleed off through inlet sensor.
- .9 Operator to be factory mounted and calibrated:
  - .1 Gauge taps for balancing with standard pressure gauge.
  - .2 Controller to have adjustable flow settings.
- 2.2 CONSTANT VOLUME BYPASS BOXES
  - .1 Maintains space condition by bypassing supply air to return air.
  - .2 Sizes and capacities: as indicated on schedule.
  - .3 Complete with:
    - .1 Bypass collar.
    - .2 Minimum air volume stop.
    - .3 Controller and operator.
    - .4 Reheat coil as indicated.
    - .5 Manual balancing damper.
- 2.3 FAN POWERED BOXES
  - .1 General:
    - .1 Primary air assembly, pressure independent with reset to any air flow between minimum and maximum air volume as indicated.
    - .2 Sizes and capacities: as indicated on schedule.
    - .3 Field calibration and readjustment of air volume as follows:
      - .1 Gauge tops for balancing with standard pressure gauge.
      - .2 Adjustable flow settings.
    - .4 Complete with:
      - .1 Sound attenuator.
      - .2 Reheat coil as indicated
  - .2 Fan section:
    - .1 CSA certified

- .2 Forward curved, centrifugal, direct drive, internally suspended and isolated from casing on rubber-in-shear isolators complete with access panel.
- .3 Fan controls sealed from primary air flow.
- .4 Electrical characteristics: as indicated.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air terminal units installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Engineer 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 Engineer.

3.2 INSTALLATION

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of ductwork.
- .3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.
- .4 Locate controls, dampers and access panels for easy access.

3.3 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
  - 1.1            ACTION AND INFORMATIONAL SUBMITTALS
    - .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
    - .2            Product Data:
      - .1            Submit manufacturer's instructions, printed product literature and data sheets for diffusers, registers and grilles, and include product characteristics, performance criteria, physical size, finish and limitations.
      - .2            Indicate following:
        - .1            Capacity.
        - .2            Throw and terminal velocity.
        - .3            Noise criteria.
        - .4            Pressure drop.
        - .5            Neck velocity.
  - 1.2            MAINTENANCE MATERIAL SUBMITTALS
    - .1            Extra Materials:
      - .1            Provide maintenance materials in accordance with Section 23 05 00 - Common Work Results for HVAC.
      - .2            Include:
        - .1            Keys for volume control adjustment.
        - .2            Keys for air flow pattern adjustment.
  - 1.3            DELIVERY, STORAGE AND HANDLING
    - .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .2            Storage and Handling Requirements:
      - .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .2            Store and protect materials from nicks, scratches, and blemishes.
      - .3            Replace defective or damaged materials with new.
    - .2            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
  - 2.1            SYSTEM DESCRIPTION
    - .1            Performance Requirements:

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.
- 2.2 GENERAL
  - .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
  - .2 Frames:
    - .1 Full perimeter gaskets.
    - .2 Plaster frames where set into plaster or gypsum board and as specified.
    - .3 Concealed fasteners.
  - .3 Concealed manual volume control damper operators.
  - .4 Colour: confirm with architect/interior designer.
- 2.3 MANUFACTURED UNITS
  - .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.
- 2.4 SUPPLY GRILLES AND REGISTERS
  - .1 General: as indicated on Diffuser Schedule.
- 2.5 RETURN AND EXHAUST GRILLES AND REGISTERS
  - .1 General: as indicated on Diffuser Schedule.
- 2.6 DIFFUSERS
  - .1 General: as indicated on Diffuser Schedule.
- 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 diffuser, register and grille installation in accordance with manufacturer's written instructions.
      - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
      - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
  - 3.2 INSTALLATION
    - .1 Install in accordance with manufacturer's instructions.
    - .2 Install with flat head screws in countersunk holes where fastenings are visible.
  - 3.3 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for outdoor HVAC equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
- .1            Submit drawings stamped and signed by the contractor including initials, date and status.
- .2            Drawings to indicate project layout and dimensions; indicate:
- .1            Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
- .2            Piping, valves, fitting shipped loose showing final location in assembly.
- .3            Control equipment shipped loose, showing final location in assembly.
- .4            Complete internal panel pneumatic tube piping and wiring and external panel pneumatic tube piping and wiring, both as schematics and as actually assembled.
- .5            Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.
- .6            Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.
- .7            Pump and fan performance curves.
- .8            Details of vibration isolation.
- .9            Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.
- .10            Type of refrigerant used.
- .4            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.
- .2            Operation and Maintenance Data: submit operation and maintenance data for outdoor HVAC equipment for incorporation into manual.

- .1 Indicate: brief description of unit, indexed, with details of function, operation, control, and service for components.
  - .2 Provide for units, manufacturer's name, type, year, number of units, and capacity.
- 1.3 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .2 Storage and Handling Requirements:
    - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Store and protect outdoor HVAC equipment from nicks, scratches, and blemishes.
    - .3 Replace defective or damaged materials with new.
  - .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.
- Part 2 Products
- 2.1 GENERAL
- .1 Factory assembled components to form unit supplying air at designed conditions, as indicated.
  - .2 Certify ratings: to ANSI/AHRI 430 with AHRI seal
  - .3 Provide air handling units as specified.
- 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 outdoor HVAC equipment installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 INSTALLATION
- .1 Provide appropriate protection apparatus.
  - .2 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated.
  - .3 Manufacturer to certify installation, supervise start-up and commission unit.
  - .4 Ensure adequate clearance for servicing and maintenance.
- 3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its product, and submit written reports, in acceptable format, to verify compliance of work with Contract.
  - .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 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.
- .2 Obtain reports within [3] days of review and submit immediately to Engineer.
- .3 Performance Verification:
  - .1 General:
    - .1 Supplemented as specified herein.
  - .2 Rooftop Air Handling Units:
    - .1 Set zone mixing dampers for full cooling, except that where diversity factor forms part of design set that percentage of zone dampers to full heating.
    - .2 Set outside air and return air dampers for minimum outside air.
    - .3 Set face and bypass dampers so face dampers are fully open and bypass dampers are fully closed.
    - .4 Check for smooth, vibration less correct rotation of supply fan impeller.
    - .5 Measure supply fan capacity.
    - .6 Adjust impeller speed as necessary and repeat measurement of fan capacity.
    - .7 Measure pressure drop each component of air handling unit.
    - .8 Set outside air and return air dampers for the percentage of outside air required by design and repeat measurements of fan capacity.
    - .9 Reduce differences between fan capacity at minimum and maximum outside air less than 5%.
    - .10 Set face and bypass dampers to full bypass and repeat measurement of fan capacity.
    - .11 Reduce difference between fan capacity with F&BPD fully closed to bypass and fully open to bypass to less than 5%.
    - .12 Reduce difference between fan capacity at full cooling and fan capacity at full heating to less than 5%.
    - .13 OAD: verify for proper stroking, interlock with RAD.
    - .14 Measure DBT, WBT of SA, RA, EA.
    - .15 Measure air cooled condenser discharge DBT.
    - .16 Measure flow rates (minimum and maximum) of SA, RA, EA, relief air.



- .17 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.
- .18 Use smoke test to verify no short-circuiting of EA, relief air to outside air intake or to condenser intake.
- .19 Simulate maximum heating load and:
- .20 Measure radiated and discharge sound power levels under maximum heating demand and under maximum cooling demand with compressors running.
- .21 Verify operating control strategies, including:
- .22 Set zone mixing dampers for full heating and repeat measurements.
- .23 Measure leakage past zone mixing dampers by taking temperature measurements. Reduce leakage to less than 5%.
- .24 Measure return fan capacity.
- .25 Adjust impeller speed as necessary and repeat measurement of return fan capacity.
- .26 Check capacity of heating unit.
- .27 Refer to other sections of these specifications for PV procedures for other components.
- .3 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.
- .4 Verify accessibility, clean ability, drainage of drain pans for coils, humidifiers.

3.4 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Perform cleaning operations in accordance with manufacturer's recommendations.
- .4 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
- 1.1            ACTION AND INFORMATIONAL SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.
- .2            Product Data:
- .1            Submit manufacturer's instructions, printed product literature and data sheets for cabinet convector heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .2            Include:
- .1            Mounting methods.
- .2            kW rating, voltage, phase.
- .3            Cabinet material thicknesses.
- .4            Colour.
- .3            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.2            CLOSEOUT SUBMITTALS
- .1            Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.
- .2            Operation and Maintenance Data: submit operation and maintenance data for cabinet convector heaters for incorporation into manual.
- 1.3            DELIVERY, STORAGE AND HANDLING
- .1            Deliver, store and handle materials in accordance with Section 23 05 00 – Common Work Results for HVAC and with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
- .1            Store materials off ground indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2            Store and protect cabinet convector heaters from nicks, scratches, and blemishes.
- .3            Replace defective or damaged materials with new.
- .4            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.
- Part 2            Products
- 2.1            CABINET CONVECTOR HEATERS
- .1            Provide as indicated on mechanical drawings.
- 2.2            CONTROLS

- .1 Wall mounted thermostats: as indicated on mechanical drawings.
- .2 Built-in thermostat: as indicated on mechanical drawings.

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 cabinet convector heater installation in accordance with manufacturer's written instructions.
  - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 INSTALLATION

- .1 Install cabinet convectors as indicated.
- .2 Locate floor drop-in heaters not closer than 150 mm from wall. For 350 mm units, fit between floor joists. For larger units frame- in as indicated. Flange of heater case must rest on finished floor. Fix rigidly with wood screws.
- .3 Install wall mounted thermostats in locations indicated.
- .4 Make power and control connections.

3.3 CLEANING

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

- Part 1            General
  - 1.1            ACTION AND INFORMATIONAL SUBMITTALS
    - .1            Submit in accordance with Section 23 05 00 - Common Work Results for HVAC.
    - .2            Product Data:
      - .1            Submit manufacturer's instructions, printed product literature and data sheets for finned tube radiation heaters and include product characteristics, performance criteria, physical size, finish and limitations.
    - .3            Shop Drawings:
      - .1            Submit drawings stamped and signed by the contractor including initials, date and status.
    - .4            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - 1.2            CLOSEOUT SUBMITTALS
    - .1            Submit in accordance with 23 05 00 - Common Work Results for HVAC.
    - .2            Operation and Maintenance Data: submit operation and maintenance data for [finned tube radiation heaters] for incorporation into manual.
  - 1.3            DELIVERY, STORAGE AND HANDLING
    - .1            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
    - .2            Storage and Handling Requirements:
      - .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
      - .2            Store and protect materials from nicks, scratches, and blemishes.
      - .3            Replace defective or damaged materials with new.
    - .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials.
- Part 2            Products
  - 2.1            DAMPERS
    - .1            Factory built, internal damper, at enclosure air outlet grille for each convection type heating unit not thermostatically controlled. Refer to schedules on drawings.
  - 2.2            CAPACITY
    - .1            As indicated on mechanical drawings.

- 2.3 BASEBOARD RADIATION
  - .1 Provide as indicated on mechanical drawings.
- 2.4 FINNED TUBE RADIATION
  - .1 Provide as indicated on mechanical drawings.
- 2.5 CABINET CONVECTORS
  - .1 Provide as indicated on mechanical drawings.
- 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 finned tube radiation heater installation in accordance with manufacturer's written instructions.
    - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
    - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.
- 3.2 INSTALLATION
  - .1 Install in accordance with manufacturer's instructions.
  - .2 Install in accordance with piping layout and approved shop drawings.
  - .3 Provide for pipe movement during normal operation.
  - .4 Maintain sufficient clearance to permit performance of service maintenance.
  - .5 Check final location with Engineer if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Engineer's directive.
  - .6 Valves:
    - .1 Install valves with stems upright or horizontal unless approved otherwise.
    - .2 Install isolating gate valves on inlet and lockshield globe balancing valves on outlet of each unit.
  - .7 Venting:
    - .1 Install screwdriver vent on cabinet convector, terminating flush with surface of cabinet.
    - .2 Install automatic air vent on continuous finned tube radiation.
  - .8 Clean finned tubes and comb straight.
  - .9 Install flexible expansion compensators as indicated.
- 3.3 CLEANING
  - .1 Progress Cleaning: leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION



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**SUPPLEMENTARY TENDER FORM**

Project : École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde  
Daycare Addition  
65 Rue Grace, Toronto

Submitted By:

of (address):

Date:

1. Having carefully examined the:

Tender Documents including the Project Description, Terms and Conditions, Instructions to Bidders, Drawings, Schedules and Specifications for the supply and installation of the Electrical System for Daycare Addition to École élémentaire Pierre-Elliott-Trudeau and the Amendments numbered \_\_\_ to \_\_\_ in accordance with the Specifications and Drawings, and having visited and investigated the site and examined all conditions affecting the work, the undersigned offers, if notified in writing of the acceptance of the Tender within sixty (60) days of the time set for the delivery of the Tenders, to furnish all plant, equipment, labour and material and perform all duties and services required, excluding all harmonized services taxes, for the lump sum price of:

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\_\_\_\_\_ dollars (\$\_\_\_\_\_).

Amount of H.S.T. Tax excluded from the  
lump sum Tender Price stated above is \_\_\_\_\_



2. PRICE SCHEDULE AND VALUATION OF CHANGES

- .1 We will submit, for approval, a complete breakdown of labour and material costs for all changes.
  - .2 The man hour labour units for changes are to be based on labour units from column 1 of the NECA Manual of Labour Units.
  - .3 Total mark up including overhead and profit on the **material** shall be limited to 10%.
  - .4 Unit hourly composite cost to be used on all changes for labour, as required. The unit hourly composite cost shall contain all provincial taxes, overhead (ie: supervision, financing, estimating, project management, CADD, as built drawings, administration, parking, mileage, clean up, safety, truck fees, ESA fees, etc.), **profit** and associated costs for the work involved, excluding HST. Unit hourly composite cost to remain in effect throughout the duration of this project.
1. Provide unit hourly composite cost for an electrician/technician to be on site during the times listed below:

Regular Time (7:00 am to 4:00 pm)                    \$ \_\_\_\_\_

Premium Time (Evenings/Weekends)                \$ \_\_\_\_\_

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SECTION TITLE	SECTION NUMBER
General Conditions	26 05 00
Common Work Results - Electrical	26 05 01
Wire and Box Connectors (0-1000V)	26 05 20
Wires and Cables	26 05 21
Grounding	26 05 27
Hangers and Supports for Electrical Systems	26 05 29
Splitter, Junction, Pull Boxes and Cabinets	26 05 31
Outlet Boxes, Conduit Boxes And Fittings	26 05 32
Conduits, Conduit Fastenings and Conduit Fittings	26 05 34
Direct Buried Underground Cable Ducts	26 05 43
Installation of Cables in Trenches and in Ducts	26 05 44
Wiring Devices	26 27 26
Fuses – Low Voltage	26 28 13.01
Disconnect Switches - Fused and Non-Fused	26 28 23
Lighting Equipment	26 50 00
Electrical Identification	26 60 01
Testing and Commissioning of Electrical Systems	26 60 02
Access Control	28 13 00
Fire Alarm System	28.31.00.02
Concrete Encased Ductbanks and Manholes	33 65 73
Panel Schedules	

## SECTION 26 05 00: GENERAL CONDITIONS.

### 1.1 Project Description:

1. The project encompasses the 65 Rue Grace, Toronto facility. In general, the work shall include, without being limited to the following:
  1. Provide new 120/208 Volt utility power service.
  2. Provide communications conduit systems, grounding systems, lighting, lighting control, fire alarm system, paging system and security and CCTV conduit requirements, etc., as shown on the drawings.
2. The electrical contractor shall provide a comprehensive Methods of Procedures (MOP's) two weeks prior to each and every power shutdown. MOP's must include a detailed sequence of operations to be completed during the respective shutdown as well as a back out plan. MOP's must be approved by the client, landlord and the electrical engineer prior to any work taking place.

### 1.2 Sub-Contractors:

1. The Contractor may not assign or sub-contract any work without the prior written consent of the Construction Manager or his designated representative. A list of sub-contractors must be submitted with the tender response.

### 1.3 Substantial Completion Of Contract

1. All the equipment and wire must be cleaned and tested, before acceptance by the consultant.
2. This Contractor shall guarantee all equipment and work furnished under this Division for a period of **two (2) years** or such longer periods as may be provided in the warranty of the manufacturer of individual components, whichever is longer from the date of final acceptance by the Engineer. This contractor shall correct all defects developing as a whole or in part, due to defective workmanship, materials or defective arrangement of the various parts or materials damaged as a result of these defects or repairs. All defects shall be made good to the satisfaction of the Engineer at this Contractor's expense.
3. Replace, at no cost, all incandescent lamps burned out during a thirty (30) day period, all burned-out fluorescent and HID lamps for a period of ninety (90) days and all burned out LEDs based on a 70% lumen maintenance within a 5 year warranty period after date of issuance of certificate of Substantial Performance for the contract of this building.
4. Additional requirements as detailed in Section 26 05 00, paragraph 1.7, sentence 9.

### 1.4 Inquiries

1. All inquiries will be responded to in writing and will be distributed to all bidders. No questions or inquiries will be answered within 48hrs of the closing period of a bid.

### 1.5 Site Meeting

1. The site meeting will be scheduled during the tender period by the project manager.

## 1.6 Examination of Premises And Work

1. Visit and examine the site where the work is to be done. Become familiar with all features and characteristics of the site and/or any existing structure before submitting a bid. No allowances will be made by the Owner for any difficulties encountered by this Contractor due to any peculiarities of the site, surrounding public or private property that existed when the Tender was submitted.
2. This Contractor shall examine the structural, mechanical, architectural and electrical and any other drawings issued to satisfy himself that the work can be satisfactorily carried out. Before commencing work or prefabrication, examine the work of other trades and report at once any defect or interference affecting the work of the electrical trade.
3. Where variances occur between the drawings and the specifications, or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the contract sum. The Engineer will decide on the item and manner in which the work shall be installed.
4. All bidders shall familiarize themselves with and adhere to the owner's building standards and guidelines.

## 1.7 Terms And Conditions

### 1. DEFINITIONS

1. The term Owner shall be understood to refer to Conseil Scolaire Viamonde.
  2. The term consultant shall be understood to refer to Howard Cohen, P. Eng., RCDD/LAN, MBA.
  3. Not used.
  4. The term electrical contractor shall be understood to refer to the successful bidder to this specifications package.
  5. The term Contract shall be understood to refer to all items and conditions of this specification, Drawings, the complete tender package, the Contractor's tender submission and any other future contractual arrangements. All such items and conditions shall be binding unless agreed otherwise by the Contractor, Consultant and Owner.
  6. The term Project shall be understood to refer to the complete supply and installation of the Electrical System and components, as defined in this specification and Drawings.
  7. Wherever the words "equal", "equivalent", "approved", or "approved equal" are used, it shall be understood to mean, "equal", "equivalent", "approved", or "approved equal" in the opinion of the Consultant only.
  8. Wherever the words "install", "provide", or "supply and install", are used it shall be understood to mean "provide and install, inclusive of all labour, materials, installation, testing, and connections" for the item to which referred.
  9. "Concealed" is defined as "out of sight" in "normal" viewing conditions, and includes buried in concrete, above acoustic tile or gypsum board ceilings, within masonry or gypsum board constructed walls, within cable trays of below raised access floors.
2. These specifications or the drawings shall not be used alone. Any item or subject omitted from one, but mentioned or reasonably implied in the other, shall be provided. Misinterpretation of any requirements of either the specification or drawings shall not result in any additional charge after submission of Tender. This Contractor shall, by careful study of the total requirements, include all necessary components to make each system workable. The consultant shall be contacted for written clarification on any point before the submission of Tenders.

3. All terms and conditions of the specifications, tender documents and accompanying Drawings shall be strictly adhered to by the Contractor, unless otherwise noted. Any inability to comply with these requirements must be stated in writing, in detail, with the response submission. Otherwise, it shall be understood that the Contractor is bound to compliance with the stated terms and conditions.
4. The Contractor shall co-operate fully with the Owner, Consultant, landlord and landlord's agent and all contractors, sub-contractors and other persons working on the site.
5. The Contractor shall do the complete installation in accordance with the latest editions of the National Building Code, Ontario Building Code, Canadian Electrical Safety Code, C.S.A., or other Codes or governing authorities of competent jurisdiction. In case of discrepancies with this or the manufacturer's specifications, the Contractor shall notify the Consultant immediately.
6. Obtain and pay for permits and ESA plans approvals (note: Building Permit obtained by owner) and inspections required for work performed. Provide Certificate (s) of Acceptance from the Authorities Inspection Department, upon completion of work.
7. Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details and drawings which these authorities may require.
8. The Contractor must comply with all requirements of the Occupational Health & Safety Act.
9. In order to meet the requirements of substantial completion the electrical contractor must complete the following:
  1. Installation and successful testing of all electrical system devices as per mutually agreed to tests and commissioning plan.
  2. Overall system test demonstrating system operation and coordination of the utility systems.
  3. Commissioning of all systems including access control systems, intrusion systems, CCTV systems and duress systems
  4. Client training for all systems including access control systems, intrusion systems, CCTV systems and duress systems.
  5. Submission of all coordination and permit documentation for the Consultant's review.
  6. Submission of all record and As-built documentation.
  7. Correction of any deficiencies in the electrical system.

#### 1.8 Schedule

1. Include for all necessary overtime required to carry out the project. The successful contractor will not be permitted claims as a consequence of this requirement. Successful Contractor to submit a full construction schedule before starting any work.
2. Sufficient manpower, materials, equipment, appliances and services are to be kept on site at all times to maintain the scheduled completion of work.
3. All work required to be done after office hours and weekends (including x-raying, core drilling and power shutdowns), shall be included in the tender price. Note: All x-raying and core drilling shall be provided by the electrical contractor.
4. Work associated with power shutdowns and with testing and commissioning of electrical systems must be carried out on Sunday mornings from 1am to 4 am. All shutdowns must be approved by Owner and by Landlord.
5. **Contractor must provide a dedicated onsite electrician for 8 hours on the Monday following each cutover.**

### 1.9 Contract Drawings

1. The Drawings for the electrical system work are diagrammatic performance Drawings, intended to convey the scope of work and indicate the approximate sizes and locations of equipment and outlets. The Drawings do not intend to show Designer's Architectural, Mechanical or Structural details.
2. Do not scale or measure Drawings, but obtain information regarding accurate dimensions, from the dimensions shown or by site measurements. Follow the Drawings to lay out the work.
3. Make, at no additional cost, any changes or additions to materials and equipment necessary to accommodate Structural conditions (offsets around beams, columns, etc.).
4. Alter at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation, and do not necessitate additional materials.
5. Change location of termination panels and devices at no extra cost providing cable length increase resulting from relocation does not exceed 3m (10') and information is given before installation.
6. Confirm at the site, the exact location of equipment.
7. Any miscellaneous materials, hardware, devices, wiring, etc., not specifically described, but required for the installation and operation of the electrical system, shall be provided and included as part of the Bid.

### 1.10 Materials And Equipment

1. All materials and equipment shall be completely new and unused products of only the most recent manufacturer model or version number, CSA certified, and manufactured to the Standards specified.
2. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the local Inspection Department.
3. No damaged, chipped or marked equipment or materials will be accepted and must not be installed.

### 1.11 Substitutes

1. All tenders must be based on specified items. Tenders shall show one price for the base bid and an itemized breakdown of all of substitutes showing "credit or cost" for each substitute.
2. Manufacturer's Basis of Design product part numbers and / or product photos have been included as part of this specifications package as the basis for the specification and tenders. and to clearly describe the quality of the product that is required for the work. A specific Manufacturer's name and model number also represents specific physical dimensions and operational requirements required on this project.
3. Substitutes will only be considered when submitted in sufficient time to review the proposal before tender closing. Proposals must be submitted at least two weeks prior to the deadline for Addenda Issues and for light fixtures must include detailed photometric plots for proposed light fixture substitutions. The photometric plots must be of the entire floor plan and must include all partitions and workstations (based on 5' high furniture panels). After reviewing the proposals, the Engineer will preliminarily accept or reject the proposed substitute(s). Addenda will be issued to confirm the preliminary acceptance of proposed substitutions. Preliminary acceptance of substitutes does not constitute approval for the use of those substitutes in the work.

4. It is the Contractor's responsibility to demonstrate in his proposal that the proposed substitutions are compatible with all related work and that the characteristics are equal to, or superior to the original specified items, including, but not limited to:
  - performance;
  - physical characteristics (i.e. dimensions, weights);
  - electrical characteristics (i.e. voltage, number of phases, rated load amperage);
  - availability;
  - noise characteristic (i.e. generated sound power, attenuation).
  - average max to min and average light levels (light fixtures).
  - lighting power density.
  - illuminated surface area.
  - lumen maintenance.
5. This Contractor shall be responsible for any additional costs necessary to accommodate substitutes.
6. All shop drawings submitted for approved substituted equipment shall be marked as such by the Contractor.

#### 1.12 Operation And Maintenance Manuals

1. Provide five (5) hard copy sets of operation and maintenance manuals for equipment and products supplied.
2. Provide three (3) soft copy scanned sets of operation and maintenance manuals for equipment and products supplied. Media shall be USB drive.
3. Include the following information in the Operation and Maintenance manuals:
  - Names and address of local suppliers for the items included.
  - Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature is not acceptable.
  - Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
4. Review information provided in the maintenance instructions and manuals with the Owners' operating personnel to ensure a complete understanding of the electrical equipment and systems and their operation.

#### 1.13 Progress Payments

1. Submit a complete breakdown of the Contract with each progress billing, indicating percentage of work complete, in a form acceptable to the Owner/Consultant.
2. The amount of monies to be allocated for close out documents must be 3% of contract value. This does not include monies allocated for testing, measurement and verification, commissioning, training, etc.

#### 1.14 Shop Drawings

1. Submitted Shop Drawings must indicate details of construction, dimensions, capacities, weights and electrical performance and flame spread characteristics of equipment or materials, as well as specification reference Section number and project name.
2. Shop Drawings shall be provided with sufficient space on the front for all Consultant's and Contractor's "review" stamps.
3. Work affected by submittal shall not proceed until review is complete.
4. Review submittal prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of the work and Contract Documents and bears the Stamp of Communications Contractor.
5. Changes made to the Shop Drawings by the Consultant will not affect the Contract Price.
6. Submit Shop Drawings for all material and equipment referred to in contract document.

#### 1.15 Field Supervision

1. Throughout the duration of the Project, a properly qualified Electrical Field Supervisor must be available at all times. The Supervisor who starts the work must not be changed unless requested by the project manager, or written permission from the project manager is obtained.
2. In addition, provide proper office supervision of the work. The person responsible for office supervision must visit the site as often as necessary, to ensure work is properly performed, and attend weekly site meetings when so requested.

#### 1.16 Site Responsibilities

1. Maintain work areas to be free of construction debris and waste. The disposal of all materials shall be the responsibility of the Contractor.
2. Make all necessary arrangements to transport materials and equipment to and within the site. The Contractor shall be responsible for arranging for the use of any hoists, lifts, pulleys, winches, cranes or service elevators.
3. The Contractor is responsible for complete storage, handling, delivery, and installation of all materials used in the performance of the work.
4. Obtain a copy of the Landlord's leasehold design manual and ensure that all requirements are complied with.

#### 1.17 Deliveries / Access

1. Coordinate all deliveries to site with the Building Manager. Book loading dock and service elevators 72 hours in advance. Contractor must pre-arrange all site access and authorization for all site personnel and subcontractor personnel with the Building Project Manager or his representative

#### 1.18 Testing And Commissioning

1. Provide testing and commissioning as per Testing and Commissioning Plan to be reviewed and approved by the Consultant and Project Manager for all items and their related components.
2. Supply all required equipment maintenance and operations manuals, for owner's staff use.
3. Provide all required software for monitoring, annunciation and control/dispatch applications



#### 1.19 Other

1. The tender documents shall remain the property of the Project Manager. Bidders are required to return the tender documents to the Project Manager with their bids.
2. It is the responsibility of the Contractor to perform all cutting, patching and repair related to the electrical system work.
3. Work by the electrical contractor shall be protected during erection against disfigurement, contamination or damage by mechanical abuse or harmful materials. Protective covers shall be installed where exposure to potential damage is likely. The contractor shall ensure that no eating, drinking or smoking is carried out in the finished areas. Damages resulting from a breach of these requirements shall be repaired at the cost of the electrical contractor.
4. Existing and adjacent finishes, work and structures shall be protected from damage resulting from work of this project.

#### 1.20 Record and As-Built Drawings

1. The Contractor shall maintain two sets of drawings on site. Clearly mark on these drawings all changes and deviations from the contract drawings and in particular mark the actual location of all feeder conduit locations.
2. All deviations from the contract drawings shall be recorded on the "as-built" drawings, including those changes due to Addenda, Site Instructions or Change Orders.
3. After the date of Substantial Performance, obtain from the Consultant, a set of AutoCAD Version 2021 files of the most recent Electrical System Drawings. These Drawings shall be marked up to record clearly, neatly, accurately and promptly all locations of Electrical System deviations as a result of Change Orders, Consultant's or Owner's Instruction, site conditions, etc. Utilize normal recognized CAD procedures that match the original drafting methodology. Submit the revised As-Built AutoCAD CD and Drawings (three sets) with changes clearly indicated to the Consultant for review and final presentation to the Owner.
4. For the disk drawing submission described above, the electrical contractor must include as part of the lump sum price \$750.00 plus HST to have HCC Engineering supply the AutoCAD floor plans denoted as 'Issued for Tender' on disks.

#### 1.21 Drawings

1. For exact details and quantities, refer to the later sections of this document and to drawing E-1.1 through E-1.10 inclusive, E-2.0, E-2.1, E-2.2, E-3.1, E-4.1, E-5.1, E-5.2, E-6.1, E-7.1, E-8.1, E-8.2, E-9.1 and E-9.2 denoted as 'Issued For Tender October 1, 2024.'

#### 1.22 Contract

1. Conform to the conditions stated in the Contract Form, Document CCDC-2.
2. A confidentiality agreement will form an integral part of the contract and will be provided to the successful contractor.

#### 1.23 Cleaning

1. It is the responsibility of the Contractor to dispose of all waste related to this project.
2. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
3. On a daily basis, remove waste materials, rubbish, tools, equipment, machinery, surplus materials and clean all sight exposed surfaces.
4. All materials must be stacked neatly and safely.
5. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.

6. Cleaning operations shall include those areas used for temporary site access or used on a temporary basis to facilitate work.
7. The contractor will remove all garbage from site on a daily basis at his own expense.
8. Failure to provide housekeeping and/or maintain a clean work area to the satisfaction of the project manager will result in the project manager providing the necessary housekeeping and/or maintenance service with all related costs, including mark-ups, being charged to the electrical contractor.

#### 1.24 Demolition

1. Disconnect and remove existing conduit and wiring in partitions to be demolished and existing 'BX' cables, conduit and wire in ceiling where existing outlets, lighting fixtures, devices and mechanical equipment are to be removed.
2. Remove all branch circuit wiring and raceways originating from the existing receptacle panels. Wiring and raceways shall be removed back to the source panel. Circuits utilized to feed existing to remain mechanical equipment and other 120/208 volt sources to remain must be maintained.
3. Remove all existing electrical outlets and light switches as well as the associated wiring and raceways not being reused and/or not required for new layout (note: existing outlets and switches to be removed are not shown on the drawings). Provide blank coverplates at all locations where electrical and/or communications devices were removed in which partitions are not being demolished.

#### 1.25 Digital Photos

1. Provide digital photos of all progress to date on a weekly basis. Each photo submission must be reviewed and approved by the consultant prior to continuing with the installation.

End of Section

## **SECTION 26 05 01: COMMON WORK RESULTS - ELECTRICAL.**

### PART I: GENERAL

#### 1.1 Reference:

1. This section forms part of every section of Division 26.

#### 1.2 Access Doors:

1. Not Required.

#### 1.3 Cleaning:

1. Clean devices and other surfaces that have been exposed to construction dust and dirt. Clean the insides and outsides of panels and other electrical equipment and completely remove all debris and tools from the project.

#### 1.4 Codes and Standards:

1. Complete the installation of the work in accordance with latest editions of the Building Code, Canadian Electrical Safety Code, CSA, ULC, NFPA, OSHA or other codes, as required.
2. Comply with CEC Electrical Bulletins in force at time of Bid submission. While not identified and specified by number in this Division, they are to be considered as forming part of related Standards.
3. Abbreviations for electrical terms are as per CSA Z85.

#### 1.5 Finishes:

1. All shop finished metal equipment and enclosure surfaces, must be prepared by removal of rust and scale from the raw metal, degreasing, cleaning, application of rust resistance primer inside and outside, and at least two coats of finish enamel paint. Use factory standard colours unless otherwise specified. Colour reference numbers are Sico.
2. Paint exterior surfaces of indoor electrical equipment to manufacturer's standard.
3. Clean and touch-up (to Consultant's acceptance) surfaces of shop-finished equipment that is scratched or marred during shipment or installation, so as to match original paint.
4. Leave with the Owner, 0.22 gal. of paint of each colour used, in the form of liquid or spray, to allow for future touch-up of damaged areas.

#### 1.6 Inserts, Hangers and Sleeves:

1. Provide hangers, inserts, sleeves and supports as required.
2. Inserts are to be of lead shield type.
3. Hangers must not be welded to structural steel members and burning of holes in structural steel is prohibited.

4. Sleeves are to be of a type suitable for the application and be sealed and made watertight. Sleeves through concrete shall be sized for free passage of conduit, and installed flush with underside of concrete slab and extend 100mm (4") above finished floor unless otherwise shown.

1.7 Intent:

1. It is the intent of these drawings and specifications that the Contractor provide complete and operational systems as required.
2. Where differences occur, the maximum condition shall govern.
3. Any miscellaneous items, hardware, devices, wiring, etc., not specifically described, but required for the operation of the system, must be provided and included as part of the Bid.

1.8 Mounting Heights:

1. Mounting height of equipment is from finished floor to center line of equipment unless specified or indicated otherwise.
2. If mounting height of equipment is not indicated, verify with Consultant before proceeding with installation.

1.9 Owners Instruction and Trial Usage:

1. Instruct the Owner's operating personnel in the startup, operation, care and maintenance of all the equipment. All equipment to be tested, operational and commissioned before instruction. Provide sheets for signatures of Owner's representative and operating personnel present at each instruction period.
2. Arrange and pay for the service of the manufacturer's factory service Engineer/Technician to supervise the start-up of his equipment installation, and to check, adjust, balance and calibrate components.
3. Provide these services for such period and for as many visits as necessary to ensure that the Owner's operating personnel are conversant with all aspects of its care and operation.
  1. Prior to any instruction sessions, commissioning coordinator shall submit check lists of each system or equipment indicating their operation status for acceptance by the Owner.
  2. Coordinate all instruction sessions to suit Owner's operation personnel schedule. Submit proposed instruction session schedule c/w training agenda three weeks prior to session start date to Owner for review.
5. The Owner's operating personnel must be permitted to operate the systems under the contractor's supervision for a reasonable period of time prior to Substantial Completion of Contract. This use shall not be misconstrued as acceptance of the equipment.

#### 1.10 Plywood Backboard:

1. Supply and install all plywood backboards required for the work of this Division. Plywood to be highest quality fire retardant fir. 1200 mm wide x 2400 mm high (4'-0" wide x 8'-0" high), 19mm (3/4") thick unless otherwise specified. Prime and paint backboards on both sides with fire retardant paint, equal to CGSB spec. #1-GP-151M, of a colour to match the equipment and services mounted thereon as defined in "Finishes" above. Do not paint over fire rated stamps.
2. Plywood backboards are to be provided for mounting the following surface wall mounted equipment:
  - Cabinets.
  - Contactors.
  - Control Panels
  - Disconnect Switches.
  - Junction Boxes 600mm (2') square and larger.
  - Pull Boxes.
  - Panel Boards.
  - Splitters
  - Transient Voltage Surge Suppression Units.
  - External Breakers
3. Where practical, group devices on a common backboard.

#### 1.11 Protection:

1. Protect exposed live equipment during construction for personnel safety.
2. Shield and mark live parts "LIVE 600 VOLTS", or with appropriate voltage in English.

#### 1.12 Sealing:

1. Where cables or conduits pass through non fire-rated floors, walls or roof, provide internal and external sealing thereto.
2. Retain the service of a specialty sealant contractor for the work required.
3. Comply with manufacturer's installation instructions for all sealant applications.
4. For non-fire rated locations, Sealant shall be silicone, that meets requirements of CGSB 19-GP-23, for the size of the joint required, and the types of materials being bonded.
5. For fire rated locations, the fire stop shall meet the requirements of ULC with regards to the type of assembly and the fire separation.
6. Provide architecturally approved air barrier seals and vapor barrier seals to electrical items passing through or terminating within walls, roofs and decks, humidity controlled areas and pressurized areas.
7. Engage the services of a third party architect to provide a sealed report for all fire stopping assemblies provided as part of this scope of work. Sealed report must detail compliance with the Ontario Building Code.

#### 1.13 Sprinkler Proofing:

1. All areas of this building are protected by a wet sprinkler system. All electrical equipment to be configured for installation in such an environment.

1.14 Warning Signs:

1. Provide warning signs, as specified to meet requirements of Ministry of Labour Safety Inspection, Inspection Department, Authorities having jurisdiction and Consultant.
2. Use decal signs, in English minimum as required by Authorities.

1.15 Wire Pulling Lubricant:

1. Lubricant to be non-corrosive and CSA approved for the type of cable used.
2. Lubricants to be soap or wax based, depending upon application. Use soap based for short runs and for semi-conducting insulated wires, and wax based for long runs.

End of Section

## **SECTION 26 05 20: WIRE AND BOX CONNECTORS.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide all wire and box connectors required for a complete electrical system installation.

### PART II - PRODUCTS

#### 2.1 Materials:

1. Pressure type wire connectors are to be manufactured to CSA C22.2 No.65. Clamps and connectors are to be manufactured to CSA C22.2 No. 18.
2. Building Wire Connectors shall be:
  1. For wire sizes up to #6 AWG - Ideal "Wing Nut" or Gardner - Bender "Wing Gard".
  2. For Wire Sizes #4 AWG and larger:
    - End to end splices - Burndy YS.
    - Parallel splices - Burndy YC & YH (CU) or YHO & YHD (CU / AL).
    - At studs and bus bars - Burndy YA (CU) or YA-A (CU / AL).
    - Two or three conductors in parallel - Burndy KA-U type (CU / AL).
3. Cable connectors shall be:
  1. For armored TECK cables, watertight type, with open compounded head - T&B series "Spin-on 2" with corrosion resistant boot.
  2. For armored cables steel type with nylon insulated throat - T&B "TITE-Bite".
  3. Clamps or connectors for armored cable, flexible conduit, non-metallic sheathed cable shall be as required.

### PART III - EXECUTION

#### 3.1 Installation:

1. Remove insulation carefully from ends of conductors and:
  1. Install connectors and tighten as recommended by manufacturer.  
Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
  2. Install bushing stud connectors in accordance with EEMAC 1Y-2.

End of Section

## **SECTION 26 05 21: WIRES AND CABLES.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide building wire as detailed below and as required for a complete electrical installation.

### PART II - PRODUCTS

#### 2.1 Materials

##### 1. Wire in Conduit:

1. Conductor material to be annealed commercial grade, copper, 98 percent conductivity, up to #10 AWG solid, with RW90 insulation, #8 and larger, stranded, with RW90 insulation, unless noted otherwise, 300V rating for fire alarm, security and other low voltage circuits, 600V rating for 120 / 208V circuits, 1000V rating for 240 / 416V circuits, 1000V rating for 277 / 480V circuits, 1000V rating for 347 / 600V circuits.

##### 2. Colour Coding:

###### 1. 120 / 208V, circuits:

- Two conductor, 1 phase: 1 black, 1 white
- Three conductor, 1 phase: 1 red, 1 black, 1 white
- Three conductor, 3 phase: 1 red, 1 black, 1 blue
- Four conductor, 3 phase: 1 red, 1 black, 1 blue, 1 white

###### 2. 347 / 600V, circuits:

- Two conductor, 1 phase: 1 orange, 1 white
- Three conductor, 1 phase: 1 orange, 1 brown, 1 white
- Three conductor, 3 phase: 1 orange, 1 brown, 1 yellow
- Four conductor, 3 phase: 1 orange, 1 brown, 1 yellow, 1 white

###### 3. Ground wires: green.

##### 3. Low voltage Armored Cables Type AC-90:

1. Type to be AC-90, Multi-conductor, with solid, annealed commercial grade 98 percent conductivity tinned copper conductors and cross-linked polyethylene with R90 insulation, 600 volt rating, on #10 and #12 size only.
2. Colour Coding:
  - Two conductor, 1 phase: 1 black, 1 white
  - Three conductor, 1 phase: 1 black, 1 red, 1 white
3. Grounding to be uninsulated, solid copper, with impregnated paper separator.



4. Low voltage Armored Cables - TECK:

1. Type to be TECK, single conductor with annealed. Class B, stranded copper conductors and cross linked polyethylene, RW90 insulation, 1000 volt rating for #8 AWG and larger.
2. Grounding to be uninsulated tinned stranded copper, with non-hygroscopic filter material to maintain circular cross-section.
3. The inner and outer jackets to be PVC "Flamenol" suitable for -40°C, with mylar tape separator and aluminum strip, armour helically wound and interlocked.

PART III - EXECUTION

3.1 Installation:

1. General:

1. Wire shall be installed in conduit and sized for the connected load (s) and protection as required, unless otherwise specified.
2. All single neutrals ran with Phase 'A', 'B', 'C' conductors to be minimum #10 AWG. #12 AWG neutrals may be used when run from final junction box to wiring devices.
3. Minimum power conductor wire size shall be #12 AWG. Use solid conductors for #10 and smaller and stranded conductors for #8 and larger. All wiring shall be copper conductors, RW90 (90°C ampacity).
4. Home runs in excess of 25 m (75') for circuits protected by a 15A over current device, shall be #10 AWG. Refer to drawings for additional requirements.
5. The current carrying capacity of the feeders, subfeeders and branch circuit conductors shall be sized to equal or better than shown on the drawings. If wire or cable sizes with equivalent current carrying capacity other than that specified is used, ensure that the voltage drop shall not be more than 2%.
6. The number of wires indicated for various systems is intended to show the general scheme only. The required number and type of wires shall be installed in accordance with the manufacturer's diagrams and with the requirements of the installation.

2. Wire in Conduit:

1. Provide pigtails at all outlets for wiring devices. All neutrals and branch circuits shall be connected in each outlet box to avoid a break in the neutral or the circuit wire when fixture or wiring device is disconnected.
2. At each junction, pull and outlet box make a 360 degree loop of the stripped uncut ground conductor under the ground screws.

3. Low Voltage Armored Cables - (Feeders):

1. Do not directly bury in or below concrete slabs or walls.
2. Do not encircle single conductor cable with ferrous metal.
3. No splices will be permitted.
4. Single conductors of the three or four wire circuit shall be run with uniform spacing of not less than one cable diameter throughout the feeder length.
5. Use wood throated cable clamps to ensure proper and uniform cable spacing.
6. Where cables are installed on walls, provide mechanical protection over them up to 2.4m (8') above finished floor, using a 12 gauge U section aluminum cover.
7. Cable connections to all enclosures, boxes and panels shall be by means of a watertight malleable aluminum connector.

End of Section

## SECTION 26 05 27: GROUNDING.

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide all grounding to conform with the Canadian Electrical Code and the latest instructions of the Inspection Authority, with any further requirements as noted herein.

### PART II - PRODUCTS

#### 2.1 Materials:

1. All grounding conductors stranded copper, bare or insulated as indicated on Drawings or in Specifications.
2. All ground wires are to be FT-4 rated factory green. Green tape, spray paint or any other means to alter the colour of the conductor is not permitted.
3. Use Cadweld or Burndy Thermoweld process for all weld connections. AMP of Canada Ltd. Wrench-Lok grounding connectors are an acceptable equivalent to welded connections.
4. All ground connectors to be designed and approved for grounding purposes.

### PART III - EXECUTION

#### 3.1 Installation:

1. Ground all conduit, and all non-current carrying metal parts, equipment cases, frames, bases, brackets, etc.
2. Grounding of all trays, AFCRs, racks, cabinets, etc. provided by the electrical contractor.
3. Ground each piece of fixed equipment back to the panel feeding that equipment, by one of the following methods:
  1. Conduit shall **not** be utilized for the ground return conductor.
  2. Where the conduit is flexible, install a separate bare soft drawn copper ground inside the conduit. At the switchboard or distribution panel, provide a grounding bushing, loop the ground conductor through the bushing, and connect to the switchboard ground bus. At the fixed equipment, connect to an internal ground bus, or connect to the inside of the metal enclosure utilizing approved screws and connectors (remove all paint). Run a separate (dedicated) insulated ground wire in all conduits to all devices and fixtures.
  4. Where equipment is fed by a multi-conductor power cable, provide a ground conductor in the cable. At the switchboard or panel, connect to the ground bus. Use a grounding connector on the cable for positive grounding of the metallic sheath. Loop the ground wire to the grounding connector.
  5. Run a separate ground wire in all flexible conduits. Connect each end to ground bus or lug or connector.
  6. Where mechanical protection is required for insulated grounding conductors install in rigid conduit.
  7. Provide weld connection or wrench type grounding connectors for:

All connections between grounding conductors.

All connections to building steel.

All connections between grounding conductors and cable lugs.

8. Arrange grounding to provide the minimum impedance paths for ground fault currents.  
Provide any additional grounding required for approval by the inspecting authorities.

### 3.2 Equipment Grounding

1. Install grounding connections to typical equipment including non-current carrying metal parts of transformers, generators, motors, circuit breakers, cable sheaths, raceways, pipe work, screen guards, switchboards, meter and relay cases, any exposed building metal and building structural steel.

End of Section

## **SECTION 26 05 29: HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide fastenings and supports as required for a complete electrical system installation.

### PART II - PRODUCTS

#### 2.1 Support Channels:

1. U shape pre-galvanized steel, size 41 mm x 41 mm x 22 mm (1-5/8" x 1-5/8" x 7/8"), for surface mounting, suspending, or inserting into poured concrete walls and ceilings as required.
2. All channel fittings to suit channel type.
3. All other fittings to suit equipment weight, location and surface as required.

### PART III - EXECUTION

#### 3.1 Installation:

1. Secure plywood backboards, channels, luminaires, equipment and fittings to wood with wood screws, to solid masonry, tile and plaster surfaces with lead anchors, to poured concrete with self-drilling expandable inserts, and to hollow masonry walls with toggle bolts.
2. All ceiling mounted equipment shall be independently supported from the structure. Do not support equipment from ceiling support system.
3. Support equipment, conduit or cable using clips, spring loaded bolts, or cable clamps designed as accessories to basic channel members.
4. Fasten exposed conduit or cables to building using:
  1. Two-hole steel straps to secure surface conduits and cables 50 mm (2") and smaller.
  2. Two-hole steel straps for conduits and cables larger than 50 mm (2").
  3. Beam clamps to secure conduit to exposed steel work.
5. For suspended support system:
  1. Support individual cable or conduit runs with 6 mm (1/4") diameter threaded rods and spring clips.
  2. Support two or more cables or conduits on channels support by 6 mm (1/4") diameter threaded rod hangers where direct fastening to building construction is impractical.
  3. Support suspended luminaire using two or more lengths of Weldless "Single Jack", bright zinc plated steel chain, Canadian Standard #10 gauge, 13 links per foot.
6. Provide metal brackets, frames, hangers, clamps and related type of support structure where indicated or as required to support conduit and cable runs.
7. Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

8. Do not use wire lashing or perforated strap to support or secure raceways or cables.
9. Do not use supports or equipment installed for other trades for conduit or cable support.
10. Install fastenings and supports as required for each type of equipment, cable and conduits, and in accordance with manufacturer's installation recommendations.
11. Hangers shall be spaced such that there is a hanger within 610mm (24") of every bend and that the maximum spacing does not exceed the limits indicated in OESC code.
12. All conduit or cable shall be supported at equipment mounted on spring isolators, with spring hangers for at least 4572mm (15').

End of Section

## **SECTION 26 05 31: SPLITTERS, JUNCTION, PULL BOXES AND CABINETS.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide splitters, junction boxes, pull boxes and cabinets as shown on the drawings and as required for a complete electrical installation.

### PART II - PRODUCTS

#### 2.1 Splitter Troughs:

1. Splitter trough construction is to be based on CSA C22.2 No. 76.
2. They shall have sheet steel enclosure, with welded corners and formed hinged cover suitable for locking in closed position.
3. Connection bars are to match required size and number of incoming and outgoing conductors as indicated.
4. Provide at least three spare terminals on each set of lugs in splitter troughs less than 400A and feed through lugs where required.
5. Provide double lugs for neutrals where required.
6. Enclosures shall be CSA/EEMAC Type 1 modified to sprinkler proof enclosure.

#### 2.2 Junction and Pull boxes.

1. Junction and pull boxes construction is to be based on CSA C22.2 No. 40.
2. They shall be suitable for surface mounting and be of welded steel construction with screw-on flat covers.
3. For flush-mounted pull and junction boxes, provide covers with 25 mm (1") minimum extension all around.

#### 2.3 General Cabinets:

1. Type D or E to be sheet steel, for surface mounting, complete with screw on cover (D) or hinged door (E), and return flange overlapping sides, handle and catch.

### PART III - EXECUTION

#### 3.1 Splitter Installation:

1. Install splitter troughs where required. Mount plumb, true and square to the building lines.
2. Extend splitters for full length of equipment arrangement except where indicated otherwise.
3. Provide watertight connections for all services entering the top of the splitter trough.

#### 3.2 Junction, Pull Boxes and Cabinet installation:

1. Install junction, pull boxes and cabinets in inconspicuous but accessible locations.
2. Only certain junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m (100') of conduit run between boxes, and after every two (2) 90 degree bends.

#### 3.3 Identification:

1. Install nameplates.

End of Section



## **SECTION 26 05 32: OUTLET BOXES, CONDUIT BOXES AND FITTINGS.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide outlet and conduit boxes and fittings as required for a complete electrical system installation.

### PART II - PRODUCTS

#### 2.1 Outlet and Conduit boxes - General

1. The construction of outlet boxes, conduit boxes and fittings is to be based on CSA C22.2 No.18.
2. Boxes shall be suitable for the utilization voltage.
3. Combination boxes shall have barriers where outlets for more than one system are grouped.
4. Recessed 100 mm (4") square or larger outlet boxes shall be complete with single or ganged plaster rings to suit application.

#### 2.2 Sheet Steel Outlet boxes:

1. Electro-galvanized steel single and multi-gang device boxes for flush installation, shall be minimum size 75 mm x 50 mm x 37 mm (3" x 2" x 1-1/2") unless otherwise specified or required. 100 mm (4") square outlet boxes shall be used when more than one conduit enters one side, with extension and plaster rings as required.
2. Boxes for door switches and push buttons shall be sized as required.
3. Utility boxes for connection to surface mounted EMT conduit, shall be minimum 100 x 54 x 48 mm (4" x 2-1/8" x 1-7/8") size.
4. Square or octagonal outlet boxes for lighting fixture outlets, shall be minimum 100 mm (4") size.
5. Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls, shall be minimum 100 mm (4") size.

#### 2.3 Masonry Boxes:

1. Electro-galvanized steel masonry single and multi-gang MBD boxes shall be used for flush mounted devices in exposed block walls.

#### 2.4 Concrete boxes:

1. Electro-galvanized sheet steel concrete boxes shall be used for flush mounting in concrete, with matching extension and plaster rings as required.

#### 2.5 Conduit Boxes:

1. Cast FS or FD ferrous boxes with factory-threaded hubs and mounting feet shall be used for outlets connected to surface mounted rigid conduit.

2.6 PVC Boxes:

1. F series and octagon boxes shall be moulded type, with fastening ears and screwed secured covers as required.

2.7 Fittings - General:

1. Bushing and connectors shall be with nylon insulated throats.
2. Provide knock-out fillers to prevent entry of foreign materials.
3. Use conduit outlet bodies for conduit up to and including 32 mm (1-1/4") and pull boxes for larger conduits.
4. Provide double locknuts and insulated bushings on sheet metal boxes.

PART III - EXECUTION

3.1 Installation:

1. Support boxes independently of connecting conduits.
2. Fill boxes with paper, foam sponges or similar approved material to prevent entry of construction material.
3. Size box wiring chambers in accordance with Canadian Electrical Safety Code.
4. Gang boxes together where wiring devices are grouped.
5. Provide matching blank cover plates for boxes without wiring devices.
6. Use combination boxes where outlets for more than one system or voltage are grouped.
7. For flush installations, mount outlets flush with finished wall using plaster rings to permit wall finish to come within 5mm (1/4") of opening.
8. Provide correct size of openings in boxes for conduit and armored cable connections. Reducing washers are not allowed.

End of Section

## **SECTION 26 05 34: CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide conduits, conduit fastenings and conduit fittings as detailed below and as required for a complete electrical installation.

### PART II - PRODUCTS

#### 2.1 Conduits:

1. Rigid and epoxy coated conduit shall be threaded, galvanized steel and shall be manufactured to CSA C22.2 No. 45.
2. Electrical metallic tube (EMT) conduit and couplings shall be manufactured to CSA C22.2 No. 83.
3. Flexible metal conduit and liquid tight - flexible metal conduit shall be manufactured to CSA C22.2 No. 56.

#### 2.2 Conduit Fastenings:

1. Conduit straps shall be steel, double hole for rigid or EMT conduit. Single hole straps are not acceptable.

#### 2.3 Conduit Fittings:

1. Fittings for conduits shall be manufactured to CSA C22.2 No.18. Provide coatings as per conduit.
2. Fittings for rigid conduit shall be steel threaded type, and for EMT conduit, to be steel set screw type.
3. Fittings for EMT conduit in wash bays to be steel compression fitting type.
4. Fittings for flexible conduit and exposed conduit outdoors to be liquid-tight type, straight or angled threaded for rigid and compression for EMT conduit.
5. Expansion fittings for rigid or EMT conduits shall be of the watertight type, with an integral bonding assembly, suitable for deflection in all directions.

#### 2.4 Pulling Cables:

1. Pulling cables shall be polypropylene and of a strength suitable for tension to be pulled.

#### 2.5 Waterproof Membrane:

1. Conduits penetrating waterproof membranes shall be PEM #6372.

## PART III - EXECUTION

### 3.1 Installation (General):

1. The conduits for the following circuits and systems shall be run separately:
  - 120/208 volt utility power distribution.
  - 347/600 volt utility power distribution.
  - Normal power to luminaries.
  - Emergency power to luminaries and exit signs.
  - Fire alarm system multiplex loop devices.
  - Fire alarm system signalling devices.
  - Security, Duress, Intrusion and CCTV system devices.
  - Telephone and data systems.
  - Control wiring.
  - Paging System
2. All conduits to be surface mounted (exposed, EMT) in mechanical and electrical service spaces and rooms and concealed elsewhere unless otherwise shown.
3. Wiring in ceiling spaces and in all partitions shall be EMT.
4. Exposed conduits shall be installed to conserve headroom and cause minimum interference in spaces through which they pass.
5. Use rigid conduit up to 2.4 m (8'-0") above finished floor where exposed indoors
6. Use RGS conduit PVC coated galvanized rigid steel Robroy Permacote in all outdoor locations and in areas that are not environmentally controlled.
7. Use electrical metallic tubing (EMT) above grade, and above 2.4 m (8'-0") above finished floor where exposed indoors.
8. Use flexible liquid tight metal conduit for connection to motors, and transformers.
9. Bend conduit without heating. Replace conduit if kinked or flattened more than 1/10<sup>th</sup> of its original diameter.
10. Mechanically bend conduit over 20mm (3/4") diameter.
11. Field threads on rigid conduit must be of sufficient length to draw conduits tight.
12. Install pulling cables in all conduits that are to remain "empty".
13. A maximum of two (2) 90 degree bends, or equivalent up to 180 degrees, will be permitted without installation of a pull box. Radius of bends must be no less than ten (10) times the conduit diameter.
14. Conduits must be dry, before installing wires.
15. Support all branch conduits from building structure. Do not clip conduits to ceiling hangers, sprinkler pipes, plumbing or BAS wiring hangers.

### 3.2 Surface Conduits:

1. Surface conduits shall be run parallel or perpendicular to building lines.
2. Conduits located near any heat producing equipment shall have 1500 mm (5') clearance.
3. Conduits adjacent to structural steel, beams or columns shall be run within the flanged portion, unless otherwise shown.
4. Group exposed conduits on surface or suspended channels.
5. Do not pass conduits through structural members except where indicated and approved by Landlord.
6. Do not locate conduits less than 75 mm (3") parallel to steam or hot water lines. Provide a minimum clearance of 25 mm (1") at crossovers.

### 3.3 Conduit Size:

1. The minimum conduit size shall be 19 mm (3/4").
2. All undimensioned conduits in the drawings are 19 mm (3/4").

### 3.4 Expansion Fittings:

1. Conduit expansion fittings shall be provided on all conduits crossing expansion joints, and at maximum of 60 m (200') spacing.
2. Install expansion fittings perpendicular to expansion joint.
3. Refer to structural drawings for location of expansion joints.

End of Section

## **SECTION 26 05 43: DIRECT BURIED UNDERGROUND CABLE DUCTS.**

### **PART 1: GENERAL**

#### 1.1 Work Included:

1. Provide all materials and install ducts as detailed below and as required for a complete electrical installation.

### **PART II - PRODUCTS**

#### 2.1 Ductwork

1. Rigid PVC underground power cable duct shall be manufactured to CSA B196.3
2. Fibreglass reinforced epoxy cable duct shall be manufactured to CSA B196.1.
3. Duct couplings, straight and angle fittings, expansion joints, plugs, caps, adaptors and solvents shall be as required to make a complete installation.

#### 2.2 Pulling Cable

1. Pulling cables shall be 6 mm (1/4") stranded nylon or polypropylene rope.

### **PART III – EXECUTION**

#### 3.1 Duct Installation

1. Provide a minimum for 150 mm (6") sand bed under ducts.
2. Lay ducts maintaining a 50 mm (2") clearance from trench sides. Provide minimum slope of 1 to 400, towards property line, unless otherwise shown.
3. Provide expansion joints every 15 m (50').
4. Before backfilling, cap ducts and obtain approval from Consultant and local Hydro Inspection.
5. After duct installation, cover with a minimum 150 mm (6") sand.
6. Pull through each duct, a steel mandrel not less than 300 mm (12") long and of a diameter 6 mm (1/4") less than the internal diameter of the duct, followed by a stiff bristle brush to remove sand, earth and other foreign matter.
7. Install pulling cable in each duct and identify location at grade.

End of Section

## **SECTION 26 05 44: INSTALLATION OF CABLES IN TRENCHES AND IN DUCTS.**

### **PART 1: GENERAL**

#### 1.1 Work Included:

1. Provide duct sealing compounds and install cables as detailed below and as required for a complete electrical installation.

### **PART II - PRODUCTS**

#### 2.1 Materials

1. Sand for cable shall be as defined in Division 2.

#### 2.2 Duct Sealing Compound

1. Duct sealing compound shall be a non-thermoplastic compound and shall allow for expansion and contraction of ducts and cables without loss of sealing properties.

### **PART III - EXECUTION**

#### 3.1 Cable Installation in Trenches

1. Provide a minimum of 150 mm (6") sand bed under cables.
2. Lay cables maintaining a minimum 75 mm (3") clearance from trench sides.
3. Provide offsets for thermal action and minor earth movements. Offset cables 150 mm (6") for each 60m (250') runs, maintaining minimum cable separation and bending radius requirements.
4. Make splices and terminations in accordance with manufacturer's instructions using approved splicing kits.
5. Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, eight (8) times diameter of cable: for metallic armoured cables, twelve (12) times diameter of cables, or in accordance with manufacturer's instructions, whichever is the least.
6. Maintain 75 mm (3") minimum separation between cables of different circuits. Maintain 300 mm (12") horizontal separation between low and high voltage cables. When low voltage cables cross high voltage cables maintain 300 mm (12") vertical separation with low voltage cables in upper position. At crossover maintain 75 mm (3") minimum vertical separation between low voltage cables and 150 mm (6") between high voltage cables. Maintain 300mm (12") minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
7. Install treated planks on lower cables 600 mm (2') in each direction at crossings.
8. Before backfilling, obtain approval from Consultant and local Hydro Inspection.
9. After cables installation cover cables with minimum 150 mm (6") sand.

10. Install continuous cable protection on top of sand cover. Ensure protection extends a minimum of 50 mm (2") beyond cables.

### 3.2 Cable Installation in Ducts

1. Before installation of cables, pull stiff bristle brush through each duct.
2. Install cables as indicated. Do not pull spliced cables inside ducts.
3. Install multiple cables in ducts simultaneously.
4. Use lubricant to reduce pulling tension.
5. To facilitate matching of colour coded multiconductor control cables, reel off in same direction during installation.
6. After installation of cables, seal duct ends with duct sealing compound.

End of Section



## **SECTION 26 27 26: WIRING DEVICES.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide all wiring devices indicated on drawings and described below.

### PART II - PRODUCTS

#### 2.1 Standards:

1. Construction of manually operated general purpose AC switches is to be based on CSA C22.2 No. 111, snap switches on CSA C22.2 No. 55, and receptacles, plugs and similar wiring devices on CSA C22.2 No. 42.
2. Devices shall be Specification Grade and of one manufacturer throughout

#### 2.2 Switches:

1. Switches shall be suitable for the voltage and load controlled and shall be single pole or three way as indicated.
2. They shall have terminal holes approved for No. 10 AWG wire, silver alloy contacts, and urea or melamine moldings for parts subject to carbon tracking.
3. They shall be suitable for back and side wiring, and rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
4. White decorator style switches shall be used for 120V circuits, in all finished areas.
5. White decorator style switches shall be used for 347V circuits in all areas.

#### 2.3 Receptacles:

1. Duplex receptacles shall be CSA Type 5-15R, 125 volt, 15 Amp, U ground and CSA Type 5-20RA, 125 volt, 15/20 Amp, U Ground.
2. They shall be colour, as specified on site by interior designer, decorator style.
3. They shall be suitable for No. 10 AWG, back and side wiring, have break-off links for use as split receptacles and shall have eight (8) back wired entrances, four (4) side wiring screws and double wipe contacts with riveted grounding contacts.

#### 2.4 Coverplates:

1. Coverplates shall be colour, as specified on site by interior designer in finished areas and stainless steel in unfinished areas.
2. Use die cast aluminum coverplates for wiring devices mounted for surface mounted FS or FD boxes, and pressed steel coverplates for utility surface boxes.
3. Use weatherproof spring-loaded, cast aluminum coverplates complete with gaskets for exterior mounted single receptacles and switches, or where indicated.

### PART III - EXECUTION

#### 3.1 Installation:

##### 1. Switches:

1. Install single throw switches with lever in "UP" position when switch closed.
2. Install switches in gang type outlet box when more than one switch is required in one location.

##### 2. Receptacles:

1. Install receptacles in gang type outlet box when more than one device is required in one location.

##### 3. Coverplates:

1. Protect coverplate finish until painting and other work is finished or install after painting is complete.
2. Do not use flush type coverplates on surface mounted boxes.

End of Section

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## **SECTION 26 28 13.01: FUSES – LOW VOLTAGE.**

### PART I - GENERAL

#### 1.2 Work Included:

1. Supply and install fuses in disconnect switches, etc. as required to complete this contract.

### PART II - PRODUCTS

#### 2.1 Fuses - General:

1. Plug and cartridge fuses shall be manufactured to CSA C22.2 No. 59.
2. HRC fuses shall be manufactured to CSA C22.2 No. 106 and to have interrupting capability of 200,000A symmetrical.
3. Fuses shall be the product of one manufacturer.
4. Fuse type reference L1, L2, J1, R1, etc. have been adopted for use in this specification.

#### 2.2 Fuse Types:

1. HRCI - J fuses.
  1. Type J1, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.
  2. Type J2, fast acting.
2. HRC - L.
  1. Type L1, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.
  2. Type L2, fast acting.
3. HRC - R fuses (For UL Class RK1 fuses, peak let-through current and  $I^2t$  values not to exceed limits of UL 198E table 10.2.)
  1. Type R1, (UL Class RK1), time delay capable of carrying 500% of its rate current for 10 seconds minimum, to meet UL Class RK1 maximum let-through limits.
  2. Type R2, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.
  3. Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
  4. HRCII - C fuses.

### PART III - EXECUTION

#### 3.1 Installation:

1. Install fuses in mounting devices immediately before energizing circuit.
2. Ensure circuit fuses fitted to physically matched mounting devices. Install Class R rejection clips for HRCI-R fuses.
3. Ensure correct fuses fitted to assigned electrical circuit.
4. Fuses protecting motor loads and transformers to be type J1 for up to and including 600A and L1 for ratings above 600A.
5. Fuses protecting feeder circuits to be type J2 for up to and including 600A and type L2 ratings above 600A.
6. Fuses protecting other services or equipment shall be of the type required for that purpose.

End of Section

## **SECTION 26 28 23: DISCONNECT SWITCHES - FUSED AND NON-FUSED.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide all disconnect switches shown on the drawings and as required for motors.

### PART II - PRODUCTS

#### 2.1 Equipment

1. Fuseholder assemblies to CSA C22.2 No. 39
2. Fusible and non-fusible disconnect switches shall be installed in CSA enclosures.
3. Provide for padlocking in "OFF" switch position by one lock.
4. Provide a mechanically interlocked door to prevent opening when handle in "ON" position.
5. Provide fuses sized as required.
6. Fuseholders in each switch shall be suitable without adapters, for type of fuse as specified.
7. Provide quick make, quick break action.
8. Provide ON-OFF switch position indication on switch enclosure cover.
9. Enclosures shall be CSA/EEMAC Type 1 modified to sprinkler proof enclosure.

### PART III - EXECUTION

#### 3.1 Installation:

1. Install disconnect switches with or without fuses as required.
2. Provide watertight connections for all services entering the top of the disconnect switches.

End of Section

## **SECTION 26 50 00: LIGHTING EQUIPMENT.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Provide Lighting fixtures as shown on the drawings and described below.

### PART II - PRODUCTS

#### 2.1 Lamp Standards:

1. Incandescent lamps shall be manufactured to CSA C22.2 No. 84.
2. Fluorescent lamps shall be manufactured to ANSI C78.
3. Incandescent, fluorescent and HID lamps shall be of 1 (one) manufacturer, either in total, or in groups defined by lamp type.
4. Ballast and lamps provided under this contract must be an approved combination by both respective manufacturers.

### PART III - EXECUTION

#### 3.1 Lamp and Ballast Installation:

1. Refer to luminaire schedule and drawings, for lamp and ballast requirements.
2. Install lamps only when the luminaires are clean.
3. Ensure that lamps are suitable for luminaires before energization and lamp length and colours are that as specified. Report any discrepancies to the consultant.

#### 3.2 Luminaire Installation:

1. Install luminaires accurately and carefully aligned complete with all mounting hardware. Ensure any suspension rods are vertical.
2. All luminaires shall be supplied with accessory items such as yokes, plaster rings, frame adjusters, etc., where required for proper installation.
3. At the time of date of "Substantial Completion" all luminaires, lenses, louvers and lamps must be clean, and the lamps illuminated.

### 3.3 Luminaire Support:

1. All fixtures must be chained by 2 points directly to main structure such that they are supported independently of the lay-in ceiling system.
2. All fixtures in exposed ceiling areas (no T-bar or Drywall) shall be mounted on 1-5/8" unistrut, running the full length of the run of fixtures. The unistrut is to be suspended from the ceiling deck by 3/8" threaded rod from unistrut between the joists. Do not puncture ceiling deck.
3. All lighting feeds for suspended fixtures shall be dropped from the deck or slab straight down into the fixture or raceway. Fixture to fixture conduits will not be permitted. Conduit must go to the deck then to the next fixture.

### 3.4 Cleaning:

1. All luminaires must be cleaned before lamping and installing lenses or louvres.
2. Use dry, clean, soft cloths if luminaires are dusty. Use mild solvents to clean soiled luminaires.

End of Section

## **SECTION 26 60 01: ELECTRICAL IDENTIFICATION.**

### PART I - GENERAL

#### 1.1 Work Included:

1. Identify electrical equipment as specified herein.

#### 1.2 Manufacturer's Nameplates:

1. Have the manufacturer's nameplates affixed to each item of all equipment 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. Ensure that nameplates are not painted over. Where apparatus is to be concealed, attach the nameplate in an approved location on the equipment support or frame.
2. Ensure that panels and other apparatus which have exposed faces in finished areas do not have any visible trademarks or other identifying symbols. Mount nameplates behind doors.

### PART II - PRODUCTS

#### 2.1 Lamacoid Plates:

1. Refer to drawings for lamacoid background and text colour. Minimum size 75mm x 25mm (3" x 1") and 3.2mm (1/8") thick laminated plastic and 6.4mm (1/4") deep engraved lettering.

#### 2.2 Conductor Markers:

1. Cable diameter less than 13 mm (1/2") - Electrovert type Z.
2. Cable diameter 13 mm (1/2") and larger - Electrovert #510 strap-on.
3. Colour - white with black markings except fire alarm and life safety system which shall be white with red markings.

### PART III - EXECUTION

#### 3.1 Conduit Services - Power:

1. Locate identification:
  - Behind each access door.
  - At each change of direction and at junction boxes.
  - At not more than 10 m (40') apart in straight runs of conduit behind removable enclosures such as lay-in type ceiling, but on both sides of sleeves through walls or floors.
  - Above each floor or platform for vertical exposed conduits, preferably 1500 mm (60") above floor or platform.



- Use stencils and stencil paint or lamacoid plates on all conduits.
- Use minimum 25 mm (1") high letters.
- The identification shall describe system voltage and service, i.e., "120 / 208V lighting to panel AA".

### 3.2 Conduits and outlet boxes:

1. Identify conduits and outlet boxes for the various systems by the use of the following distinctive colour paints. Apply a small area of paint to the inside of each outlet box, pull box and panel as it is being installed. Identify junction boxes in suspended ceiling areas with colour on both inside and outside.
  1. 120 / 208 volt system. - Black
  2. Fire Alarm systems. - Red
  3. 347/600 volt system. - Blue
  4. Security Alarm system - Orange
2. Use the colour coding as defined in CGSB Code 24-GP-3A and CSA Standard B53.
3. Where the existing colour coding differs from these Specifications, notify the Consultant of colours used and maintain existing colour coding.

### 3.3 Equipment Nameplates:

1. Identify all equipment listed below with lamacoid plates, letters 10 mm (0.4") high, unless otherwise noted.
  1. Lighting and Power Panels - Plates to be on outsides of door. Typical identification: "Lighting Panel C 120/208V, 3PH, 4W MAINS 225A 18KA RMS. Supplied from Panel BB".
  2. Disconnect switches and starters - Plates to be mounted externally on switch cover. Typical identification: "Fan S4, 208V, 3PH".
  3. Transformers - Plates to be mounted externally on case. Typical identification: "Transformer TR-UPSA 225 KVA/416/120/208V, 3PH / 4W fed from Panel UPS A".
2. Secure with mechanical fastening devices except on the inside of panel doors where gluing will be acceptable.

### 3.7 Wiring Colour Code:

1. Power and Lighting Conductors:
  1. Phase A - Red
  2. Phase B - Black
  3. Phase C - Blue
  4. Neutral - White
  5. Ground - Green
2. For sizes available in black only, use coloured tape markers at junction boxes and terminal points to match phase coding described above.
3. Band green isolated ground conductors with yellow tape.

4. Control conductors - Orange
5. Fire Alarm System Conductors.
  1. Alarm initiating devices and manual pull stations - red and blue.
  2. Alarm signaling devices - black and white.

### 3.8 Conductor Markers:

1. For power feeders, install markers at either end of the conductors where terminated inside of equipment to match wiring diagram conductor identification or panelboard circuit numbers. Typical identification Panel AA circuits - 21; use "AA-21". For a three phase circuit provide identification on phase A conductor only. For a single phase circuit provide identification on the phase conductor.
2. For Branch circuits supplying single phase and three phase devices such as receptacles and connections to equipment identify conductors at panel and in device outlet box. Install marker on phase conductor inside outlet box. Typical identification if device is connected to Panel B - circuit 14, marker identification "B-14".

End of Section

## **SECTION 26 60 02: TESTING AND COMMISSIONING OF ELECTRICAL SYSTEMS.**

### PART I - GENERAL

#### 1.1 Description:

1. Include in work of this section, the testing and commissioning of all new electrical and component systems.
2. Include any specific testing of equipment required by the Hydro Inspection or Supply Authorities.
3. The complete costs of the site, load bank and factory testing and commissioning witnessing of Electrical Equipment is to be included in the Bid price.
4. Inform manufacturers of all factory and site testing requirements and include all their costs in the Bid price.
5. At their own discretion, testing is to be witnessed by the Owner and the Electrical Consultant.

#### 1.2 Scope:

1. Include factory testing and approved certification, where required.
2. Coordinate with the equipment manufacturer, notify the Electrical Consultant in writing, 10 (ten) days before any factory testing to confirm Consultant's desired presence, and be present for all site testing.

#### 1.3 Completion of Work:

1. All electrical systems and equipment shall be totally commissioned and operating before date of "Substantial Completion".
2. Coordinate with other trades and the building operations staff for work which affects the operation of the electrical systems, before submitting request for testing and commissioning. Failing to comply, bear all costs including Consultant's time cost, incurred for re-testing and re-commissioning.

### PART II - PRODUCTS

#### 2.1 Materials:

1. Provide all tools, equipment, labour and materials required to perform electrical testing and commissioning as specified. Provide the test results report (s).

#### 2.2 Temporary Load Bank:

1. For testing of the UPS systems, provide resistive variable load banks.
2. Load banks must be complete with breakers to protect generators and UPS systems from cable faults.

## PART III - EXECUTION

### 3.1 Installation:

1. Perform site testing and commissioning only after all equipment is installed and operational.
2. Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
3. Provide 4 (four) copies of certificates of all factory and site testing in complete detail bearing in each case, the seal of the engineer responsible for the tests.
4. Submit all test results for Consultant's review.
5. All equipment or system deficiencies identified by factory or site testing procedures, to be corrected by the Contractor prior to obtaining a "Certificate of Substantial Completion".
6. Submit report, at completion of measurements, listing phase and neutral currents on panelboards, dry-type transformers and motor control centres, operating under normal load. Include hour and date on which load was measured, and voltage at time of test.
7. General operations: energize and operate electrical circuit and item. Repair, alter, replace, test and adjust as necessary for a complete and operating electrical system.
8. Test systems and obtain written confirmation from manufacturers that components have been installed correctly and system functioning as intended. Submit certification for power distribution, communications systems and emergency power to Owner's Consultant.
9. Provide labour, instruments, apparatus and pay expenses required for testing. Owner's Consultant reserves right to demand proof of accuracy of instruments used.
10. Perform the following tests on completed power systems:
  1. Supply voltage: measure line voltage of each phase at load terminals of main breakers and report results in writing to Owner's Consultant. Perform test with majority of electrical equipment in use.
  2. Motor loading: measure line current of each phase of motors with motor operating under load, and report results in writing to Owner's Consultants.
    1. Upon indications of imbalances or overloads, thoroughly examine electrical connections and rectify defective parts or wiring.
    2. If electrical connections are correct, report overloads due to defects in driven machines in writing to Owner's Consultant.
  3. Insulation resistance tests:
    1. Megger circuits, feeders and equipment up to 350V with a 500V instrument for at least one (1) minute.
    2. Megger 350-600V circuits, feeders and equipment with a 1000V instrument for at least one (1) minute.
    3. Check resistance to ground before energizing.
    4. Coordinate and carry out motor testing at same time as driven equipment is being tested. In addition to motor loading tests, provide labour and instruments to read and record motor load readings required to supplement tests on driven equipment through various load sequences, as required by driven equipment tests.
11. Immediately prior to occupancy, test entire electrical system by performing loss and return of utility power test. Demonstrate operation of:
  1. Low voltage service equipment and metering
  2. Exit and emergency lighting
  3. restabilization of systems after power return. Attach report printouts as evidence of expected operation on systems.
  4. User equipment shut-down and auto-restart.

### 3.2 Field Tests

1. Provide advance notice to Owner's Consultant of proposed testing schedule.
2. Perform tests at time of acceptance of work.
3. Conduct and pay for field tests:
  1. Power distribution, including phase voltage, grounding and load balancing.
  2. Circuits originating from branch distribution panels.
  3. Lighting and lighting control. Motors, heaters and associated control equipment, including sequenced operation.
  4. Emergency Power Systems
4. Perform tests in presence of Owner's Representative.
  1. Provide instruments, meters, equipment and personnel required to conduct required tests.
  2. Test systems to verify operation as specified.
5. Conduct di-electric tests, hi-pot tests, insulation resistance tests and ground continuity tests as required by nature of various systems and equipment

### 3.3 General Testing:

1. With the system completely connected, perform the following tests:
  1. Control and Switching - all circuits shall be tested for the correct operation of devices, switches and controls.
  2. Polarity Tests - all sockets shall be tested for correct polarity.
  3. Voltage Test - a voltage test shall be made at the last outlet of each circuit. The maximum drop in potential permitted will be 2% on 120 and 208 volt branch circuits and on 208 volt feeder circuits. Any deficiency in this respect shall be corrected.
  4. Phase Balance - measure the load on each phase at each splitter, and lighting and power panelboard and report the results in writing to the Consultant. Rearrange phase connections as necessary to balance the load on each phase as instructed by the Consultant, with the re-arrangement being restricted to the exchanging of connections at the distribution points mentioned in this paragraph. After making any such changes, make available to the Consultant drawings or marked prints showing the modified connections.
  5. General Operations - energize and put into operation each and every electrical circuit and item. Necessary repairs, alterations, replacements, tests and adjustments required shall be made for complete and satisfactory operating systems.

### 3.4 Sealing:

1. Ensure and verify that all penetrations of electrical equipment have been properly sealed with appropriate material and to the manufacturers' requirements.

### 3.5 Noise and vibration:

1. Ensure and verify that all isolation equipment has been installed where required and to the manufacturers' recommendations. Include the locations of and measurements of static deflection of spring isolators.

### 3.6 Coordination Study

1. For the entire electrical distribution system provided as part of this contract and for the existing high voltage base building switchgear and low voltage base building switchgear, supply a report from an independent test agency of the short circuit, protection, co-ordination study of the electrical distribution system. **An existing coordination study is not available for contractor's use.**
2. Procure (coordinate and pay for) the services of Krka Power Inc. David Bibic [david@krka.ca](mailto:david@krka.ca), or Brosz Technical Services Kyle Bunte [kbunte@brosz.net](mailto:kbunte@brosz.net) to prepare the coordination study and arc flash analysis.
3. Co-ordination of Protective Devices:
  - .1 Ensure circuit protective devices such as overcurrent trips, relays, circuit breakers and fuses are installed to values and settings so as to provide protection by means of opening the closest device to the fault.
  - .2 Submit a short circuit protection and co-ordination study as follows:
    1. Obtain and organize all electrical protection data for all the equipment. This will consist of obtaining the relay types and settings, transformer impedances, cable sizes, fuse sizes and types, motor data, etc., required to carry out the short circuit.
    2. Perform a short circuit analysis to determine short circuit current levels at all critical points in the distribution system, having obtained the available short circuit current available from the Hydro Supply Authority.
    3. Generate appropriate settings for all relays and protective devices from the level of the Hydro Supply Authority feeder protective devices to the largest downstream device on all the feeder secondary distribution levels.
  - .3 Provide a complete, comprehensive report at the conclusion of the short circuit, protection and co-ordination study consisting of the following:
    1. A set of time current curve characteristics of all protective devices in the system plotted on log/log graph paper with corresponding short circuit current levels.
    2. Time current damage curves for all transformers, large motors and cables are also to be plotted.
    3. Provide a complete schedule of all main protective relays, fuses and other protective device listing device locations, function number, manufacturer, model number, size, range, setting, etc.
    4. The complete study will illustrate and ensure that the settings and sizes of all protective devices for each voltage level have been chosen to ensure maximum or optional protection and co-ordination during electrical fault or overload conditions.
    5. These generated settings will then be applied by "in-field" testing methods to the respective devices.

### 3.7 Ground Fault Protection System

1. Inspect relays visually for condition and clean where necessary.
2. Check all connections for tightness.
3. Apply settings to each relay as specified in the short circuit, protection and co-ordination study and test operation by means of a relay test set.
4. Verify each protective system by means of a primary current injection through the zero phase sequence transformer. This will provide correct operation of both the transformer and relay as well as proper functioning of the circuitry through to the breaker tripping elements.

### 3.8 Arc Flash Analyses

1. For the entire electrical distribution system provided as part of this contract and the existing electrical distribution system shown on the drawings, conduct an electrical arc flash hazard analysis as prescribed under NFPA 70E (CSA Z462-18) and provide a written report summarizing the findings and recommended control measures to be taken. The arc flashing analysis results must be deemed acceptable prior to the equipment purchase.
2. The power systems software utilized to perform the study must be SKM Powertools
3. Provide appropriate labels for all equipment (including all prepurchased equipment and equipment supplied by owner). The labels shall warn a qualified worker who intends to open the equipment for analysis or work that a serious hazard exists and that the workers should follow appropriate work practices and wear appropriate personal protection equipment (PPE) for the specific hazard.
4. An existing coordination study is not available for the electrical contractor's use.
5. Procure (coordinate and pay for) the services of Krka Power Inc. David Bibic [david@krka.ca](mailto:david@krka.ca), or Brosz Technical Services Kyle Bunte [kbunte@brosz.net](mailto:kbunte@brosz.net) to prepare the coordination study and arc flash analysis.

### 3.9 Emergency Light Level Measurements

1. As part of this scope of work procure the services of a professional engineer to measure and record emergency lighting levels in foot candles throughout all scope of work areas with a calibrated light meter. Readings shall be taken based on a minimum of one reading for every 20' center in open office areas and corridors / hallways and one reading in each closed office, meeting room, boardroom and stairwell.
2. All light level readings are to be taken during non-daylight hours.
3. Provide a sealed letter identifying light level readings and stating that the emergency lighting levels meet the requirements of the National Building Code. Notify Owner and Consultant at least ten (10) days prior to proposed testing date and schedule testing at time and date acceptable to Owner and Consultant.

### 3.10 Test Results

1. Submit test results to Owner's Consultant for review.
2. Testing methods and test results: to CSA, CEC and authorities having jurisdiction.
3. Remove and replace conductors found damaged with new materials.
4. Provide required labour and tools, if during testing Owner's Representative requests equipment be opened and removed from their housings to examine equipment, terminations and connections.

End of Section

## **SECTION 28 13 00: ACCESS CONTROL.**

### **PART I – GENERAL**

#### 1.1 Work Included:

1. All power and conduit work required and /or shown on drawings related to security system (ie: for electric strike hardware, maglocks, door release button, glass break detectors, etc) shall be included in the electrical contractor's tender price. Provide all conduit and junction boxes and all necessary accessories and devices to facilitate the complete installation of the security system. Obtain exact requirements (including power requirements) from the security contractor. Installation shall be under the direct guidance of, and to the manufacturer's recommendations.

### **PART II - PRODUCTS**

#### 2.1 Refer to drawings for product details.

#### 2.2 Material Standards:

1. All equipment will be manufactured in accordance with applicable CEMA and NEMA specifications, and CSA/ULC standards.

End of Section



**SECTION 28 13 00.02: FIRE ALARM SYSTEM.**

**PART I – GENERAL**

1.1 Work Included:

1. All work required and /or shown on drawings related to life safety systems (ie: fire alarm, EVAC speakers, etc.) shall be included in the tenant electrical contractor's tender price. Employ and pay for the services of the landlord's contractor to provide all conduit, wiring, devices, final connections, modifications and provision of new interfacing devices in existing system control panels (ie: modules, relays, sub-panel, etc.). Ensure new devices to be used are compatible with the existing system. Maintain the integrity of the existing supervised circuits when new devices are to be connected. The system shall be tested and certified for proper operation upon completion of the work. Employ and pay for the services of the landlord's verification contractor.
2. Employ and pay for the services of the landlord's contractor to update the base building active graphic software system with all devices provided, deleted and relocated as part of this scope of work and with fire alarm system zone changes as part of this scope of work.
3. Employ and pay for the services of the landlord's contractor to update the base building passive graphics with all devices provided, deleted and relocated as part of this scope of work and with fire alarm system zone changes as part of this scope of work.
4. Employ and pay for the services of the landlord's contractor to provide additional power boosters, amplifiers and all other controls and accessories as required to ensure that the existing fire alarm system can accommodate all signaling devices shown on the drawings.
5. In **addition** to the field devices indicated on the drawings to be provided under this contract, include in the tender price to supply and install the following quantities of additional devices throughout the scope of contract floors, complete with 75'-0" of conduit and wiring, programming, testing and certification, labeling, verification and 100% repeat verification for each device post City Fire Department inspection. Reverify all existing fire alarm devices.

Quantity of Devices	Device Type
2	Fire Alarm System Horn
2	Strobe Light
1	Fire Alarm System Pull Station
4	Initiating Device Interface Zone Module
2	Fire Alarm System Smoke Detector

6. Test and verification in conformance with CAN/ULC S1001, Integrated Systems Testing Of Fire Protection And Life Safety Systems. Provide a satisfactory Integrated Testing Report. As part of the base bid price, electrical contractor must procure (engage, coordinate and pay for) an Integrated Testing Coordinator, responsible to develop and implement the Integrated Testing Plan. The systems which must be included as part of the integrated systems testing to be determined by the Integrated Testing Coordinator hired by the electrical contractor. All costs related to the integrated systems testing must be included as part of the base bid price. Electrical contractor is responsible to provide all requirements to all required trades through the construction manager / general contractor during the bid period. The integrated systems testing must be completed after hours.

7. Electrical contractor must include the following scopes of work as part of the base bid price specific to the CAN/ULC S1001, Integrated Systems Testing Of Fire Protection And Life Safety Systems:
- Fire Alarm Technician required for operations and resetting of the fire alarm control panel for the duration.
  - Electrician required for operations and initiating alarms, demonstrating wiring, etc., for the duration.

End of Section

## **SECTION 33 65 73: CONCRETE ENCASED DUCT BANKS AND MANHOLES.**

### **PART I - GENERAL**

#### 1.1 Work Included:

1. The correct routing, slopes, size, location and construction of all manholes, ductbanks, drainage pits and markers area within the scope of this Section.

### **PART II - PRODUCTS**

#### 2.1 Pulling Cable:

1. Pulling cable shall be 6mm (1/4") stranded nylon or polypropylene rope.

#### 2.2 Cable Racks:

1. Cable racks shall be manufactured from hot dipped galvanized steel and mounted on 12 x 100mm (1/2" x 4") preset inserts.

#### 2.3 Ductwork:

1. Rigid plastic power cable ducts shall be manufactured to CSA C22.2 No. 211.1.
2. PVC telecommunication and data cable ducts shall be manufactured to CSA B196.3.
3. Duct couplings, straight and angle fittings, expansion joints, plugs, caps, adaptors and solvent shall be as required to make a complete installation.

#### 2.4 Formwork and Shoring:

1. Provide all required framework and shoring.

#### 2.5 Markers:

1. Markers shall be pre-cast concrete type, with direction arrows.

### PART III - EXECUTION

#### 3.1 General:

1. Prior to any concrete pouring, obtain approval from both Consultant and local Utilities Inspectors.
2. Slope ductbank away from manhole and building towards property line. Provide drainage pit between manhole and building and between manhole and property line if above slope is not possible and at all low points in the system.
3. After completion of ductbank/manhole system, install pulling cables in each duct.

#### 3.2 Drainage Pit:

1. Provide drainage pit at low points of ductbank where required. At pit, use perforated duct with openings on the underside and compacted Granular 'A' gravel drainage material. 1m (3ft.) dia. pre-cast concrete pipe sections shall form the exterior of the pit. Depth of pit shall be such that base is down to permeable material.

#### 3.3 Ductbank:

1. Build the ductbank on undisturbed soil, or on well compacted granular fill, no less than 150mm (6") thick, compacted to 95% of maximum Proctor dry density and at the elevations as required and with a minimum slope of 0.3%, towards the property line unless otherwise shown.
2. Provide formwork and shoring as required when sides of excavation are not suitable for ductbank encasement.
3. Install base spacers at maximum intervals of 1.5m (5'-0").
4. Make transpositions, offsets and changes in direction using 5° bend sections, do not exceed a total of 20° with duct offset. Use Bell ends, at duct entry to building or manholes. At the end of a ductbank run, terminate duct with a duct coupling, set flush with the concrete envelope.
5. Lay ducts with configuration as indicated with preformed interlocking, rigid plastic, intermediate spacers to maintain spacing between ducts at not less than 75mm (3") horizontally and vertically unless otherwise shown. Stagger joints in adjacent duct layers at least 150mm (6") and make joints watertight. Clean and cap ducts before allowing any reinforcing or concrete work.
6. Use 15M reinforcing rods that conform to CSA G30.12, grade 400, unless otherwise noted and form ductbank as required.
7. Ensure ductwork is encased with 75mm (3") thick 20MPA (3000 psi) concrete envelope unless otherwise shown. Ensure ducts do not move during reinforcing work or concrete pouring operation.
8. Immediately after placing of concrete, pull through each duct a (steel) mandrel not less than 300mm (12") long and of a diameter 6mm (1/4") less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely.
9. Ensure concrete has attained 50% of its specified strength before any backfilling.
10. Install four (4) 3m (10') lengths of 15M reinforcing rods, one at each corner of ductbank, when connecting ductbank to manholes or buildings.

End of Section

**Communications Cabling Infrastructure  
Specifications**

**for**

**Daycare Addition to  
École élémentaire Pierre-Elliott-Trudeau  
65 Rue Grace  
Toronto, Ontario**

**HCC PROJECT #23029**

**Prepared By:**

**HCC ENGINEERING LIMITED**

**40 Eglinton Avenue East**

**Suite 600**

**Toronto, Ontario**

**M4P 3A2**

**(416) 932-2423**

**Issued for Tender**

**October 1, 2024**

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**SUPPLEMENTARY TENDER FORM**

Project : École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde  
Daycare Addition  
65 Rue Grace, Toronto

Submitted By:

of (address):

Date:

1. Having carefully examined the:

Tender Documents including the Project Description, Terms and Conditions, Instructions to Bidders, Drawings, Schedules and Specifications for the supply and installation of the communications cabling infrastructure for Daycare Addition to École élémentaire Pierre-Elliott-Trudeau and the Amendments numbered \_\_\_ to \_\_\_ in accordance with the Specifications and Drawings, and having visited and investigated the site and examined all conditions affecting the work, the undersigned offers, if notified in writing of the acceptance of the Tender within sixty (60) days of the time set for the delivery of the Tenders, to furnish all plant, equipment, labour and material and perform all duties and services required, excluding all harmonized services taxes, for the lump sum price of:

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\_\_\_\_\_ dollars (\$\_\_\_\_\_).

Amount of H.S.T. Tax excluded from the  
lump sum Tender Price stated above is \_\_\_\_\_

2. PRICE SCHEDULE AND VALUATION OF CHANGES

- .1 We will submit, for approval, a complete breakdown of labour and material costs for all changes.
- .2 The man hour labour units for changes are to be based on labour units from column 1 of the NECA Manual of Labour Units.
- .3 Total mark up including overhead and profit on the **material** shall be limited to 10%.
- .4 Unit hourly composite cost to be used on all changes for labour, as required. The unit hourly composite cost shall contain all provincial taxes, overhead (ie: supervision, financing, estimating, project management, CADD, as built drawings, administration, parking, mileage, clean up, safety, truck fees, ESA fees, etc.), **profit** and associated costs for the work involved, excluding HST. Unit hourly composite cost to remain in effect throughout the duration of this project.
  1. Provide unit hourly composite cost for an electrician/technician to be on site during the times listed below:

Regular Time (7:00 am to 4:00 pm) \$ \_\_\_\_\_

Premium Time (Evenings/Weekends) \$ \_\_\_\_\_

3. LIST OF APPROVED SUBCONTRACTORS

.1 The following contractors are approved to carry out the scope of work described in the specifications and drawings for the communications cabling scopes of work:

- .1 Activo Inc.  
40 Vogell Road Richmond Hill, Ontario L4B 3N6  
(T) 905-787-0750  
(F) 905-946-8971  
Contact: Jim Taylor Email: jtaylor@activo.ca
- .2 Ca Tech Systems Ltd.  
201 Whitehall Drive, Unit #4 Markham, Ontario  
L3R 9Y3  
(T) 905-944-0000  
(F) 905-944-4844  
Contact: Estimating Department
- .3 Idea Networks Inc.  
1320 Britannia Road East Mississauga, Ontario L4W 1C8  
(T) 905-790-3900  
(F) 905-790-1164  
C): 647-637-4332  
Contact: George Chapman  
Email: gchapman@ideanetworks.com
- .4 Telecon Inc.  
3585 Laird Road, Unit 16 Mississauga, Ontario L5L 5Z8  
(T) 905-569-2882 2312  
(F) 905-569-9587  
Contact: Shaf Mohammed  
Email: shaf.mohammed@telecon.ca

END OF SECTION



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## PART 1 - GENERAL REQUIREMENTS

### 1.1 Scope of Work

- 1.1.1 The project encompasses the 65 Rue Grace, Toronto facility.
- 1.1.2 This contract includes the complete supply and installation of the analog and data horizontal cabling, interlink cabling, riser cabling, house cabling and backbone cabling and terminating hardware and connectivity products specified within this document or shown on the drawings.
- 1.1.3 A complete Commscope GigaSPEED product and cable based solution is required for the analog and data copper Category 6 and Category 6A based infrastructure.
- 1.1.4 A complete Commscope Systimax product and cable based solution is required for the data fiber optic based infrastructure.
- 1.1.5 Carry out all testing and provide documentation of the test results as specified herein.
- 1.1.6 Allow for the removal and replacement of ceiling tiles to allow the communications consultant to review all installed horizontal cabling in the ceiling space at the completion of the project.
- 1.1.7 The Contractor may not assign or sub-contract any work without the prior written consent of the Owner or his designated representative. A list of sub-contractors must be submitted with the tender response.
- 1.1.8 This specifications book includes the technical specifications for the copper cabling and fiber optic cabling provided as part of this scope of work, termination hardware provided as part of this scope of work and accessories provided as part of this scope of work. Refer to drawing No. C-1.1, C-1.2, C-2.0 and C-2.1 for quantity of cables and accessories provided as part of this scope of work, for cable type provided as part of this scope work and for additional requirements.
- 1.1.9 The cabling system must be certified by the manufacturer for a period of 25 years. The Contractor will provide a letter of Certification and a plaque by Commscope within two (2) weeks of substantial completion of the project. These documents will include the following:
  - Verification of the performance of the installed system:
    - Category 6 – analog and data copper cabling system
    - Category 6A – data copper cabling system
    - Single Mode OS2 – fiber optic cabling system
    - Multi Mode OM4 10 GB – fiber optic cabling system
  - Identification of the installation by location and Project Number

Please note that Commscope has authorized the use of Belden BIX distribution connectors and Belden BIX multiplying connectors for termination of Category 6 cables for this project and will provide an end to end certification of the installation.

1.1.10 Certification

- 1.1.10.1 The successful bidder must be trained and certified by both Commscope and shall provide written confirmation of this fact.
- 1.1.10.2 Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project. Proof of certification must be provided prior to commencement of work.

**1.2 Completion of Contract**

- 1.2.1 All the equipment and cabling must be cleaned and tested, before acceptance by the École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde Project Manager.
- 1.2.2 At points of termination, all cabling and terminations must be free of any cable pulling lubricants before acceptance by the École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde Project Manager.
- 1.2.3 This Contractor shall guarantee all equipment and work furnished under this Division for a period of **five (5) years** or such longer periods as may be provided in the warranty of the manufacturer of individual components, whichever is longer from the date of final acceptance by the Consultant. This contractor shall correct all defects developing as a whole or in part, due to defective workmanship, materials or defective arrangement of the various parts or materials damaged as a result of these defects or repairs. All defects shall be made good to the satisfaction of the Consultant at this Contractor's expense.

**1.3 Inquiries**

- 1.3.1 Bidders shall direct their questions or other inquiries in writing to:

HCC Engineering Limited  
40 Eglinton Avenue East  
Suite 600  
Toronto, Ontario  
M4P 3A2  
Tel: (416) 932-8393  
Email: hcohen@hccengineering.com  
Attention: Howard Cohen, P. Eng., RCDD/LAN, MBA

- 1.3.2 All inquiries will be responded to in writing and will be distributed to all bidders. No questions or inquiries will be answered within 24hrs of the closing period of a bid.

**1.4 Site Meeting**

- 1.4.1 The site meeting will be scheduled during the tender period by the project manager. Hard hat, safety glasses, vests and steel toe boots are required and must be provided by participant.

## **1.5 Examination Of Premises And Work**

- 1.5.1 Visit and examine the site where the work is to be done. Become familiar with all features and characteristics of the site and/or any existing structure before submitting a bid. No allowances will be made by the Owner for any difficulties encountered by this Contractor due to any peculiarities of the site, surrounding public or private property that existed when the tender was submitted.
- 1.5.2 This Contractor shall examine the structural, mechanical, architectural, electrical or any other drawings issued to satisfy himself that the work can be satisfactorily carried out. Before commencing work or prefabrication, examine the work of other trades and report at once any defect or interference affecting the work of the communications trade.
- 1.5.3 Where variances occur between the drawings and the specifications, or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the contract sum. The Engineer will decide on the item and manner in which the work shall be installed.
- 1.5.4 All bidders shall familiarize themselves with and adhere to the Conseil Scolaire Viamonde building standards and guidelines.

## **1.6 Terms And Conditions**

### **1.6.1 DEFINITIONS**

- 1.6.1.1 The term Owner shall be understood to refer to Conseil Scolaire Viamonde.
- 1.6.1.2 The term consultant shall be understood to refer to the communications consultant, Howard Cohen, P. Eng., RCDD/LAN, MBA of HCC Engineering.
- 1.6.1.3 The term cabling contractor shall be understood to refer to the successful bidder to this specification for the communications cabling infrastructure.
- 1.6.1.4 The term Contract shall be understood to refer to all items and conditions of this specification, Drawings, the complete tender package, the Contractor's tender submission and any other future contractual arrangements. All such items and conditions shall be binding unless agreed otherwise by the Contractor and Conseil Scolaire Viamonde.
- 1.6.1.5 The term Project shall be understood to refer to the complete supply and installation of the Communications Cabling System and components, as defined in this specification and Drawings.
- 1.6.1.6 Wherever the words "equal", "equivalent", "approved", or "approved equal" are used, it shall be understood to mean, "equal", "equivalent", "approved", or "approved equal" in the opinion of the École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde project manager only.
- 1.6.1.7 Wherever the words "install", "provide", or "supply and install", are used it shall be understood to mean "provide and install, inclusive of all labour, materials, installation, testing, and connections" for the item to which referred.
- 1.6.1.8 "Concealed" is defined as "out of sight" in "normal" viewing conditions, and includes buried in concrete, above acoustic tile or gypsum board ceilings, within masonry or gypsum board constructed walls, within cable trays of below raised access floors.

- 1.6.2 These specifications or the drawings shall not be used alone. Any item or subject omitted from one, but mentioned or reasonably implied in the other, shall be provided. Misinterpretation of any requirements of either the specification or drawings shall not result in any additional charge after submission of tender. This Contractor shall, by careful study of the total requirements, include all necessary components to make each system workable. The École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde project manager shall be contacted for written clarification on any point before the submission of tenders.
- 1.6.3 All terms and conditions of the specifications, tender documents and accompanying Drawings shall be strictly adhered to by the Contractor, unless otherwise noted. Any inability to comply with these requirements must be stated in writing, in detail, with the response submission. Otherwise, it shall be understood that the Contractor is bound to compliance with the stated terms and conditions.
- 1.6.4 The Contractor shall co-operate fully with the Conseil Scolaire Viamonde and all contractors, sub-contractors and other persons working on the site.
- 1.6.5 The Contractor shall do the complete installation in accordance with the latest editions of the Building Code, Electrical Safety Code, C.S.A., or other Codes or governing authorities of competent jurisdiction. In case of discrepancies with this or the manufacturer's specifications, the Contractor shall notify École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde project manager immediately.
- 1.6.6 Obtain and pay for permits and inspection required for work performed where applicable.
- 1.6.7 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details and drawings which these authorities may require.
- 1.6.8 The Contractor must comply with all requirements of the Occupational Health & Safety Act.
- 1.6.9 In order to meet the requirements of substantial completion the contractor must complete the following:
1. Installation and testing of all cable runs.
  2. Submission of all testing documentation for the Communication Consultant's review.
  3. Submission of all record and As-built documentation (in handwritten format until typed / AutoCAD versions are available).
  4. Correction of any deficiencies in the horizontal cabling systems and associated outlets.
  5. Correction of any deficiencies in the backbone cabling systems.

## 1.7 Schedule

- 1.7.1 **Obtain a detailed schedule from the construction manager.** Include for all necessary overtime required to carry out the project. Successful Contractor to submit a full procurement, delivery, installation, testing and labeling schedule to École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde Project Manager before starting any work.
- 1.7.2 All work required to be done after office hours and weekends (ie: drilling of anchors), shall be included in the tender price.
- 1.7.3 **All cutovers must be carried out on weekends.**
- 1.7.4 **Contractor must provide a dedicated on site technician for 8 hours per cutover to support the client for each and every cutover.**

## 1.8 Contract Drawings

- 1.8.1 The Drawings for the Communications work are diagrammatic performance Drawings, intended to convey the scope of work and indicate the approximate sizes and locations of equipment and outlets. The Drawings do not intend to show Designer's Architectural, Mechanical or Structural details.
- 1.8.2 Do not scale or measure Drawings, but obtain information regarding accurate dimensions, from the dimensions shown or by site measurements. Follow the Communications Drawings to lay out the work.
- 1.8.3 Make, at no additional cost, any changes or additions to materials and equipment necessary to accommodate Structural conditions (offsets around beams, columns, etc.)
- 1.8.4 Alter at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation, and do not necessitate additional materials.
- 1.8.5 Change location of termination panels and outlets at no extra cost providing cable length increase resulting from relocation does not exceed 3m (10') and information is given before installation.
- 1.8.6 Confirm at the site the exact location of equipment.
- 1.8.7 Any miscellaneous materials, hardware, devices, wiring, etc., not specifically described, but required for the installation and operation of the communications cabling system, shall be provided and included as part of the Bid.

**1.9 Materials and Equipment**

1.9.1 All materials and equipment shall be completely new and unused products of only the most recent manufacturer model or version number, CSA certified, and manufactured to the Standards specified.

**1.10 Substitutes**

1.10.1 All tenders must be based on specified items.

1.10.2 Manufacturer's names and model numbers are given in the specification as the basis for the specification and tenders, and to clearly describe the quality of the product that is desired for the work. A specific Manufacturer's name and model number may also represent a certain physical dimension or operational requirement required on this project.

1.10.3 Substitutes will **not** be considered.

**1.11 Operation And Maintenance Manuals**

1.11.1 Provide three (3) sets of operation and maintenance manuals for equipment and products supplied.

1.11.2 Provide three (3) soft copy scanned sets of operation and maintenance manuals for equipment and products supplied. Media shall be USB drives.

1.11.3 Include the following information in the Operation and Maintenance manuals:

- Names and address of local suppliers for the items included.
- Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature is not acceptable.
- Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.

1.11.4 Review information provided in the maintenance instructions and manuals with the Owners' operating personnel to ensure a complete understanding of the electrical equipment and systems and their operation.

**1.12 Progress Payments**

1.12.1 Submit a complete breakdown of the Contract with each progress billing, indicating percentage of work complete, in a form acceptable to the Owner/Consultant.

1.12.2 The amount of monies to be allocated for close out documents must be 3% of contract value. This does not include monies allocated for testing, measurement and verification, commissioning, AutoCAD files, etc.

### **1.13 Shop Drawings**

- 1.13.1 Submitted Shop Drawings must indicate details of construction, dimensions, capacities, weights and electrical performance and flame spread characteristics of equipment or materials, as well as specification reference Section number and project name.
- 1.13.2 Shop Drawings shall be provided with sufficient space on the front for all Consultant's and Contractor's "review" stamps.
- 1.13.3 Work affected by submittal shall not proceed until review is complete.
- 1.13.4 Review submittal prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of the work and Contract Documents and bears the Stamp of Communications Contractor.
- 1.13.5 Changes made to the Shop Drawings by the Consultant will not affect the Contract Price.
- 1.13.6 Submit Shop Drawings for all material and equipment referred to in contract document

### **1.14 Field Supervision**

- 1.14.1 Throughout the duration of the Project, a properly qualified Communications Field Supervisor must be available at all times. The Supervisor who starts the work must not be changed unless requested by the Project Manager, or written permission from the Project Manager is obtained.

### **1.15 Site Responsibilities**

- 1.15.1 Maintain work areas to be free of construction debris and waste. The disposal of all materials shall be the responsibility of the Contractor.
- 1.15.2 Make all necessary arrangements to transport materials and equipment to and within the site. The Contractor shall be responsible for arranging for the use of any hoists, lifts, pulleys, winches, cranes or service elevators.
- 1.15.3 The Contractor is responsible for complete storage, handling, delivery, and installation of all materials used in the performance of the work.

### **1.16 Deliveries / Access**

- 1.16.1 Coordinate all deliveries to site with the Building Project Manager. Book loading dock and service elevators 72 hours in advance. Contractor must pre-arrange all site access and authorization for all site personnel and subcontractor personnel with the Building Project Manager or his representative.

### **1.17 Testing And Commissioning**

- 1.17.1 Provide testing and commissioning of all items and their related components. Include maintenance manuals and operating instructions for owner's staff use.



**1.18 Other**

- 1.18.1 The tender documents shall remain the property of the owner. Bidders are required to return the tender documents to the owner with their bids.
- 1.18.2 It is the responsibility of the Contractor to perform all cutting, patching and repair related to the communications cabling work.
- 1.18.3 The Contractor will be responsible for fishing walls, columns etc., wherever conduit has not been provided by others to ensure all cabling is concealed.

**1.19 Record And As-Built Drawings**

- 1.19.1 On the cable pull end date, the contractor must provide the client with one copy of working drawings showing all installed outlet locations and corresponding labels.
- 1.19.2 The Contractor shall maintain two sets of drawings on site. Clearly mark on these drawings all changes and deviations from the contract drawings and in particular mark the actual location of all feeder conduit and floor monument locations.
- 1.19.3 All deviations from the contract drawings shall be recorded on the "as-built" drawings, including those changes due to Addenda, Site Instructions or Change Orders.
- 1.19.4 After the date of Substantial Performance, obtain from the Consultant, a set of AutoCAD Version 2021 files of the most recent Communications Drawings. These Drawings shall be marked up to record clearly, neatly, accurately and promptly all locations of Communications deviations as a result of Change Orders, Consultant's or Owner's Instruction, site conditions, etc. Utilize normal recognized CAD procedures that match the original drafting methodology. Submit the revised As-Built AutoCAD disks as well as a CD and Drawings with changes clearly indicated to the Consultant for review and final presentation to the Owner. Provide three (3) sets.
- 1.19.5 For the disk drawing submission described above, the contractor must include as part of the base bid price \$450.00 to have HCC Engineering supply the AutoCAD Version 2021 floor plans denoted as 'Reissued for Tender' through a file transfer site.

END OF SECTION

## PART 2 - PRODUCTS

### 2.1 General

2.1.1 The equipment, material and installation shall conform with the latest version of the applicable Codes, Standards and regulations of authorities having jurisdiction.

CSA C22.1	Canadian Electric Code Part 1 Ontario Hydro Electrical Safety Code
ANSI/EIA/TIA-568-A	Commercial Building Telecommunications Cabling Standard (CSA T529).
ANSI/EIA/TIA-569	Commercial Building Standard For Telecommunications Pathways And Spaces (CSA T530).
ANSI/EIA/TIA-606	Administration Standard For The Telecommunications Infrastructure Of Commercial Buildings (CSA T528).
ANSI/EIA/TIA-607	Commercial Building Grounding And Bonding Requirements For Telecommunications (CSA T527).
ANSI/EIA/TIA TSB-67	Performance Specification For Field Testing Of Unshielded Twisted-Pair Cabling Systems.
CSA C22.2 No. 214	Communications Cables.
CSA C22.2 No. 232-M	Optical Fibre Cables.
ANSI/EIA/TIA-492AAAA	Detailed Specification For 62.5 $\mu$ m Core Diameter / 125 $\mu$ m Cladding Diameter Class 1a Multimode, Graded-Index Optical Waveguide fibres.
ANSI/EIA/TIA-492BAAA	Detail Specifications For Class Iva Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communication Systems.
ANSI/EIA/TIA-472CAAA	Detailed Specifications For All Dielectric (Construction 1) Fibre Optic Communications Cable For Indoor Plenum Use, Containing Class 1a, 62.5 $\mu$ m Core Diameter / 125 $\mu$ m Cladding Diameter Optical Fibre(s).
ANSI/EIA/TIA-472DAAA	Detailed Specifications For All Dielectric Fibre Optic Communications Cable For Outdoor Plant Use, Containing Class 1, 62.5 $\mu$ m Core Diameter / 250 $\mu$ m Cladding Diameter Optical Fibre(s).
ANSI/EIA/TIA-455	Test Procedures For Optical Fibres, Cables And Transistors.
ANSI/EIA/TIA-598	Colour Coding Of Optical Fibre Cables.

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ANSI/EIA/TIA-604-3	FOCIS 3 Fibre Optic Connector Intermateability Standard.
ANSI/ICEA S-83-596	Fibre Optic Premises Distribution Cable.
ANSI/ICEA S-83-640	Fibre Optic Outside Plant Communications Cable.
ANSI Z136.2	American Standards For The Safe Operation Of Optical Fibre Communication Systems Utilizing Laser Diode And LED Sources.
ISO/IEC IS 11801A	Generic Cabling For Customer Premises.
CENELEC EN 50173	Performance Requirements For Generic Cabling Schemes.
IEC 603-7, PART 7	Detailed Specification For Connectors, 8-Way, Including Fixed And Free Connectors With Common Mating Features.
FIPS PUB 174	Commercial Building Telecommunications Wiring Standard. Federal Information Standard Publication.
UL 444 and 13	Adopted Test And Follow-Up Service Requirements For the Optional Qualification Of 100Ω Twisted-Pair (Cables).
IEC 807-8	Rectangular Connectors For Frequencies Below 3 Mhz, Part 8: Detailed Specification For Connectors, Four-Signal Contacts And Earthing Contacts For Cable Screens, First Edition.
NEMA WC 63	Performance Standard For Field Testing Of Unshielded Twisted-Pair Cabling System.

2.1.2 Components to meet CSA, ULC and ANSI/EIA/TIA-568A requirements.

## **2.2 Data and Analog Outlets**

2.2.1 Category 6 UTP Modular Information Outlets - 8 Position

2.2.1.1 Utilize GigaSPEED MGS400-XXX Category 6 UTP modules for data and analog designated outlets.

2.2.1.2 RJ45 modules complete with insulation displacement contacts for termination of all eight cable conductors.

2.2.1.3 Minimum 50 microns of hard gold over nickel or copper on modular jack contact wires.

2.2.1.4 Modular jack to meet or exceed the requirements of ANSI/EIA/TIA-568-B for Category 6.

2.2.1.5 Pin out Termination Sequence = 568A (unless stated otherwise).

- 2.2.2 Category 6A UTP Modular Information Outlets - 8 Position
  - 2.2.2.1 Utilize Systimax MGS600-XXX Category 6A UTP modules for data and analog designated outlets.
  - 2.2.2.2 RJ45 modules complete with insulation displacement contacts for termination of all eight cable conductors.
  - 2.2.2.3 Minimum 50 microns of hard gold over nickel or copper on modular jack contact wires.
  - 2.2.2.4 Modular jack to meet or exceed the requirements of ANSI/EIA/TIA-568-B for Category 6A.
  - 2.2.2.5 Pin out Termination Sequence = 568A (unless stated otherwise).
- 2.2.3 Telecommunications Outlets - Wall Mounted Faceplates (Copper Cables)
  - 2.2.3.1 Utilize GigaSPEED flush mounted 3-port M108FR3-XXX faceplate. Faceplates to be available in Telco Ivory, Gray, White, and Electrical Ivory. (Architect to select final colour). **Provide sample as part of shop drawing process prior to ordering.**
  - 2.2.3.2 Faceplates equipped with ports to accommodate 3 modular information outlets.
  - 2.2.3.3 Use recessed blank modular inserts for all unused communication ports. Blanks to match faceplate colour.
  - 2.2.3.4 Provide dustcovers and icons.
- 2.2.4 Telecommunications Outlets - Furniture Mounted Faceplates
  - 2.2.4.1 Utilize GigaSPEED 3-port furniture faceplate. Black in colour.
  - 2.2.4.2 Faceplates equipped with ports to accommodate 3 modular information outlets.
  - 2.2.4.3 Use recessed blank modular inserts for all unused communication ports. Blanks to match faceplate colour.
  - 2.2.4.4 Provide dustcovers and icons.
  - 2.2.4.5 **Confirm faceplate requirements with consultant and furniture supplier prior to procurement.**
  - 2.2.4.6 **Provide sample as part of shop drawing process prior to ordering.**
- 2.3 **Punch Down Block Assemblies**
  - 2.3.1 Assemblies to consist of cable termination wiring blocks and connecting blocks.
  - 2.3.2 Connector construction to allow for termination of cables on one side and cross connect jumper wire on the other.
  - 2.3.3 Each wiring block strip to be equipped with fifty (50) double-ended Insulation Displacement Connection (IDC) clips. Each clip capable of terminating 22-,24- and 26-AWG plastic insulated solid copper conductors without stripping.
  - 2.3.4 Mounting blocks shall be wall mountable and stackable.
  - 2.3.5 Utilize Belden QCBIX1A connectors for house and riser cabling terminations, QCBIX1A4 (4-pair marking) connectors for interlinks and horizontal cabling terminations, QCBIX2A and QCBIX5A multiplying connectors where detailed on the drawings and QMBIX10 mounts.

## 2.4 Horizontal and Interlink Copper Cables

### 2.4.1 Category 6 Cables

- 2.4.1.1 Unshielded twisted pair cordage with eight (8) - 23 AWG thermoplastic insulated, solid conductors formed into individually twisted pairs and enclosed in a CSA FT-6 (CMP) rated thermoplastic jacket and all individual conductors to be insulated with fluorinated ethylene propylene (FEP).
- 2.4.1.2 Diameter of insulated conductors not to exceed 1.2 mm (0.048") and diameter of completed cable not to exceed 5.70 mm (0.225").
- 2.4.1.3 Cable to withstand a bend radius of 25.4 mm (1") at a temperature of  $-20^{\circ}\text{C} \pm 1^{\circ}\text{C}$  without jacket or insulating cracking.
- 2.4.1.4 Cable to meet or exceed the requirements of ANSI/EIA/TIA-568-B for Category 6.
- 2.4.1.5 Cable shall be 2071E GigaSPEED XL Solution plenum series.

### 2.4.2 Category 6A Cables

- 2.4.2.1 Unshielded twisted pair cordage with eight (8) - 23 AWG thermoplastic insulated, solid conductors formed into individually twisted pairs and enclosed in a CSA FT-6 (CMP) rated thermoplastic jacket and all individual conductors to be insulated with fluorinated ethylene propylene (FEP).
- 2.4.2.2 Diameter of insulated conductors not to exceed 1.2 mm (0.048") and diameter of completed cable not to exceed 5.70 mm (0.225").
- 2.4.2.3 Cable to withstand a bend radius of 25.4 mm (1") at a temperature of  $-20^{\circ}\text{C} \pm 1^{\circ}\text{C}$  without jacket or insulating cracking.
- 2.4.2.4 Cable to meet or exceed the requirements of ANSI/EIA/TIA-568-B for Category 6A.
- 2.4.2.5 Cable shall be Systimax 2091SD plenum series.

## 2.5 Patch Panels

### 2.5.1 Category 6 Copper Patch Panel –

- 2.5.1.1 482 mm (19") rack mountable 48 port, 8-position Category 6 jack patch panel
- 2.5.1.2 Patch panels equipped with ports to accommodate 48 UTP modules.
- 2.5.1.3 RJ45 modules complete with insulation displacement contacts for termination of all eight cable conductors.
- 2.5.1.5 All patch panels to be **fully populated** with UTP modules.
- 2.5.1.5 Utilize GigaSPEED M2000-24 or M2000-48 patch panels c/w MGS400-003 outlets (workstation data) (Black) and MGS400-317 outlets (cross data) (Red).
- 2.5.1.6 Patch panel frame black in colour.

### 2.5.2 Category 6A Copper Patch Panel –

- 2.5.2.1 482 mm (19") rack mountable 48 port, 8-position Category 6 jack patch panel
- 2.5.2.2 Patch panels equipped with ports to accommodate 48 UTP modules.
- 2.5.2.3 RJ45 modules complete with insulation displacement contacts for termination of all eight cable conductors.
- 2.5.2.5 All patch panels to be **fully populated** with UTP modules.
- 2.5.2.5 Utilize Systimax 2U 760151779 360-IPR-1100A-E-GS6-2U-48 port Angled patch panels, c/w stuffer caps.
- 2.5.2.6 Patch panel frame black in colour.

- 2.5.3 Fiber Optic Patch Panel
- 2.5.3.1 482 mm (19") rack mountable.
- 2.5.3.2 Equip patch panels with LC (duplex) (quantity as shown on the drawings) multimode and singlemode adapter sleeves.
- 2.5.3.3 All patch panels must be equipped with high (double) density LC duplex modules, phosphor bronze for multimode and zirconia for single mode.
- 2.5.3.4 Fiber optic patch panels provided as part of this scope of work shall be Systimax 360G2-1U-MOD-SD (Panel) splicing fiber shelf c/w front cover for rack mounted applications, cassette (no pigtailed) and pigtailed.
- 2.5.3.5 Fiber optic patch panels provided as part of this scope of work shall be Systimax 360DP-12LC-LS (Fiber Modular Distribution Panel) splicing fiber shelf c/w front cover for rack mounted applications, cassette (no pigtailed) and pigtailed.
- 2.5.3.6 Provide blank strips required.

## 2.6 Backbone and Interlink Cables

- 2.6.1 Fiber Optic Cables - Backbone Singlemode
  - 2.6.1.1 Not Applicable
- 2.6.2 Fibre Optic Cables – Backbone Multimode
  - 2.6.2.1 Optical fibre cable construction of 50/125  $\mu\text{m}$  graded-index optical fibers to be of **aqua coloured jacket**.
  - 2.6.2.2 Cable to be formed into groups of six fibres each. Groups and individual fibers to be identified in accordance with ANSI/EIA/TIA-598.
  - 2.6.2.3 Groups assembled to form a single compact core and core is covered by a protective sheath.
  - 2.6.2.4 Sheath consisting of an overall jacket and one or more layers of dielectric material applied over the core.
  - 2.6.2.5 All test to be performed at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .
  - 2.6.2.6 Fiber optic cables to be as follows:
    1. Systimax Laszspeed 50/125 micron fiber Part # P-012-DS-5L- FSUAQ (12-fiber, Laszspeed optical fiber).
- 2.6.3 Fiber Optic Cables - Backbone Interlocking Armored Singlemode
  - 2.6.3.1 Optical fibre cable to be of **yellow coloured jacket**.
  - 2.6.3.2 Cable to be formed into groups of six fibres each. Groups and individual fibres to be identified in a accordance with ANSI/EIA/TIA-598.
  - 2.6.3.3 Groups assembled to form a single compact core and core is covered by a protective sheath.
  - 2.6.3.4 Sheath consisting of an overall jacket and one or more layers of dielectric material applied over the core.
  - 2.6.3.5 All test to be performed at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .
  - 2.6.3.6 Fiber optic cables to be Commscope P-006-DZ-8W-FSUYL series OS2 Plenum Rated Interlocking Armored Riser Cable, 6 strand.
  - 2.6.3.7 Fiber optic cables to be Commscope P-012-DZ-8W-FSUYL series OS2 Plenum Rated Interlocking Armored Riser Cable, 12 strand.
  - 2.6.3.8 Fiber optic cables to be Commscope P-144-DZ-8W-FMUYL series OS2 Plenum Rated Interlocking Armored Riser Cable, 144 strand.
  - 2.6.3.9 Provide cable clamp kit to ground metallic sheath of cable as required per manufacturer's direction.

- 2.6.4 Fiber Optic Cables - Backbone Interlocking Armored Multimode
- 2.6.4.1 Not Applicable

## 2.7 Patch Cords, Pigtails and Cross Connect Jumpers

- 2.7.1 Copper Patch Cords
  - 2.7.1.1 Category 6 UTP patch cords to have copper stranded conductors to assure adequate flex-life.
  - 2.7.1.2 Patch cords to be factory assembled and not site prepared.
  - 2.7.1.3 Patch cords to be a snagless type using a rubber housing for the connector.
  - 2.7.1.4 Patch cord to have characteristics of 100Ω Category 6 data cables and the minimum performance characteristics at 20°C that meet or exceed the requirements of ANSI/EIA/TIA-568A for Category 6.
  - 2.7.1.5 The patch cords shall be wired EIA-A to EAI-A with a one-to-one correspondence straight-through and terminated on both ends on 8-position Modular Long-Plugs (one end for pigtails).
  - 2.7.1.6 Colours:
    - purple (workstation data)
    - yellow (wireless)
    - blue (camera)
    - orange (BAS)
    - red (panel cross)
  - 2.7.1.7 Category 6 patch cords and pigtails are to be SYSTIMAX CPC3312-OBF001/CPC3312-OZF-001/CPC3312-09F001/CPC3312-06F001/CPC3312-07F001/CP3312-OBF010.
  - 2.7.1.8 Not Applicable
- 2.7.2 Category 3 Voice Cross-Connect Jumper
  - 2.7.2.1 Cross-Connect Wire for Analog and Voice to be CommScope, 1-pair 24 AWG.
- 2.7.3 Fibre Optic Patch Cords
  - 2.7.3.1 Two strand fibre optic patch cables
  - 2.7.3.2 Cables to meet same performance criteria as stated above for optical cables.
  - 2.7.3.3 Multimode LC to LC
  - 2.7.3.4 Patch cords positions (i.e. A & B) to be in accordance with ANSI/EIA/TIA-568A.
  - 2.7.3.5 **Colours: Aqua / Yellow**
  - 2.7.3.6 Factory terminated.
  - 2.7.3.7 Patch cords are to be Systimax FPCXLCLC32-RF007.
- 2.8 **1RMU Horizontal Cable Manager**
  - 2.8.1 Provide CPI 35441-701 1RMU wire managers where shown on the drawings.
- 2.9 **2RMU Horizontal Cable Manager**
  - 2.9.1 Provide CPI 35441-702 2RMU wire managers where shown on the drawings.
- 2.10 **Corrugated Tubing**
  - 2.10.1 Exposed cables are to be bundled and wrapped with corrugated loom tubing, as manufactured by Panduit.
- 2.11 **RJ45 to Ceiling Connector**
  - 2.11.1 RJ45 to Ceiling Connector to be Commscope MGS400-123 (Yellow).

END OF SECTION

## PART 3 - EXECUTION

### 3.1 Installation

- 3.1.1 The following minimum clearances from electrical and heat sources must be maintained when routing cables.

Item	Minimum Clearance
Motor	1.2 m (4'-0")
Transformers	1.2 m (4'-0")
Conduit and cables used for electrical distribution less than 1kV	0.3 m (1'-0")
Conduit and cables used for electrical distribution greater than 1kV	1.0 m (3'-0")
Pipes (gas, oil, water, etc.)	0.3m (1'-0")
HVAC (equipment, ducts, etc.)	15 cm (6")
Fluorescent Luminaires	12 cm (5")

- 3.1.2 Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Consultant and documented on as-built drawings.
- 3.1.3 Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Damaged cables shall be replaced by the Contractor without any additional compensation.
- 3.1.4 Ensure that all cable lengths are sufficient to allow for slack, vertical runs, cable necessary for splicing, wastage, connectorization and future moves.
- 3.1.5 Bush, ream and remove any sharp projections on all conduits. There must be a minimum of one spare pull string in each conduit.
- 3.1.6 Supply and install non-permanent CSA approved intumescent fire stopping, to cap all empty sleeves and around cabling passing through sleeves. All fire stopping must meet applicable Federal, Provincial and Local building codes.
- 3.1.7 When terminating copper cables remove cable jacket only enough to perform termination and untwist pairs only 13 mm (1/2") for Category 6 cables and 25 mm (1") for Category 3 cables.
- 3.1.8 Ensure ANSI/EIA/TIA-568A installation practices are followed. Consultant will determine quality of workmanship during installation. Cables that have not been properly combed and dressed will have to be redressed at the Contractor's expense.

### 3.2 Termination Requirements

- 3.2.1 Horizontal Data Termination Fields
- 3.2.1.1 At the Equipment Cabinet / Rack end, terminate Horizontal Distribution Data cables on rack mounted patch panels. Terminate all four (4) cable pairs.
- 3.2.1.2 Communications contractor shall patch owner supplied switches.
- 3.2.2 Horizontal Analog Termination Fields
- 3.2.2.1 At the Equipment Cabinet / Rack end, terminate Horizontal Distribution Analog cables on rack mounted patch panels. Terminate all four (4) cable pairs.



### 3.3 Horizontal Distribution

- 3.3.1 Pull all cables in a continuous run. No cable splices will be permitted.
- 3.3.2 When bundling Category 6/6A cables, comply with manufacturer's recommended bundling practices for Category 6/6A cables installation. Ensure that no cable bundle put excess pressure on the cable at any point which may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.
- 3.3.3 Neatly comb, bundle and tie-wrap all cables every three (3) feet. Utilize **Polytie style 1030 velcro nylon fasteners**, as manufactured by Polygon Wire Management Ltd. Note: plastic tie wraps are **unacceptable** during any phase of this project. **All cables bundled using plastic tie wraps will be replaced at contractor's cost.**
- 3.3.4 Follow proper installation and termination practices for Category 6/6A UTP cabling. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as a bend radius if no bend radius is specified. For fiber optic cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.
- 3.3.5 Secure and support cables every 1.2 m (4'-0") when running in free space.
- 3.3.6 Utilize all indicated and available cable pathways such as conduits, cable tray, raceways and furniture system channels except where otherwise noted. Exercise caution when pulling cables in such pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- 3.3.7 Inform Consultant immediately of any horizontal cable runs exceeding 90 m (295'-0").
- 3.3.8 Supply Caddy J Pro hangers, threaded rod extensions, cable supports, tie-wraps and any other miscellaneous hardware required to support horizontal cabling where conduit has not been provided. Anchors for Caddy hangers must not be drilled into post tensioned beams under any circumstances.
- 3.3.9 Bridal ring Caddy Fasteners and other alternates to 'J-hooks' or their equivalent may **not** be used to support the horizontal cabling.
- 3.3.10 Do not support cables to T-bar ceiling hangers or have any cables laying on ceiling tiles.
- 3.3.11 Wrap cables servicing systems furniture with corrugated tubing. Match colour with systems furniture manufacturer's power feed. Tubing to be butted so that no cables are exposed.
- 3.3.12 Cables shall be bundled on a **per** mounting frame / patch panel basis.

### 3.4 Backbone Distribution

- 3.4.1 Pull all cables in a continuous run. No cable splices will be permitted.
- 3.4.2 Install backbone cables in accordance with manufacturer's specifications ensuring that proper installation techniques are observed, and that the cable's maximum pull-force and maximum bend radii specifications are adhered to.

- 3.4.3 Utilize vertical pipe split mesh to support the weight of the cable at the top of the riser. Use a minimum of five (5) cable ties per floor to prevent side to side movement of cable. Ensure cable ties do not deform the cable jacket.
- 3.4.4 Neatly bundle, tie-wrap and route all riser cables such that copper data cables, copper voice cables and fibre optic cables are in separate bundles. Secure cable bundles to vertical and horizontal supports and neatly fasten to plywood backboards or termination racks/cabinets when routing cables to backbone cross-connects.
- 3.4.5 Utilize Polytie style 1030 velcro nylon fasteners, as manufactured by Polygon Wire Management Ltd. In the Computer room.
- 3.4.6 Follow proper installation and termination practices for Category 6 UTP cabling. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as a bend radius if no bend radius is specified. For fibre optic cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.
- 3.4.7 Utilize all indicated and available cable pathways such as conduits, cable tray, ducts raceways and furniture system channels except where otherwise noted. Exercise caution when pulling cables in such pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- 3.4.8 Terminate all pairs of cable and all strands of fibre optic cable at both ends, including all spares unless indicated otherwise.

### **3.5 Testing And Repairing**

- 3.5.1 Consultant must approve the testing procedure prior to testing commencing.
- 3.5.2 Consultant may request to be present during the initial testing period of all cables.
- 3.5.3 Upon completion of the testing by the Contractor, the Consultant will ask the Contractor to perform a random test of up to 10% of the cables.
- 3.5.4 All deficiencies must be corrected before Consultant will provide a certificate to release the Holdback on the project.
- 3.5.5 Horizontal and backbone cables are to be completed in accordance with the following test criteria. The testing must be completed on the Link Level (testing does not include patch and equipment cords). Testing is to be completed at both ends of the installed cable.
- 3.5.6 End to end testing for UTP copper shall be conducted for 100% of all pairs supplied and must be performed at 10 MHz, 50 MHz, 100 MHz, 155 MHz, 200 MHz, 250 MHz and 300 MHz for continuity, shorts, opens, grounds, crosses, wiring resistance, near-end cross-talk, attenuation, wire map, impedance and ACR as well as for the completeness and accuracy of the cable labeling scheme. All testing to be carried out with a Microtest Omni Scanner tester or Fluke DSP4000 incorporating the most recent software version. In addition, documentation shall be present to show length of the cable between the ICC cabinet / Radio Room / Telecom Room and the respective Work Areas. Each cable shall be tested in both directions.

- 3.5.7 All fiber cables (each strand) are to be tested for continuity and attenuation, including the connectors and adapters. (In practice continuity and attenuation can be combined, because if attenuation can be measured continuity exists).
- 3.5.8 Tests have to be in accordance with ANSI/TIA/EIA-526-14A and ANSI/TIA/EIA-568-A Standard, for both wavelengths 850 nm and 1300 nm (multimode) and 1310 nm and 1550 nm (singlemode).
- 3.5.9 Clean all connections and adaptors at the optical test points prior to taking measurements.
- 3.5.10 Test jumpers must be of the same fibre core size and connector type as the cable system and shall be 1 to 5 meters long.
- 3.5.11 Before installing the cable, test the cable on the reel for continuity.
- 3.5.12 Divide the end-to-end links into segments at each cross connect and measure the attenuation of each link segment. Note: connector pairs must be included as part of link segment including test cord connectors that mate with the link interface.
- 3.5.13 Calculate the individual attenuation values for segment in the path. The end-to-end link attenuation for multimode fibre must be less than 2.6dB @850nm and less than 6.2dB @1300nm for singlemode fibre.
- 3.5.14 The maximum accepted loss for a mated pair shall be no greater than 0.35dB. The maximum accepted loss utilizing a preconnectorized cable assembly (LC and MTP) shall be 1.3 dB or less.
- 3.5.15 Contractor to produce a test report based on the cable schedules. The report should indicate for each cable, when it was tested successfully and the signature of the technician that performed the test. A copy of the test report must be submitted to the consultants for approval. The entire report must be signed by an authorized person and certified by a Professional Engineer or RCDD for the Contractor at the end of the project. **Note: Test results must be verified by Commscope.**
- 3.5.16 Correct all cable faults. Splicing of any cables will not be permitted, for any reason, unless prior authorization is received in writing by the École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde Project Manager.
- Hard-copy test results should also be provided in tabular form.
  - Test results should be segregated into horizontal runs, inter-room runs, and patch cables by category and cable type.
  - Test results should be presented in ascending order in order to allow easy retrieval of any particular link.

### 3.6 Labeling

- 3.6.1 Adhesive cable labels to meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition, the labels shall meet the general exposure requirements in UL 969 for indoor use.
- 3.6.2 Self-laminating vinyl construction cable labels with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times. Hubbell Data Symbols

(PO702914) are to be used on each Data Jack along with the Alpha Numeric label for cable identification

- 3.6.3 Mechanically print labels using a laser printer and follow guidelines in ANSI/EIA/TIA-606 for colour codes. Handwritten labels are not permitted.
- 3.6.4 Labels should appear at the following locations:
- Each end of cable at maximum distance of 2" from the end of the sheath.
  - Front of voice and data cable termination fields.
  - Front of workstation faceplates.
- 3.6.5 Labels on connectors are to be mechanically printed and are to follow the guidelines in CSA-T528-93 for colour coding.
- 3.6.6 Labels used on the wall and system furniture outlets shall be White, Metalized Plastic Stickers.
- 3.6.7 Cable numbers are to be assigned by the communication contractor in accordance with these specifications.
- 3.6.8 All labels are to be as manufactured by Panduit. Provide Soft copy results to the Project Manager in Microsoft EXCEL format on USB drive.

### **3.7 Naming standards**

- 3.7.1 All cables will be labeled according to the École élémentaire Pierre-Elliott-Trudeau, Conseil Scolaire Viamonde naming standard. Naming standard will be provided at the time of installation.

END OF SECTION

**Construction Specification for  
Sodding**

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**TS 5.00.01            SCOPE**

This specification covers the requirements for the supplying, placing, and maintaining sod within the contract limits.

**TS 5.00.02            REFERENCES**

This specification refers to the following standards, specifications or publications:

**City of Toronto Specifications**

TS 5.10            Construction Specification for Growing Medium

**Canadian Nursery Landscape Association**

CNLA Canadian Standards for Nursery Stock

**TS 5.00.03            DEFINITIONS – Not Used**

**TS 5.00.04            DESIGN AND SUBMISSION REQUIREMENTS**

**TS 5.00.04.01        Delivery and Storage**

Schedule deliveries in order to keep storage at job site to a minimum without causing delay.

Deliver and store sod on pallets on site within 24 hours of being lifted.

During wet weather allow sod to dry sufficiently to prevent tearing during lifting and handling.

During dry weather protect sod from drying and water sod as necessary to ensure its vitality and prevent dropping of soil in handling. Dry sod shall be rejected.

Broken, dry, discoloured pieces shall be rejected by the Contract Administrator.

**TS 5.00.05            MATERIALS**

**TS 5.00.05.01        Nursery Sod**

The quality and the source of nursery sod supplied shall be according to the specifications for number one grade turf grass nursery sod as set out in the latest edition of *Canadian Standards for Nursery Stock*. It shall be Number One Kentucky Bluegrass or Kentucky Bluegrass/Fine Fescue cultivars or as specified in the Contract Documents.

The source of sod shall be approved by the Contract Administrator before it is used in the Contract. No other source shall be used without the approval of the Contract Administrator.

**TS 5.00.05.02        Sod Stakes**

Sod stakes shall be wooden pegs 17 x 17 x 300 mm or approved 200 mm long steel staples.

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**TS 5.00.05.03            Fertilizer**

Fertilizer shall be a complete synthetic slow release fertilizer with maximum 35 per cent water soluble nitrogen. Apply fertilizer at rates based on soil analysis recommendations.

**TS 5.00.05.04            Water**

Potable water shall be used, unless the Contractor provides testing results that demonstrate the water to be used is free of contaminants or impurities that would adversely affect the germination and growth of vegetation

**TS 5.00.05.05            Mesh**

Mesh shall be jute or synthetic plastic.

**TS 5.00.05.06            Herbicide**

Type, rate, and method of application subject to approval by the Contract Administrator, and shall be according to Toronto Municipal Code Chapter 612 Pesticides, Use of.

**TS 5.00.05.07            Topsoil**

Topsoil shall be 100 mm in depth and be Type 1 – Standard Mix according to TS 5.10.

**TS 5.00.06                EQUIPMENT – Not Used**

**TS 5.00.07                CONSTRUCTION**

**TS 5.00.07.01            Workmanship**

Keep site well drained. Clean up immediately any soil and debris spilled onto pavements and dispose of deleterious materials.

**TS 5.00.07.02            Preparation of Topsoil Substrate**

Verify that grades are correct. If discrepancies occur, notify the Contract Administrator and do not commence work until instructed by Contract Administrator

Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.

Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

Where new sod is to be installed in existing sodded areas not disturbed by construction, rototill the area, apply a topdressing of topsoil, and install sod as specified.

**TS 5.00.07.03            Laying of Sod**

Prior to sodding, obtain approval from Contract Administrator that finished grade and depth of topsoil are satisfactory.

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Lay sod within 36 hours of being lifted.

Sodding during excessively wet conditions, at freezing temperatures or over frozen soil is not acceptable.

Lay sod in rows, perpendicular to slope, and with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

Water sod immediately after laying to obtain moisture penetration into top 75 mm of topsoil/growing medium.

Provide adequate protection of sodded areas against erosion and mechanical damage. Remove protection after lawn areas have been accepted.

#### **TS 5.00.07.04            Layering of Pegged Sod**

Place mesh on top of topsoil on slopes steeper than 3H:1V. Secure mesh in place with wooden pegs or staples at maximum intervals of 600 mm. Cover with topsoil/growing medium.

Lay sod sections perpendicular to slopes greater than 4H:1V and secure with wooden pegs. Place pegs 3 per m, 100 mm below top edge of sod roll to prevent shifting of sod. Drive pegs flush with top of sod soil.

#### **TS 5.00.07.05            Maintenance of Sod**

Water the sodded areas in sufficient quantities and at frequency required to maintain soil under sod continuously moist to depth of 75 to 100 mm.

Cut grass when height is above 65 mm and maintain to a 60 mm – 100mm height. Remove clippings longer than 20 mm in length.

Maintain sodded areas weed free.

Fertilize sodded areas one month after sodding with fertilizer at rate per soil analysis recommendations. Postpone fertilizing until following spring if application falls within four week period to expected end of growth season.

Overseed with perennial rye and fescue grass blends (excluding creeping fescue) in the fall.

#### **TS 5.00.07.06            Maintenance Period**

The Contractor shall maintain the sod for 60 Days following completion of the sod placement. During this period, the Contractor shall ensure that all placed sod is kept healthy, actively growing and green in leaf colour. At the end of the 60-day period, the Contractor Administrator will inspect the placed sod for defects. Any defective sod shall be replaced at no extra cost to the City.



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Maintenance of the placed sod should be suspended during the winter dormant period (November 1 to April 30) and the 60-day maintenance period shall resume in the following spring after the winter dormant period.

The completed sod is subject to a general warranty period as specified in the Contract Documents, notwithstanding the 60-day maintenance period mentioned in this specification.

**TS 5.00.08                      QUALITY ASSURANCE**

**TS 5.00.08.01                  Performance Measure**

Sixty days after installation, the sod shall be green and show evidence of rooting into the underlying soil. Any areas of sod which fail to meet these requirements shall be rejected and the Contractor shall replace the rejected sod at no extra cost to the City.

Sodded areas will be considered meeting the performance measure provided that:

- 1) Sodded areas are properly established, healthy, actively growing, and green in leaf colour.
- 2) Sod is free of bare and dead spots and without weeds.
- 3) No surface soil is visible when grass has been cut to height of 40 mm.
- 4) Sodded areas have been cut minimum 2 times.
- 5) All placed sod shall be in the same location as originally placed and shall not have moved, eroded, slipped or slough. Lawns sodded after September 30 shall be accepted in the following spring one month after start of the growing season provided acceptance conditions are fulfilled.

**TS 5.00.08.02                  Failure to Meet Performance Measure**

If the completed work does not meet the performance measures, the Contractor shall re-apply the specified materials according to this specification. All replaced sod shall be subject to a further maintenance period of 60 consecutive days.

If the Contractor cannot apply or re-apply the sod due to site condition of for any reason, the Contractor shall maintain the site and control erosion until conditions permit application of the sod.

**TS 5.00.09                      MEASUREMENT FOR PAYMENT**

**TS 5.00.09.01                  Nursery Sod – Unstaked**

Measurement of nursery sod shall be by area in square metres (m<sup>2</sup>).

**TS 5.00.09.02                  Nursery Sod – Staked**

Measurement of nursery sod and stakes shall be by area in square metres (m<sup>2</sup>).

**TS 5.00.09.03                  Nursery Sod – Staked with Mesh**

Measurement of nursery sod, stakes and mesh shall be by area in square metres (m<sup>2</sup>).

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**TS 5.00.10****BASIS OF PAYMENT****TS 5.00.10.01****Nursery Sod – Unstaked – Item****Nursery Sod – Staked – Item****Nursery Sod – Staked with Mesh – Item**

Payment at the Contract Price for the above tender items shall be full compensation for all labour, Equipment and Material to do the work. Payment shall include the supplying and placing of topsoil, sod, watering, weeding, fertilizing and maintenance until Final Acceptance, as well as, sod replacement and water for sod when no separate item for payment exists for such work.

## Construction Specification for Planting

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## **TS 5.30.01 SCOPE**

This specification covers the requirements for the supply and installation of trees, shrubs, and perennials, groundcovers, ornamental grasses and the regular maintenance of plant material within the contract limits.

## **TS 5.30.02 REFERENCES**

This specification refers to the following standards, specifications or publications:

### **City of Toronto Specifications**

TS 5.10 Construction Specification for Growing Medium

### **City of Toronto Standard Drawings**

T-850.026 Planting Details and Sample Layouts

### **Canadian Nursery Landscape Association**

CNLA Canadian Standards for Nursery Stock

### **Agriculture Canada**

Plant Hardiness Zone Map – Zone 5

### **Society for Ecological Restoration – Ontario Chapter**

Native Plants Buyers Guidelines

## **TS 5.30.03 DEFINITIONS**

For the purpose of this specification, the following definitions apply:

**Certified Arborist** means they are designated and regulated by the International Society of Arboriculture (ISA).

**Pruning** means pruning is the horticultural or arboricultural practice involving the selective removal of certain parts of a plant, such as branches, buds, or roots.

## **TS 5.30.04 DESIGN AND SUBMISSION REQUIREMENTS**

### **TS 5.30.04.01 Plant Material**

Make arrangements for approval of plant material by the Contract Administrator at a time mutually agreed upon according to TS 5.30.07.01 herein. No work shall proceed without approval of the Contract Administrator.

Prior approval shall not invalidate rejection of stock at later inspection at site should it, in the Contract Administrator's opinion, prove defective, damaged or generally inappropriate.

All plants shall be according to the varieties specified in the plant list and be legibly tagged with their proper name and size. No substitutions will be accepted without written approval of the Contract Administrator

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Prior to installation, the Contractor shall advise the Contract Administrator in writing if in the Contractor's opinion any of the specified plant material will not perform according to the specifications. The City retains the right to direct the Contractor to proceed with the specified plant material including guarantee and as tendered.

Planting soil mix requirements shall be according to TS 5.10 and Type 4 – Bio Retention Mix, and Contract Documents.

Imported plant material shall be accompanied with the necessary permits and import licenses. Contractor is to conform to all federal and provincial regulations.

Tagged material to be purchased and secured for project.

Any additional expenses for re-sourcing and approval of plant material shall be at no extra cost to the City.

All plant material industry suppliers shall be considered for material supply, not only those having pre-existing or current supply accounts with the landscape contractor.

If plant material is undersized, plant quantities will increase according to the following schedule:

- (1) perennial / groundcover / ornamental grass 9 cm pot = (3) perennial / groundcover / ornamental grass plug (PL50)
- (1) 1 gal container perennial/groundcover = (3) perennial/groundcover 9 cm pots
- (1) 5 gal container shrub = (2) 3 gal container shrubs
- (1) 3 gal container shrub = (2) 2 gal container shrubs
- (1) 2 gal container shrub = (3) 1 gal container shrubs / grasses

Undersize nursery stock for trees will not be accepted.

#### **TS 5.30.04.02          Submittals**

Submit affidavits to certify that manufactured or processed materials supplied in bulk meet specified requirements.

Submit instructions on maintenance procedures to be followed after end of specified maintenance period.

Prior to planting, submit the following to be approved by the Contract Administrator and Urban Forestry:

- 1) Plant list including the source, scientific and common name, quantity, caliper, root ball size and root ball packaging specification for each plant
- 2) Plant schedule including dates scheduled for tagging, field digging, delivery and planting
- 3) Certification of plant quality from growing nursery confirming that plants tagged, field dug and shipped meet all requirements of the Canadian Nursery Stock Standard, 9th Edition
- 4) Maintenance plan and schedule for maintenance during warranty period.

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Prior to completion of the warranty period, submit the following to be approved by the Contract Administrator and Urban Forestry:

- 1) Maintenance log indicating the date and duration of every maintenance activity completed.
- 2) Plans for any maintenance activity that differ from the submitted maintenance plan and schedule, such as Integrated Pest Management (IPM), fertilizing or soil remediation, prior to undertaking such activities.
- 3) Plant list, plant schedule and certification of plant quality prior to any replacement planting.

### **TS 5.30.04.03            Product Delivery, Storage and Handling**

All materials shall be inspected by the Contractor for damage in transit. No defective material shall be delivered to the site. Material subsequently damaged shall be removed from the site immediately.

Label manufactured, processed or otherwise prepared materials that are packaged to indicate manufacturer, contents, weight, and a detailed description of the material. If delivered in bulk, submit affidavits giving information required as specified for labels and certifying that materials meet specified requirements. Store and protect fertilizer, limestone, bone meal, mulching materials, and similar products to prevent damage from moisture.

No plant shall be accepted when the ball of earth surrounding its root system has been cracked or broken prior to or during planting, or after the burlap, staves, ropes or platform required in transplanting have been removed.

Trees specified as W.B.—wire basket—shall have solid root balls wrapped with 140 gram burlap with no preservatives added. Root balls to have double thickness and be drum laced with 15 mm twine at 200 mm spacing.

Shrubs specified as B & B—ball & burlap—shall have solid root balls wrapped with 140 gram burlap with no preservatives added. Root balls under 460 mm diameter to have single thickness, and between 460 and 900 mm diameter size to have double thickness and be drum laced with 15 mm twine at 200 mm spacing.

Transport plants with branches tied to prevent damage, and padded to avoid abrasion from equipment. Protective materials and burlap wrap tied around base of tree trunk are to be removed from the tree prior to planting.

Trees are to be handled securely and with care to protect the bark and branches from mechanical damage. Trees must not be handled by the trunk.

Prevent drying out of roots, root balls, trunks, branches, and leaves of plants from time of removal at place of origin until they are planted. While temporarily stored at site, protect them with soil, or similar materials and keep moist. If stored for more than one hour between delivery and planting, store in a shaded location approved by the Contract Administrator, cover with soil or mulch, and keep root balls moist through frequent watering until trees are planted.

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#### **TS 5.30.04.04            Job Conditions**

**Field Measurements:** Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

Installation shall be done under suitable weather conditions and in a suitable growth season for each specified material, as noted below:

Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of acceptance.

- 1) Spring Planting: May–June.
- 2) Fall Planting: September–November.

**Weather Limitations:** Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements. Suspend work when the temperature is below 4°C, the wind velocity is over 32 km/hr, the ground or planting soil is frozen or wet, or the continuation of prevailing weather will damage plant materials, including sustained periods of above-normal high temperatures and precipitation.

#### **TS 5.30.05                MATERIALS**

##### **TS 5.30.05.01            Plant Material**

Type of root preparation, sizing, grading and quality shall be according to the Canadian Standards for Nursery Stock.

Source of plant material shall be grown in Zone 5 according to Agriculture Canada Plant Hardiness Zone Map. Native plants to be sourced from nurseries within 100 km of Toronto, unless otherwise approved by the City.

Plant material shall be freshly dug—at a time of year that is horticulturally acceptable for the species—free of disease, die-back, insects, defects or injuries and structurally sound with strong fibrous root system and densely foliated, root pruned regularly, but not later than one growing season prior to arrival on site.

Trees shall be with straight trunks, well and characteristically branched for species. Container grown trees shall not be permitted for planting, unless approved by the Contract Administrator prior to purchase. Contractor to advise nurseries that trunk flare must be exposed above root ball before arrival on site. Trees that fail to meet this requirement shall be rejected by the Contract Administrator. Where the Contract Administrator approves the removal of any excess soil on top of the root ball shall be at no extra cost to the City and the 2-year warranty remains.

- 1) Provide healthy stock, grown in a nursery and free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant.



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- 2) Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified.
  - 3) The form and density of the crown shall be typical for a young specimen of the species or cultivar pruned to a central and dominant leader.
  - 4) The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Plants shall not show signs of prolonged moisture stress or over watering as indicated by wilted, shriveled, or dead leaves.
  - 5) Shoot growth – length and diameter – throughout the crown should be appropriate for the age and size of the species or cultivar. Plants shall not have dead, diseased, broken, distorted, or otherwise injured branches.
  - 6) Main branches shall be distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.
  - 7) Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 25 mm above the branch union.
  - 8) The attachment of the largest branches – scaffold branches – shall be free of included bark.
  - 9) Tree trunks shall be relatively straight, vertical, and free of wounds that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks – fungal fruiting bodies, wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions – mechanical injury.
  - 10) All graft unions, where applicable, shall be completely closed without visible sign of graft rejection. All grafts shall be visible above the soil line.
  - 11) Roots shall be free of scrapes, broken or split wood.
  - 12) The root system shall be free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents.
  - 13) A minimum of three structural roots reasonably distributed around the trunk – not clustered on one side – shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.
  - 14) The root collar shall be within the upper 50 mm of the substrate/soil. Two structural roots shall reach the side of the root ball near the top surface of the root ball.
  - 15) The root system shall be free of stem girdling roots over the root collar or kinked roots from nursery production practices

Measure plants with branches in normal position, finish grade to top of main body of plant, not from branch tip to branch tip or from root base to branch tip. Caliper dimension shall refer to diameter of trunk measured 300 mm above ground in original growing state.

Plants larger than specified shall be accepted without liability to extra charges if approved by the Contract Administrator, and they meet all specified requirements for their size.

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Collected plants, those dug from native stands, wood lots, orchards or neglected nurseries, and having received no cultural maintenance, will not be accepted.

Plant varieties are specified in a plant schedule on the plan, and all substitutions must be approved by the Contract Administrator prior to ordering plant material. In case of discrepancy in quantity between the plant schedule or unit price schedule, the plan shall take precedence.

**TS 5.30.05.02          Planting Soil**

Planting soil shall be according to TS 5.10.

**TS 5.30.05.03          Water**

Potable water shall be used unless the Contractor provides testing results that demonstrate the water to be used is free of contaminants or impurities that would adversely affect the germination and growth of vegetation.

**TS 5.30.05.04          Tree Guards**

Suppliers shall install an Arbor Guard™ tree guard, or pre-approved equivalent, around each newly planted tree. If required, use more than one guard to ensure that the entire base of the tree is protected. The cost of installation shall be included in the unit price of the tree. Proof of purchase will be required. The Supplier shall replace or reinstall defective guards for the duration of the warranty period. Tree guards shall remain onsite at the end of the warranty period.

**TS 5.30.05.05          Root Barrier**

Root barrier—root diversion device—shall be a geo-composite membrane to prevent root penetration under hard boulevard surfaces. The material shall be impermeable and ribbed with a thickness of 1 – 2 mm. Provide sample and proof of source to the Contract Administrator for approval prior to delivery and installation.

**TS 5.30.05.06          Mulch**

Planting beds shall be a blend of aged bark and compost materials. Provide sample and proof of source to the Contract Administrator for approval prior to delivery and installation. For compost requirements, see TS 5.10.

Tree planting openings or planting beds in hard boulevard surface areas shall be a hardwood blend or finely shredded pine bark mulch pre-blended with an erosion control organic tacifier. Provide sample and proof of source to the Contract Administrator for approval prior to delivery and installation. For compost requirements, see TS 5.10.

A low growing sedum mat or similar low growing, low maintenance groundcover option. Provide sample and proof of source to the Contract Administrator for approval prior to delivery and installation.

For mulch requirements in bioretention areas, see TS 5.10.

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**TS 5.30.05.07          Soil Amendments**

Soil amendments shall refer to soil test report recommendations, according to TS 5.10.

**TS 5.30.05.08          Anti-desiccant**

Anti-desiccant shall be an emulsion to form permeable film over plant surfaces and mixed according to manufacturer's directions.

**TS 5.30.06              EQUIPMENT – Not Used**

**TS 5.30.07              CONSTRUCTION**

**TS 5.30.07.01          Pre-planting Operations**

All plant material shall be acceptable to the Contract Administrator. Contractor shall:

- 1) Arrange for nursery approval of trees. Contractor to source trees upon Contract award, as trees are a long lead item.
- 2) Contractor to provide a schedule of suppliers for plant stock showing supplier, species and size, as well as a purchase order showing purchase arrangements.
- 3) All trees must be planted according to the Contract Drawings, approved by Urban Forestry, and must arrive on site in balled and burlapped condition with a minimum caliper of 70 mm or as specified in Contract Drawings.

Unwrap and cut away top one half of jute wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.

Each tree shall have the burlap and wire cage opened and soil brushed away until the first proper root is found, indicating the top of the root ball. In planting instructions for the tree, this level will be considered the top of root-ball.

- 4) Arrange for approval sample of each shrub type on site, prior to general order and delivery.

Properly prune damaged roots and branches from plant material prior to planting.

Ensure that subgrade preparation and drainage is satisfactory for plant material growth.

Drain test shall ensure adequate subsoil drainage by filling bottom one-third of tree pit with water and checking for complete drainage after 24 hours. Obtain approval of drain test from the Contract Administrator prior to planting and backfilling.

**TS 5.30.07.02          Excavation and Preparation of Planting Beds**

Preparation of planting beds shall be according to TS 5.10 and as specified in the Contract Documents.

For individual planting holes:

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- 1) Stake out location and obtain approval from the City prior to excavating.
  - 2) Excavate to depth and width as specified in the Contract Documents
  - 3) Scarify sides and break up soil at bottom of planting hole to a depth of 200 mm, or as specified in the Contract Documents.
  - 4) Remove water which enters excavations prior to planting. Notify the Contract Administrator if water source is ground water.

For requirements for using existing topsoil/growing medium for planting, see TS 5.10.

Mix topsoil/growing medium and amendments just before planting, but not when frozen or muddy. Do not stockpile more than two days.

Excavate plant pits to allow at least 150 mm of planting soil under root ball, or as specified in the Contract Drawings.

When planting in late fall or early spring, prevent freezing of bottom of plant pits.

Provide further excavation and additional planting soil to ensure adequate drainage for survival of the plants.

Install root barrier to the full depth of the planting area, and as shown on the Contract Drawings.

Placing of growing medium shall be according to TS 5.10.

Fertilizer shall be applied during the final operation of fine grading, but not longer than one week prior to planting, as per the recommendations in the soil analysis report.

### **TS 5.30.07.03          Planting**

Final placement of shrubs shall be approved by the Contract Administrator prior to backfilling with growing medium.

Final placement of trees shall be approved by the Contract Administrator prior to excavation for tree planting.

Any tree found planted with the first proper root more than 2.5 cm below planting level will be rejected and require replacement or replanting.

For container stock or root balls in non-biodegradable wrapping, remove entire container or wrapping without damaging root ball prior to planting.

Plant material to be planted vertically in locations as indicated.

Trees to be oriented with southern exposure as marked by the nursery, or as directed by the Contract Administrator to give best appearance on site.

Trees to be planted at a level that places trunk flare above finished grade, and as specified in the Contract Drawings.

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For trees and shrubs:

- 1) Backfill growing medium in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.
- 2) Form watering saucer as indicated on details.

Planting details shall be according to T-850.026.

Water plant material thoroughly. After soil settlement has occurred, fill with soil to finish grade. Dispose of burlap, wire and container material off site.

#### **TS 5.30.07.04 Mulching Planting Beds**

Ensure soil settlement has been corrected prior to mulching.

Provide continuous layer of mulch for all shrub beds.

Ensure ground is not frozen prior to mulching.

#### **TS 5.30.07.05 Pruning**

Any tree pruning must be undertaken by a certified arborist. Prior to pruning, submit the name and credentials of the certified arborist to the Contract Administrator and a copy furnished to urban Forestry.

Shrubs shall be pruned according to proper arboricultural practices. Make pruning cuts smooth and clean just outside the branch collar. Leave no stubs. Cut back cambium to living tissue where cuts are made at bruises, scars and other injuries. Ensure that pruning cuts are shaped to prevent the retention of water.

#### **TS 5.30.07.06 Maintenance During Establishment Period**

Perform the following maintenance operations from time of planting:

- 1) Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
- 2) For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
- 3) Remove weeds monthly.
- 4) Replace or re-spread damaged, missing or disturbed mulch.
- 5) Where mulch is in place, remove and replace in spring after soil thaws and warms up. Top up as necessary to maintain a 25–50 mm layer depth.
- 6) Apply pesticides according to federal, provincial and municipal regulations as and when required to control insects, fungus and disease. Obtain written product approval from Urban Forestry prior to application.

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- 7) Remove dead or broken branches from shrubs and herbaceous material, according to proper horticultural practice.
  - 8) Remove dead or broken branches from trees according to proper arboricultural practice. Any such pruning is to be performed by a certified arborist.
  - 9) Keep trunk protection in proper repair and adjustment.
  - 10) Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

#### **TS 5.30.07.07 Acceptance, Adjustment and Replacement**

At time of Final Acceptance and again at termination of Warranty Period, Work shall be inspected by the Contract Administrator and adjustments and replacements shall be made according to the following:

- 1) Commencement of Warranty Period is predicated on written acceptance by the Contract Administrator.
- 2) Adjustment and replacement work shall be performed with materials of same size, variety and quality of material replaced.
- 3) Replacement work shall be done under an additional Warranty Period of the same length and conditions as described in this specification. It shall date from time of the Contract Administrator's approval of replacement work.
- 4) Replace plant stock that in the opinion of the Contract Administrator is dead, or not in satisfactory growing state, or does not meet specification requirements. Remove dead stock immediately. Replace stock at proper time during planting season. At the discretion of the Contract Administrator, unacceptable plant material may be left, its guarantee period extended, and again inspected next planting season. At this time, the Contract Administrator will decide if replacement will be made and the guarantee extended accordingly.
- 5) For repair of settled growing medium, see TS 5.10.

#### **TS 5.30.07.08 Regular Maintenance During Warranty Period**

Work shall include maintenance of installations to ensure both satisfactory aesthetic upkeep and a vigorous and healthy growth until the end of the Warranty Period.

For plant material and planting areas such as planters, tree planting areas and beds: pruning; cultivating; hand weeding; mulching; litter and debris removal, resetting to proper grade or to upright positions; spraying to keep free from pests, insects and disease; and barriers to prevent damage by persons or animals.

Inspect protective tree surrounds such as tree fences, tree grates, planter curbs and tree guards for damage or graffiti, and for any discontinuity between planting sites and walking surfaces that could create tripping risks. Repair immediately or secure site until repairs can be made, notify Contract Administrator and record repairs in maintenance log.

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Litter removal shall take place every two weeks. Weeds shall not exceed 150 mm in height. Annual spring and fall clean-ups shall be completed, including seasonal pruning and cutting back of vegetation, removal of dead or excess foliage and debris, and general preparation of beds for the upcoming season.

All plant material installed under this section is to be watered for the duration of the Warranty Period to ensure healthy, vigorous plant growth at all times. Watering is to be coordinated in order to prevent over and/or under watering. Contractor is responsible for ensuring adequate watering of plant material during Warranty Period.

Water tree and shrub beds to ensure saturation of full depth of planting soil. Care must be taken to avoid over-watering in the event of slow draining subsoil conditions.

Top up mulch as necessary to maintain a 25–50 mm minimum layer depth.

## **TS 5.30.08                    QUALITY ASSURANCE**

### **TS 5.30.08.01                Warranty**

All plants shall be guaranteed for a period of two years following written acceptance in accordance with the General Conditions of the Contract and as modified by this section, and shall be alive and in vigorous growth at the end of the Warranty Period.

Less than 30 Days prior to frost or after October 15, whichever comes first, the start of warranty does not start until the following spring, 30 Days after start of growing season.

All plant material that in the opinion of the Contract Administrator is not in a healthy growing condition shall be replaced by the Contractor at no extra cost to the City, prior to terminating their responsibilities under this Contract.

All plant material that in the opinion of the Contract Administrator has not survived the first winter—based on a site inspection by the Contract Administrator in early spring—shall be replaced by the Contractor within two weeks of notification by the Contract Administrator.

Seasonal timing of all other replacement plantings shall be at the discretion of the Contract Administrator, based on an evaluation of the original planting and replacement planting conditions.

All replacements shall be plants of the same size and variety as specified in the Contract Documents. The cost shall be borne by the Contractor, except for possible replacement resulting from theft, vandalism, or carelessness on the part of others. The Contract Administrator shall be the sole judge in case of dispute regarding responsibility for replacement of plant material.

## **TS 5.30.09                    MEASUREMENT FOR PAYMENT**

### **TS 5.30.09.01                Perennial, Ground Cover, Ornamental Grass, 9 cm Pot**

For measurement purposes, a count shall be made of the number of 9 cm pot(s) installed.

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**TS 5.30.09.02 Perennial and Ground Cover, 1 Gallon**

For measurement purposes, a count shall be made of the number of one-gallon containers(s) installed.

**TS 5.30.09.03 Shrub, 5 Gallon**

For measurement purposes, a count shall be made of the number of 5-gallon containers(s) installed.

**TS 5.30.09.04 Shrub, 3 Gallon**

For measurement purposes, a count shall be made of the number of 3-gallon containers(s) installed.

**TS 5.30.09.05 Shrub, 2 Gallon**

For measurement purposes, a count shall be made of the number of 2-gallon containers(s) installed.

**TS 5.30.09.06 Tree, 70 mm Caliper**

For measurement purposes, a count shall be made of the number of 70 mm caliper tree(s) installed.

**TS 5.30.09.07 Mulch**

Measurement of mulch shall be measured by area in square metres (m<sup>2</sup>).

**TS 5.30.10 BASIS OF PAYMENT**

- TS 5.30.10.01 Perennial, Ground Cover, Ornamental Grass, 9 cm Pot – Item**  
**Perennial and Ground Cover, 1 Gallon – Item**  
**Shrub, 5 Gallon – Item**  
**Shrub, 3 Gallon – Item**  
**Shrub, 2 Gallon – Item**  
**Tree, 70 mm Caliper – Item**

Payment at the Contract Price for the above tender items shall be full compensation for all labour, Equipment and Material to do the Work.



**Amendment to OPSS.MUNI 772 (Apr 2019) –  
Construction Specification for  
Chain-Link Fence**

**OPSS 772.05 MATERIAL**

**OPSS 772.05.01 Chain-Link Fence**

Subsection 772.05.01 of OPSS.MUNI 772 is amended by the addition of the following:

The width and type of fence fabric shall be as specified in the Contract Documents.

The diameter of the posts and rails shall be as specified in the Contract Documents.

The diameter of the diagonal wire brace and the bottom wire shall be 5 mm.

**OPSS 772.07 CONSTRUCTION**

**OPSS 772.07.02.04 Top Rails, Top Wires, and Bottom Wires**

Clause 772.07.02.04 of OPSS.MUNI 772 is amended by deleting the reference to top wire in the first, second and fifth sentence and replacing it with the following:

Top rails shall be installed as specified in the Contract Documents.

Top rails shall be fastened securely to line post tops using waterproof caps.

In sag locations, drill the post and cap and fasten with a self-tapping screw to ensure a secure fit.

Top rails shall be fastened to terminal posts with centre bands.

Bottom wires shall be stretched tight and securely fastened to terminal posts with turnbuckles and centre bands.

One turnbuckle is to be used between terminal posts.

**OPSS 772.07.02.04 Top Rails, Top Wires, and Bottom Wires**

Clause 772.07.02.04 of OPSS.MUNI 772 is amended by the addition of the following sentence:

The top wire is to be replaced by a top rail conforming to the same material standards as the posts.

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**OPSS 772.09            MEASUREMENT FOR PAYMENT**

**OPSS 772.09.01.01   Chain-Link Fence**

Clause 772.09.01.01 of OPSS.MUNI 772 is deleted in its entirety and replaced with the following:

Measurement of chain-link fence is along the contour of the ground for the actual length of fence erected and shall not include gate openings.



**CONSTRUCTION SPECIFICATION FOR  
CHAIN-LINK FENCE**

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**772.01 SCOPE**

This specification covers the requirements for the installation of chain-link fence.

**772.01.01 Specification Significance and Use**

This specification has been developed for use in municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

## **772.01.02 Appendices Significance and Use**

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

## **772.02 REFERENCES**

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

### **Ontario Provincial Standard Specifications, Construction**

OPSS 904 Concrete Structures

### **Ontario Provincial Standard Specifications, Material**

OPSS 1541 Chain-Link Fence Components

### **CSA Standards**

W59-13 Welded Steel Construction (Metal Arc Welding)

### **ASTM International**

A 123/A 123M-17	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 780/A 780M-09 (2015)	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
B 209-14	Aluminum and Aluminum-Alloy Sheet and Plate

For the purpose of this specification, the following definitions shall apply:

**Barbed Wire** means the twisted longitudinal wires, termed line wires, to which the barbs are attached.

**Barbed Wire Arm** means the metal arm to support the barbed wire.

**Bottom Wire** means the wire installed at the bottom of fence and fastened to the bottom of the fence fabric and extending throughout each section of fence between terminal posts.

**Brace Band** means a symmetrically formed strip of metal shaped to fit around a post and used with a carriage bolt and nut to attach the rail end or brace rail end to the post. Also, used for attaching barbed wire, tension wire, and other items to a terminal post.

**Brace Rail** means a tubular or fabricated steel section used for bracing terminal posts.

**Corner Post** means a terminal post when the direction of the line of fence changes in two or more directions.

**Diagonal Brace Wire** means the wire used for bracing terminal posts.

**End Post** means the fence post positioned at the ends of a section of fence.

**Fence Post** means an upright tubular or fabricated steel member for supporting fencing material.

**Fitting** means the mechanical connection of various designs, shapes, and metals to join fence components into an integral structure.

**Gatepost** means a terminal post on each side of a gate forming a gateway.

**Hog Ring** means a preformed open wire clip designed to close up into a ring to secure chain-link fabric to horizontal top and bottom wires.

**Knuckled** means the type of selvage obtained by interlocking adjacent wire ends in pairs and then bending the wire ends back into a closed loop.

**Line Post** means the fence post spaced at regular intervals between terminal posts throughout each section of fence.

**Line Post Cap** means a cap or top with a loop or hole used to position the top rail or top wire on top of the line posts. It also prevents water from entering the tubular post.

**Marcelled Tension Wire** means a type of wire manufactured with either a uniform helix or a series of waves put into the wire to facilitate tensioning the wire when installed to support the top or bottom of the chain-link fence fabric.

**Post Sleeve** means a specified length of tube or pipe set into a concrete retaining wall into which fence posts are placed.

**Rail End** means a cup-shaped fitting used with a brace band to connect the top rail or brace to a post.

**Selvage** means the edge finish on woven chain-link fabric joining pairs of pickets. The selvage may be knuckled or twisted.

**Straining Post (or Pull Post)** means a terminal post in a line of fence to brace a long stretch or to effect a change in elevation along a fence line.

**Tension Band** means an offset strip of metal shaped to fit around the terminal post and used with a carriage bolt and nut to attach the tension bar to the post.

**Tension Bar** means the bar used with tension bands to secure the fence fabric to a terminal post.

**Terminal Post** means end, gate, corner, and straining post.

**Terminal Post Cap** means a cap atop a post (end, gate, corner or straining post) that prevents water from entering the tubular post.

**Top Rail** means a tubular or fabricated steel section continuously joined by means of sleeves or couplings throughout all sections of fence extending between terminal posts.

**Top Rail Sleeve** means a fitting used to join two pieces of top rail when swedged top rail is not used.

**Top Wire** means the wire installed at the top of fence and extending continuously throughout all sections of fence between terminal posts.

**Twisted** means the type of selvage obtained by interlocking adjacent wire ends in pairs and then twisting the wire at least two turns with the wire ends above the twist.

**Wire Ties** means the wire used to tie chain-link fence fabric to line posts, bottom wires, and top rails or top wires.

## **772.05 MATERIALS**

### **772.05.01 Chain-Link Fence**

Chain-link fence components shall be according to OPSS 1541.

### **772.05.02 Concrete**

Concrete shall have a nominal minimum 28-Day compressive strength of 20 MPa.

## **772.07 CONSTRUCTION**

### **772.07.01 Site Preparation**

Prior to the commencement of fencing operations, all debris shall be removed and ground undulations shall be corrected along the fenceline to obtain a smooth and uniform gradient.

All trees, stumps, and brush along the fenceline shall be cut off at ground level and all logs and overhanging branches that interfere with the installation of the fence shall be removed.

**772.07.02 Chain-Link Fence**

**772.07.02.01 General**

Chain-link fence shall be installed at locations specified in the Contract Documents.

Survey reference points or permanent property boundary markers shall not be disturbed or moved without the authorization of the Contract Administrator. When it is necessary to set posts adjacent to such points, the posts shall be placed on the roadway side of the property line as close as feasible to the monuments or markers.

**772.07.02.02 Post Installation**

**772.07.02.02.01 General**

All posts shall be installed plumb and to the depth specified in the Contract Documents.

Posts shall be cut to the required height above the ground to present a smooth and uniform profile. Line post spacing shall be in equal horizontal distances with a maximum of 3,000 mm between line posts.

All posts shall be fitted with waterproof metal caps designed to fit and fasten securely over the posts. All line post caps shall carry either the top rail or top wire as specified in the Contract Documents.

Corner posts shall be installed at horizontal deflections in the fence line of 10 degrees or more.

Straining posts shall be installed at equal intervals not exceeding 150 m. Additional straining posts shall be installed when changes in vertical alignment of the fence exceed 30 degrees.

**772.07.02.02.02 Posts On Concrete Barrier**

All posts installed on concrete barrier shall be according to the Contract Documents.

Each post shall be fabricated with a welded steel base plate grade 300W, hot dip galvanized according to ASTM A 123, and according to the Contract Documents. All welds shall be to a low hydrogen classification according to CSA W59. Manual electrodes shall be E7015, E7016, or E7018. All welds shall be continuous.

**772.07.02.02.03 Footings**

All posts shall be installed according to the Contract Documents.

Concrete placing, curing, and protection from the elements shall be according to OPSS 904.

**772.07.02.03 Bracing**

A brace rail or brace wire shall be placed diagonally across the panel at all ends and gateposts. Corner and straining posts shall be supported with diagonal braces placed on both sides of the post. The higher end of the diagonal brace shall be connected at the terminal post.

End fittings shall be secured by a 6 mm bolt placed through the fitting and braced at both ends of the brace.

#### **772.07.02.04 Top Rails, Top Wires, and Bottom Wires**

Top rails or top wires shall be installed as specified in the Contract Documents.

Top rails or top wires shall be fastened securely to line post tops using waterproof caps.

In sag locations, the post and cap shall be drilled and fastened with a self-tapping screw to ensure a secure fit.

Top rails shall be fastened to terminal posts with centre bands.

Top and bottom wires shall be stretched tight and securely fastened to terminal posts with turnbuckles and centre bands.

One turnbuckle shall be used between terminal posts.

#### **772.07.02.05 Fence Fabric**

Fence fabric shall not be installed until the concrete footings have cured for a minimum of 5 Days.

The fabric shall be stretched tight and securely fastened to terminal posts with steel tension bars and steel or aluminum tension bands. The longitudinal axis of the diamond pattern shall be perpendicular to the slope of the top rail or top wire.

The fabric shall be placed on the side of the post nearest the roadway with the barbed edge at the top, except on curves of 50 m or smaller radius, the fabric shall be placed on the side of the post away from the centre of the curve.

The fabric shall be securely fastened to the line posts, bottom wire, and top rail or top wire with wire ties. The fabric shall not be fastened to any diagonal braces.

Manually fastened round wire ties shall engage one strand of the chain-link fence fabric with one end of the tie by wrapping it with two 360 degree turns and then wrapping the body of the tie around the post or top rail a minimum of 180 degrees. The remaining end of the tie shall be secured to the second strand of the chain-link fence fabric by wrapping it with two 360 degree turns. The fabric and the main body of the tie shall be drawn tightly to the rail or post.

Power fastened wire ties shall engage two strands of the chain-link fence fabric at a diamond joint closest to the post or top rail. The manufacturer's installation instructions shall be followed to complete the operation. The ends shall be twisted three full twists or one and one half machine turns. The end of the tie shall be positioned on the post or rail so that it is parallel to the chain-link fence fabric.

The ends of wire ties shall not protrude beyond the vertical plane on either side of the chain-link fence fabric. Protruding ends of wire ties shall be removed.

The hog rings on top and bottom wires shall be installed according to the Contract Documents.

#### **772.07.02.06 Barbed Wire**

Barbed wire shall be installed when specified in the Contract Documents. The barbed wire shall be pulled taut to remove all slack and shall be firmly installed in the slots of the barbed wire arms. The ends of the barbed wire shall be securely connected at the terminal posts with brace bands. Barbed wire arms shall be installed with the arm pointing away from the roadway.



### **772.07.03 Gates**

Gates shall be installed at locations and of the type and size as specified in the Contract Documents.

#### **772.07.03.01 Gate Installation**

Gates shall be constructed with the fabric on the side furthest from the roadway with the barbed edge at the top.

All gates shall have a chain hook to hold gates open and double gates shall have a steel gate centre rest with a drop bolt for the closed position.

The surface grade within the required gate sweep area shall be low enough to permit free movement of the gate.

#### **772.07.04 Marking**

Identification plates, provided by the material supplier, shall be securely attached to the completed fence installation at the following intervals:

- a) At the start and end of each fence installation.
- b) At a maximum interval of 300 m.

The fence identification plate shall be located within 300 mm of a terminal post with the top of the plate located approximately 300 mm from the top of the fence fabric. The maximum dimensions of the plate shall be 200 by 200 mm. The plate shall be made from 0.81 mm thick anodized aluminum sheet according to ASTM B 209 series 1100 or 5005-H34.

Each fence identification plate shall be engraved with the following information:

- a) Contract number.
- b) Name or trademark of fence Subcontractor.
- c) Name or trademark of fence supplier (i.e., supplier(s) of fence fabric and posts)
- d) Date of completed installation (i.e., yyyy-mm).

The height of the letters and numerals shall be within the range of 6 to 32 mm.

#### **772.07.05 Zinc Coating Repairs**

Cut ends, field drilled holes, and damaged areas of hot dip galvanized coatings on galvanized components shall be repaired according to ASTM A 780.

#### **772.07.06 Site Restoration**

After fence installation, the site shall be cleaned and trimmed and the ground restored to a neat and original condition existent prior to the fencing operations.

#### **772.07.07 Management of Excess Material**

Management of excess material shall be according to the Contract Documents.

**772.08 QUALITY ASSURANCE**

**772.08.01 Construction**

The Contract Administrator may perform a spot visual inspection to determine conformance with the workmanship, design, and dimensional requirements of this specification.

Failure to conform to the specification may result in a partial or complete inspection of the installation and removal and replacement of all defective workmanship or materials.

**772.08.02 Material Certification**

Certificates of compliance for each fence component used in the installation shall be provided to the Contract Administrator. The certificate of compliance shall indicate that the material was manufactured, sampled, tested, and inspected in accordance with the reference specification and has been found to meet the requirements.

Each certificate of compliance shall include the following information typed on company letterhead:

- a) Manufacturer's name or trademark.
- b) General description of the component.
- c) Reference specification for material (e.g., CGSB 138.1 Fence Fabric for Chain-Link Fence).
- d) Signed and dated by the manufacturer's authorized representative.

All certificates of compliance shall be assembled and submitted to the Contract Administrator prior to completion of the Work.

**772.08.03 Material Sampling**

The Contract Administrator may obtain and test samples to ensure compliance with the specifications. Products represented by the test samples that are not in compliance shall be removed from the Work Area and replaced.

**772.09 MEASUREMENT FOR PAYMENT**

**772.09.01 Actual Measurement**

**772.09.01.01 Chain-Link Fence**

Measurement of chain-link fence shall be by length in metres along the contour of the ground for the actual length of fence installed and shall include gate openings.

**772.09.01.02 Gates**

For measurement purposes, a count shall be made of the number of gates installed, regardless of the size and type. Double gates shall be counted as one gate.

**772.09.02 Plan Quantity Measurement**

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

**772.10 BASIS OF PAYMENT**

**772.10.01 Chain-Link Fence - Item  
Gates - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

**772.10.02 Removals and Replacements**

Costs associated with any required removals and replacements of defective workmanship or materials shall be the Contractor's responsibility at no cost to the Owner.

**Appendix 772-A, April 2019  
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

**Note:** This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

**Designer Action/Considerations**

The designer should specify the following in the Contract Documents:

- Chain-link fence locations. (772.07.02.01)
- Locations of top rail or top wire to be used. (772.07.02.02.01)
- Barbed wire locations. (772.07.02.06)
- Gate locations, type, and size. (772.07.03)

The designer should consider the placement of the fence fabric in relation to the post when the fence is located between two roadways and when snow loading from ploughing operations could separate the fence fabric from the post, (e.g., freeway and service road).

When chain-link fence is located adjacent to a highway, a top rail represents a potential spearing hazard. The default installation method will be to install chain-link fence with top wire. For those installations where the chain-link fence will be installed in a non-roadside installation (e.g., park, recreation facility, storm water management facility, etc.), when, as a minimum, the chain-link fence is located beyond the clear zone, the designer may specify a top rail when desired. (772.07.02.02.01 and 772.07.02.04)

See MTO Roadside Design Manual for additional information.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

**Related Ontario Provincial Standard Drawings**

OPSD 972.101	Fence, Chain-Link, Component - Barbed Wire
OPSD 972.102	Fence, Chain-Link, Component - Gate
OPSD 972.130	Fence, Chain-Link, Installation - Roadway
OPSD 972.131	Fence, Chain-Link, Installation - Concrete Barrier
OPSD 972.132	Fence, Chain-Link, Details and Table