



**CITY OF KITCHENER**  
**MILL COURTLAND COMMUNITY CENTRE ADDITION**  
**216 MILL STREET, KITCHENER, ON.**  
**“ISSUED FOR TENDER ”**  
**Q25-020**

**Project 24015**

**DATE** FEBRUARY 27, 2025



**BARRY BRYAN ASSOCIATES**  
*Architects, Engineers, Project Managers*

**250 Water Street**  
**Suite 201**  
**Whitby, Ontario**  
**Canada**  
**L1N 0G5**

Telephone: 905 666-5252  
Toronto: 905 427-4495  
Fax: 905 666-5256  
Email: [bba@bba-archeng.com](mailto:bba@bba-archeng.com)  
Web Site: [www.bba-archeng.com](http://www.bba-archeng.com)

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A001	OBC Matrix and Life Safety Plan	4		Feb. 27, 2025
A101	Overall Site Plan	6		Feb. 27, 2025
A102	Part Site Plan	7		Feb. 27, 2025
A103	Part Site Plan	7		Feb. 27, 2025
A104	Part Demolition Plan	6		Feb. 27, 2025
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A107	Site Details	4		Feb. 27, 2025
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A201	First Floor Demolition Plan	4		Feb. 27, 2025
A202	Roof Demolition Plan	4		Feb. 27, 2025
A203	Ceiling Demolition plan	4		Feb. 27, 2025
A204	Overall First Floor Plan	4		Feb. 27, 2025
A205	Roof Plan	4		Feb. 27, 2025
A206	Enlarged New Floor Plan Addition	4		Feb. 27, 2025
A207	Enlarged New Floor Plan Reno	4		Feb. 27, 2025
A208	Overall Reflected Ceiling Plan Addition/Reno	4		Feb. 27, 2025
A209	Enlarged Reflected Ceiling Plan	2		Feb. 27, 2025
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A401	Building Sections	4		Feb. 27, 2025
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A701	Washroom Interior Elevations	4		Feb. 27, 2025
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A801	Millwork	4		Feb. 27, 2025
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A803	Millwork	4		Feb. 27, 2025
A804	Millwork	4		Feb. 27, 2025
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A902	Door Head & Jamb Details	4		Feb. 27, 2025
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C200	Grading and Servicing plan	4		Feb. 27, 2025
C300	Impacted Site Area	4		Feb. 27, 2025
C500	General Notes and Details	2		Feb. 27, 2025
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L3	Landscape Details & Specifications	2		Feb. 27, 2025
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S203	High Roof Framing Plan	4		Feb. 27, 2025
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M103	Site Plan	6		Feb. 27, 2025

Dwg. No.	Title	Issue No.	Rev. No.	Issue Date
M201	Ground Floor Plan-Plumbing & Drainage -Demolition	6		Feb. 27, 2025
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E103	Site Plan- Renovation	6		Feb. 27, 2025
E104	Site Plan-Renovation	6		Feb. 27, 2025
E106	Details	6		Feb. 27, 2025
E105	Details & Legend	6		Feb. 27, 2025
E201	Ground Floor Plans -Demolition	6		Feb. 27, 2025
E301	Ground Floor Plans -Renovation-Lighting	6		Feb. 27, 2025
E302	Ground Floor Plan -Renovation-Power & Systems	6		Feb. 27, 2025
E303	Ground Floor Plan -Renovation-Power & Systems	6		Feb. 27, 2025
E401	Distribution Riser Diagram-Demolition & Renovation	6		Feb. 27, 2025
E501	Fire Alarm Riser	6		Feb. 27, 2025
E601	Schedules	6		Feb. 27, 2025
E602	Panel Schedules	6		Feb. 27, 2025

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 Engineer design
- .9 Designated substances: ACM and others
- .10 Building smoking environment
- .11 Special conditions
- .12 Integrated systems testing
- .13 Site security
- .14 "By Others"
- .15 Protection of Drawings

### **1.2 Work Covered by Contract Documents**

- .1 Work of this Contract comprises the construction of the Mill Courtland Community Centre Addition as indicated on the Contract Drawings and specifications.

### **1.3 Owner**

- .1 City of Kitchener.

### **1.4 Place of the Work**

- .1 The Work of this Contract is located at 216 Mill Street, Kitchener, Ontario.

### **1.5 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.

### **1.6 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.

### **1.7 Work Sequence**

- .1 Construct Work continuously.

1.8 Contractors Use of Premises

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

1.9 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.

1.10 Designated Substances: ACM and Others

- .1 The Owner shall provide any prospective constructor or contractor a copy of building ACM surveys and information on designated substances that are known or suspected of being present within the area or scope of work.
- .2 The General Contractor shall ensure that a copy of the ACM survey is provided to each contractor and subcontractor who will be working on the Project.
- .3 Any findings of undeclared ACM, or damaged ACM that could pose a risk to workers is to be brought to the attention of the Owner immediately, and work is to be stopped.
- .4 All project design and construction activities must be carried out in compliance with the Regulations.
- .5 No asbestos-containing materials, as defined by O. Reg. 278/05, may be specified or used in any project.

1.11 Verification

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

1.12 Building Smoking Environment

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

1.13 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.



**1.14 Integrated Systems Testing**

- .1 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. 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. All costs related to the integrated systems testing must be included as part of the base bid price. Provide all requirements to all required trades during the bid period. The integrated systems testing must be completed after hours.
- .2 Include the following scopes of work as part of the base bid price specific to CAN/ULC S1001, Integrated Systems Testing of Fire Protection and Life Safety Systems:
  - .1 Fire Alarm Technician required for operations and resetting of the fire alarm control panel for the duration.
  - .2 Electrician required for operations and initiating alarms, demonstrating wiring, etc., for the duration.

**1.15 Site Security**

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

**1.16 "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.

**1.17 Use of Drawings**

- .1 Drawings are not to be scaled.
- .2 Copies of architectural and structural "issued for construction" drawings in digital format will be made available for the contractors use under the following conditions.
  - .1 Copyright remains with BBA.
  - .2 The drawings will only be used for shop drawings for this project and not be put to any other use.
  - .3 BBA assumes no liability for errors or omissions in the drawings. The Contractor assumes all risk and expenses associated with the use of drawings in the production of his work.
  - .4 References to BBA and other Consultants must be deleted from the title block.
  - .5 The Contractor signs a release available from BBA that addresses the above items in more detail.
- .3 Arrangements for use of Sub-Consultant drawings must be made with the Appropriate Sub-Consultant.

**1.18 Protection of Drawings**

- .1 Copyright of electronic document belongs to the Consultant. Electronic documents may not be forwarded to others, transmitted, downloaded or reproduced in any format, whether print or

electronic, without the express, written permission of the copyright owner.

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

## **PART 2 PRODUCTS**

### **3.1 Not Used**

- .1 Not used

## **PART 3 EXECUTION**

### **3.2 Not Used**

- .1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Consultants

- .1 ARCHITECT:  
Barry Bryan Associates  
201 - 250 Water Street  
Whitby, Ontario L1N 0G5  
Tel: (905) 666-5252  
Fax: (905) 666-5256  
Attention: Mrs. Cassandra Cautius, OAA
- .2 STRUCTURAL ENGINEER:  
Barry Bryan Associates  
201 - 250 Water Street  
Whitby, Ontario L1N 0G5  
Tel: (905) 666-5252  
Fax: (905) 666-5256  
Attention: Mr. Doug McLaughlin, P.E., P. Eng.
- .3 MECHANICAL ENGINEER:  
DEI Consulting Engineers  
7 Innovation Dr. Unit 245  
Dundas, ON L9H7H9  
Tel: 519-725-3555 Ext. 269  
Attention: Mr. Michael Pace, P.Eng.
- .4 ELECTRICAL ENGINEER:  
DEI Consulting Engineers  
7 Innovation Dr. Unit 245  
Dundas, ON L9H7H9  
Tel: 519-725-3555  
Attention: Mr. Jason Legacy, P.Eng.
- .5 CIVIL ENGINEER  
Walter Fedy  
675 Queen Street S #111  
Kitchener, ON N2M1A1  
Tel: (519) 576-2150 Ext. 241  
Attention: Shelley Forwell, P.Eng.
- .6 LANDSCAPE ARCHITECT  
Kendall Flower Landscape Architecture  
Guelph, Ontario  
Tel: 519-763-2000  
Attention: Ms. Kendall Flower, OALA

## PART 2 PRODUCTS

### 3.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.2 Not Used

.1 Not used

End of Section

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PART 1 GENERAL

1.1 Section Includes

- .1 Cash Allowances

1.2 References

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

1.3 Cash Allowances

- .1 Refer to General Conditions, GC4.1.
- .2 Unless otherwise specified, Cash Allowances shall cover the cost of the materials and equipment delivered F.O.B. job site, and all applicable taxes, except Harmonized Sales Tax. The Contractor's handling costs on the site, labour, installation costs, overhead and profit and other expenses shall be included separately in the Stipulated Price and not in the Cash Allowance.
- .3 Where it is specified that a Cash Allowances is to include both supply and installation costs, such allowances shall cover the cost of the materials and equipment delivered and unloaded at the site, all applicable taxes and the contractor's handling costs on the site, labour and installation costs and other expenses, except overhead and profit which shall be included separately in the Stipulated Price.
- .4 If the cost of the Work covered by Cash Allowances, when determined, is more or less than the allowance, the Contract Sum shall be adjusted accordingly.
- .5 In the event that the cost of the work covered by Cash Allowances should exceed the cash allowance, while the Contract Sum will be adjusted in conformity therewith, there shall be no adjustment to the Contractor's fee or other expenses such as overhead or profit, it being understood and agreed that the contract sum includes the Contractor's expenses and profit for all Cash Allowances whether or not they are exceeded.
- .6 Progress payments on accounts of work authorized under Cash Allowances shall be included in monthly certificate for payment.
- .7 Expenditures from Cash Allowances shall be authorized by Site Instruction, Change Directive or Change Order.
- .8 Cash Allowance for independent inspection and testing shall cover the cost of such services as provided by independent testing agency only. The Contractor's cost for labour, overhead and other expenses related to independent inspection and testing shall be included separately in the Stipulated Price and not in the Cash Allowance.
- .9 Cause the work covered by Cash Allowances to be performed for such amounts and by such persons as the Consultant may select and direct or as required by the project drawings and specifications.

.10 Cash Allowances in the amounts indicated in the Owners Bids and Tenders site, are as follows:

- .1 Independent Inspection and Testing
- .2 Floor Levelling
- .3 Exterior pre-engineered sheds
- .4 Balancing
- .5 Contingency

**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 Alternatives

1.2 References

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 23-2018 A Guide to Calling Bids and Awarding Contracts.

1.3 Requirements

- .1 Referenced specification Sections stipulate pertinent requirements for products and methods to achieve Work stipulated under each Alternative.
- .2 Co-ordinate affected related Work and modify surrounding Work to integrate Work under each Alternative.

1.4 Substitution of Materials Prior to Bid Closing

- .1 Where products or systems have been specified by trade name, no substitution will be allowed except where alternatives have been approved by the Consultant prior to bid closing.
- .2 Where a specified product or system is not available at the time of bid, the bidder must inform the Consultant in writing so that they may advise all bidders of proposed changes. In the event that the Bidder fails to do so, the Consultant will choose a substitute product suitable for the application at the time of construction.

1.5 Request for Approval of Alternates

- .1 Contractors and suppliers of products or systems that have not been specified may apply for approval of their product or system as an "alternative".
- .2 Requests for approval must reach the Consultant at least five working days prior to the bid closing. The Consultant will advise applicants of the status of their request two working days prior to bid closing.
- .3 Request for approval shall include sufficient information for the Consultant to satisfactorily review the alternative. This may include the following:
  - .1 Project name and number.
  - .2 Specification sections to which the product or system applies.
  - .3 Description of proposed substitution, including manufacturer's material specifications, manufacturer's preparation and application requirements and manufacturer's warranties.
  - .4 Sample of product indicating surface finish and material thickness to be applied under this Contract.
  - .5 Installation history of proposed alternative including:
    - .1 projects and locations
    - .2 approximate value of contract
    - .3 approximate size of projects
    - .4 number of years in use
    - .5 type of usage
    - .6 name of owner and consultant involved.

- .4 When submitting alternatives to specified materials or equipment, Bidders shall include in their Bid any changes in the Work required to accommodate the alternatives. A later claim for an addition to the Contract Price due to changes in the Work that are necessitated by the use of the alternatives will not be considered.

1.6 Approval of Alternates

- .1 An addendum will be issued prior to bid closing if an alternative is approved. No alternative materials or equipment will be considered after bid closing.
- .2 Products or systems that have been approved as alternatives may be substituted for specified products and systems as outlined in the addendum.
- .3 When substitution of any proposed alternative into the work, either in whole or in part, affects other parts of the work, the Contractor shall assume full responsibility and bear the associated costs. The Contractor will also be responsible for paying for any drawing changes required as a result of the substitution.
- .4 Cost savings arising from approved alternative products or systems are to be credited to the Contract and the Contract Price will be adjusted accordingly.
- .5 The Consultant reserves the right to reject any or all requests for approval.
- .6 No substitutions will be permitted without the approval of the Consultant in the form of an addendum.

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: a specification which includes one or more proprietary names of products or manufacturers, or both, and may also include descriptive, reference standard, or performance requirements, or any combination thereof.
- .3 Non-proprietary Specification: a specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does not include proprietary names of products or manufacturers.
- .4 Substitution: a product or manufacturer not specified by proprietary name, which may be acceptable in place of a product or manufacturer which, is specified by proprietary name.

### 1.3 Procedures

- .1 Product Options:
  - .1 For products specified by non-proprietary specification:
    - .1 Select any product by any manufacturer, which meets requirements of Contract Documents.
  - .2 For products specified by proprietary specification:
    - .1 Select any product or manufacturer named, or
    - .2 Substitute an unnamed product or manufacturer in accordance with Substitutions – Manufacturers article of this Section.
  - .3 For products specified by proprietary specification and accompanied by words indicating that substitutions will not be accepted:
    - .1 Select any product or manufacturer named; substitutions are not permitted.
- .2 Substitution Requests Prior to Execution of Contract: Submit substitutions requests to Consultant no later than the time stated in the Instructions to Bidders.

### 1.4 Substitutions – Products

- .1 Substitute Products: Where substitute products are permitted, unnamed products may be accepted by the Consultant, subject to the following:
  - .1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the specified products.
  - .2 Substitutions for Cause: Changes proposed by Subcontractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - .3 Substitutions for Convenience: Changes proposed by Subcontractor or Contractor that are not required in order to meet other Project requirements but may offer advantage to Contractor or Subcontractor.

1.5 Substitutions – Manufacturers

- .1 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers 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 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.
- .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 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 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 Submittal and RFI procedures
  - .3 Schedules
  - .4 Personnel and vehicle permit procedures
  - .5 Use of premises
  - .6 Location of any Contractor on-site facilities
  - .7 Security
  - .8 Housekeeping
  - .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 Safety Data Sheets (SDS).
- .14 Health and Safety Plan and other safety related documents.
- .15 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 reviewed copy within 10 days after receipt.
- .4 Resubmit finalized schedule within 7 days after return of reviewed copy.
- .5 During progress of Work revise and resubmit schedule as directed by Consultant.
- .6 Submit revised progress schedule with each application for payment.

- .7 Distribute copies of revised schedule to:
  - .1 Job site office.
  - .2 Subcontractors.
  - .3 Other concerned parties.
  - .4 Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.
- .8 Table current and up to date schedule at each regular site meeting.

#### 1.6 Critical Path Scheduling

- .1 Include complete sequence of construction activities.
- .2 Schedules shall represent a practical plan to complete the work within the Contract period, and shall convey the plan to execute the work. Schedules as developed shall show the sequence and interdependencies of activities required for complete performance of the work.
- .3 The submittal of schedules shall be understood to be the Contractor's representation that the schedule meets the requirements of the Contract Documents and that the work will be executed in the sequence and duration indicated in the schedule.
- .4 Failure to include any element of work required for performance of the Contract or failure to properly sequence the work shall not excuse the Contractor from completing all work within the Contract Time.
- .5 All schedules shall be developed utilizing industry standard 'best practices' including, but not limited to:
  - .1 No open-ended activities.
  - .2 No use of constraints other than those defined in the Contract Documents without the prior approval of the Consultant.
  - .3 No negative leads or lags.
  - .4 No excessive leads or lags without prior justification and approval from the Consultant.
  - .5 For individual schedule construction activities, do not exceed 14 days in duration without prior approval of the Consultant. Subdivide activities exceeding 14 days in duration to an appropriate level.
  - .6 Sufficiently describe schedule activities to include what is to be accomplished in each work area. Express activity durations in whole days. Clearly define work that is to be performed by subcontract.
  - .7 Create the schedule in conformance with the work-hours and constraints set forth in these Contract Documents.
- .6 Include dates for commencement and completion of each major element of construction.
- .7 Show projected percentage of completion of each item as of first day of month.
- .8 Indicate progress of each activity to date of submission schedule.
- .9 Show changes occurring since previous submission of schedule:
  - .1 Major changes in scope.
  - .2 Activities modified since previous submission.
  - .3 Revised projections of progress and completion.
  - .4 Other identifiable changes.

- .10 Provide a narrative report to define:
  - .1 Problem areas, anticipated delays, and impact on schedule.
  - .2 Corrective action recommended and its effect.
  - .3 Effect of changes on schedules of other prime contractors.

1.7 Submittals Schedule

- .1 Include schedule for submitting shop drawings, product data, and samples. Indicate manufacture and delivery lead times into the shop drawing submittal schedule.
- .2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.1 Not Used

- .1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 Construction Documentation.

### 1.2 Construction Documentation

- .1 This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - .1 Daily construction reports.
  - .2 Material location reports.
  - .3 Field condition reports.
  - .4 Special reports.

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Field Condition Reports: Submit at time of discovery of differing conditions.
- .3 Special Reports: Submit at time of occurrence.

### 1.4 Coordination

- .1 Coordinate preparation and processing of reports with performance of construction activities and with reporting of separate Contractors.

### 1.5 Reports

- .1 Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project Site:
  - .1 List of Subcontractors at Project Site.
  - .2 Approximate count of personnel at Project Site.
  - .3 Equipment at Project Site.
  - .4 Material deliveries.
  - .5 High and low temperatures and general weather conditions.
  - .6 Accidents.
  - .7 Meetings and significant decisions.
  - .8 Stoppages, delays, shortages, and losses.
  - .9 Meter readings and similar recordings.
  - .10 Emergency procedures.
  - .11 Orders and requests of authorities having jurisdiction.
  - .12 Change Orders received and implemented.
  - .13 Work Change Directives received and implemented.
  - .14 Clarifications requested, received, and implemented.
  - .15 Services connected and disconnected.
  - .16 Equipment or system tests and startups.
  - .17 Partial Completions and occupancies.
  - .18 Substantial Performances authorized.

- .2 Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project Site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project Site.
- .3 Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

1.6 Special Reports

- .1 Prepare Coordination Memoranda for distribution to each Contractor involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings. Provide copy 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 Administrative
- .2 Requests for Information
- .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 Verify field measurements and affected adjacent work are coordinated.
- .6 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review.
- .7 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant's review.
- .8 Keep one reviewed copy of each submission on site.

### 1.3 Requests for Information (RFI's)

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

### 1.4 Shop Drawings and Product Data

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, product data and other data which the Contractor provides to illustrate details of a portion of Work.
- .2 Coordinate each submission with requirements of Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .3 Submit shop drawings bearing stamp and signature of qualified professional Engineer registered or licensed in the Province of Ontario where required by the individual specification sections. Each submittal and each resubmittal must bear the stamp of the Engineer
- .4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where

articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .5 Prior to submission to Consultant, review all submitted drawings. By this review, Contractor represents to have determined and verified field measurements, site conditions, materials, catalogue number and similar data and to have checked and coordinated each drawing with the requirements of Work and of Contract Documents. Contractor's review of each drawing shall be indicated by stamp, date and signature of a responsible person.
- .6 At time of submission, notify Consultant in writing of any deviations in drawings from the requirements of the Contract Documents.
- .7 Allow ten days for Consultant's review of each submission.
- .8 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .9 Make any changes in submitted drawings which Consultant may require, consistent with Contract Documents and resubmit unless otherwise directed by Consultant. When resubmitting, notify Consultant in writing of any revisions other than those requested by Consultant.
- .10 Accompany submissions with transmittal letter containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .11 Submissions shall include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.
    - .4 Capacities.
    - .5 Performance characteristics.
    - .6 Standards.
    - .7 Operating weight.
    - .8 Wiring diagrams.
    - .9 Single line and schematic diagrams.
    - .10 Relationship to adjacent work.
- .12 After Consultant's review, distribute copies.



- .13 Submit one electronic copy in PDF format of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.
- .14 Submit electronic copy in PDF format of product data sheets or brochures for requirements requested in Specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.
- .15 Delete information not applicable to project.
- .16 Supplement standard information to provide details applicable to project.
- .17 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .18 The review of shop drawings by the Consultant is for sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that the Consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

#### 1.5 Interference Drawings

- .1 Prepare interference drawings to coordinate the installation of the work of all sections, within available space. Conflicts between trades which could be determined beforehand, by the careful coordination and preparation of interference drawings, shall be corrected at no expense to the Owner.
- .2 Prepare interference drawings of all buried services as necessary to avoid conflicts with new or existing structures, foundations or services.
- .3 Submit interference and equipment placing drawings as specified in Section 01 71 00, when requested by the Consultant.

#### 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.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.1 Not Used

- .1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 Administrative
- .2 Fires
- .3 Disposal of Wastes
- .4 Drainage
- .5 Site Clearing and Plant Protection
- .6 Pollution Control
- .7 Unanticipated Soil Contamination

### 1.2 References

- .1 Statutes of Canada 1999 Chapter 33.
  - .1 Canadian Environmental Protection Act 1999.
  - .2 SOR/2003-289. Federal Halocarbon Regulations, 2003.
  - .3 Transportation of Dangerous Goods Act, 1992 (1992, c. 34)
- .2 OPSS 805 "Construction Specification for Temporary Erosion and Sediment Control Measures".
- .3 Province of Ontario Environmental Protection Act, R.S.O. 1990, c. E.19
- .4 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management

### 1.3 Administrative

- .1 Comply with all federal, provincial, and municipal regulatory requirements and guidelines for environmental protection and natural resource conservation, including those referenced above.
- .2 Failure to comply with environmental requirements may result in a stop work order or assessment of damages commensurate with repair of damage.
- .3 It is the Contractor's responsibility to be aware of environmental requirements and the best management practices and pollution control measures necessary to meet them.
- .4 It is the Contractor's responsibility to obtain and abide by permits, licenses and compliance certificates at appropriate times and frequencies as required by the authorities having jurisdiction.
- .5 All hazardous materials are to be stored with secondary containment

### 1.4 Fires

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

### 1.5 Disposal of Wastes

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

### 1.6 Drainage

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing deleterious substances into waterways, sewer or drainage systems.
- .3 Protect storm drains against entry by sediment, debris, oil, or chemicals.

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

1.7 Site Clearing and Plant Protection

- .1 Protect trees and plants on site and adjacent properties.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
- .4 Restrict tree removal to areas indicated.
- .5 Prevent unnecessary disturbance of topsoil and underlying soil from vehicles and heavy equipment.
- .6 Minimize stripping of topsoil and vegetation.
- .7 Comply with the requirements of Ontario Regulation O. REG 406/19, "On-Site and Excess Soil Management", for the importation of new soils and fill materials and the exportation, removal and disposal off-site, of excavated materials. Complete testing of imported and exported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

1.8 Pollution Control

- .1 Maintain, inspect, and repair temporary erosion and pollution control features installed under this contract on a weekly basis. Submit inspection logs to the Owner when requested.
- .2 Control emissions from equipment and plant to conform to federal, provincial, and municipal requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .4 Take all measures necessary to prevent material and mud tracking on adjacent roads and streets.
- .5 Use mechanical sweepers as often as necessary to keep adjacent roads and streets clean of material and mud that is deposited from this project.
- .6 On site disposal or clean out of concrete trucks is not permitted. Any spillage of concrete onto asphalt or other surfaces must be cleaned up before spillage sets.

1.9 Unanticipated Soil Contamination

- .1 Should unanticipated soil contamination be discovered:
  - .1 Stop work and assess the situation for safety.
  - .2 If situation does not appear to be safe, evacuate workers from area.
  - .3 If safe to do so, take immediate steps to control any spread of contamination, in accordance with Contractor's spill prevention and response plan.
  - .4 Immediately contact the Consultant.

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

**PART 2 PRODUCTS**

**2.1 Not Used**

- .1 Not used

**PART 3 EXECUTION**

**3.1 Not Used**

- .1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 References
- .2 Owner's Regulations
- .3 Standards and Definitions
- .4 Designated Substances
- .5 Hazardous Materials
- .6 Spills Reporting
- .7 Protection of Water Quality
- .8 Potable Water Systems
- .9 Soils Management
- .10 Access for Inspection and Testing
- .11 Other Regulatory Requirements

### 1.2 References

- .1 Perform Work in accordance with Ontario Building Code (OBC), National Fire Code of Canada (NFC), the Canadian Electrical Code CSA C22.1:21, including all Supplements and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Where a material is designated in the Contract Documents for a certain application, unless otherwise specified, that material shall conform to standards designated in the Code. Similarly, unless otherwise specified, installation methods and standards of workmanship shall also conform to standards invoked by the aforementioned Code.
- .3 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.
  - .3 Manufacturer's instructions.
- .4 Where requirements of Contract Documents exceed Code requirements provide such additional requirements.
- .5 Where the 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 and agencies, conform to latest edition of standards, as amended and revised to date of Contract.
- .2 Have a copy of each specified standard which relates to 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 provided by the Owner.
- .2 Stop work immediately when material resembling asbestos, mould or any other designated substance which is not identified in the Designated Substance Report is encountered during the course of the work. Notify Owner and Consultant immediately.
- .3 The Owner will arrange for independent testing of suspected designated substances and removal of such substances encountered on the site during the course of the work which are not identified in the Designated Substance Report.

1.6 Hazardous Materials

- .1 Definition: "Hazardous Material" is material, in any form, which by its nature, may be flammable, explosive, irritating, corrosive, poisonous, or may react violently with other materials, if used, handled or stored improperly. Included are substances prohibited, restricted, designated or otherwise controlled by law.
- .2 Provide SDS for all materials brought to the Place of Work.
- .3 Hazardous Materials will not be introduced for experimental or any other use prior to being evaluated for hazards.
- .4 Make known to the Consultant those hazardous materials or designated substances intended to be used in the workplace and receive permission to use before introducing to the Owner's property.
- .5 Many common construction materials such as asbestos pipe and various insulations are designated substances and shall not be used under any circumstances.

1.7 Spills Reporting

- .1 Spills or discharges of pollutants or contaminants under the control of the Contractor, and spills or discharges of pollutants or contaminants that are a result of the Contractor's operations that cause or are likely to cause adverse effects shall forthwith be reported to the Consultant. Such spills or discharges and their adverse effects shall be as defined in the Environmental Protection Act R.S.O. 1999.
- .2 All spills or discharges of liquid, other than accumulated rain water, from luminaries, internally illuminated signs, lamps, and liquid type transformers under the control of the Contractor, and all spills or discharges from this equipment that are a result of the Contractor's operations shall, unless otherwise indicated in the Contract, be assumed to contain PCB's and shall forthwith be reported to the Consultant.
- .3 This reporting will not relieve the Contractor of his legislated responsibilities regarding such spills or discharges.

1.8 Protection of Water Quality

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

- .2 If de-watering is required, the water shall be pumped into a sedimentation pond or diffused onto vegetated areas a minimum of 30 metres from any watercourses and not pumped directly into the watercourses.
- .3 Provide all de-watering and sedimentation control required to properly complete the work of this contract.
- .4 Supply, install and maintain silt/sediment control fencing along the edge of the site to intercept construction runoff silt, to the satisfaction of the Owner.

1.9 Potable Water Systems

- .1 Potable water systems in completed buildings must meet criteria and guidelines established by Provincial and Municipal authorities, prior to occupancy by the Owner.
- .2 Upon completion, submit testing certificates verifying water quality and water systems meets all applicable Provincial and Legislated Standards

1.10 Soils Management

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

1.11 Access for Inspection and Testing

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

1.12 Other Regulatory Requirements

- .1 Conform to the requirements of the Ontario Ministry of Transportation, Regional and Local authorities regarding transportation of materials.
- .2 Obtain required road occupancy permits.
- .3 Pay any required roadway damage deposits required by the local municipality.
- .4 Conform to the requirements of the Ontario Ministry of the Environment.
- .5 Conform to the requirements of the Ontario Ministry of Labour.
- .6 Conform to the requirements of the local Conservation Authority.
- .7 Conform to all applicable local by-laws, regulations and ordinances.

**PART 2 PRODUCTS**

2.1 Not Used

- .1 Not used



PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

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## PART 1 GENERAL

### 1.1 Section Includes

- .1 This Section specifies administrative and procedural requirements for the following:
  - .1 Field samples and mock-ups.
  - .2 Non- conformance
  - .3 Removal after completion

### 1.2 Field Samples and Mock-Ups

- .1 Field samples and mock-ups shall be prepared at the jobsite by the Contractor as specified in the various Sections of these Specifications. Affected finish work shall not be started until the Consultant has approved the field samples and jobsite mock-ups in writing.
- .2 Construct and prepare field samples and jobsite mock-ups at designated locations at the jobsite or on the structure as directed by the Consultant.
  - .1 Notify Consultant a minimum of 5 working days prior to mock-up.
  - .2 Unless specified or approved otherwise, schedule mock-ups a minimum of 5 working days prior to actual installation of the work represented by the mock-up.
  - .3 For each mock-up, provide conditions which will duplicate the conditions of the actual installation, including lighting.
  - .4 The Contractor shall have product manufacturers inspect and approve field samples and mock-ups, that involve their materials, for proper application or installation of the materials in accordance with their respective instructions and recommendations for the conditions or circumstances involved in the application or installation.
  - .5 The Contractor shall make arrangements with the respective product manufacturers to provide job or field service as specified in Section 01 45 00 - Quality Control.
  - .6 Do not proceed with subsequent work until approval of the mock-up is obtained.
- .3 Construct or prepare as many additional samples and mock-ups as may be required, as determined by the Consultant, until desired features, textures, finishes, and colours are obtained.
- .4 Approved samples and mock-ups shall serve as the standards of quality for the various affected units of work.
- .5 Preserve approved field samples and mock-ups for comparison purposes until the affected work is completed and accepted by the Consultant. Finished work shall match the approved field samples and mock-ups.

### 1.3 Non-Conformance

- .1 Completed work that does not exactly match approved field samples and mock-ups will be rejected and shall be replaced with work that does exactly match the approved field samples and mock-ups at the Contractor's expense.
- .2 If the Contractor elects to start work before the Consultant has approved the related field samples or mock-ups, the Contractor does so at the risk of having the work rejected by the Consultant without compensation.

### 1.4 Removal After Completion

- .1 Field samples and mock-ups shall be removed from the jobsite and structures after completion

and acceptance of the affected work or otherwise as directed by the Consultant.

.2 Prior to removal photo-document mock-up with digital files to 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 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 - Payment Procedures for Testing Laboratory Services.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and re-inspection.

### 1.4 Access to Work

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

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

1.5 Procedures

- .1 Notify Owner and Consultant 48 hours in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples

1.6 Rejected Work

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other work damaged by such removals or replacements promptly.
- .3 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Consultant will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.7 Reports

- .1 Submit electronic .pdf format inspection and test reports to Consultant.
- .2 Provide copies to Subcontractor of work being inspected or tested or manufacturer or fabricator of material being inspected or tested.

1.8 Contractors Responsibilities

- .1 Be responsible for the execution of the Construction Quality Plan and is to pay all costs for the execution of the Construction Quality Plan. Designate an experienced site representative for carrying out the Construction Quality Plan.
- .2 Provide the Owner with a completed quality product for the Work. Contractor shall be responsible for any costs associated with re-testing and reperforming the Work as a result of the Contractor's poor performance or workmanship or other failure to comply with the Contract Documents.
- .3 All Work shall be done by persons qualified in their respective trades, and the workmanship shall be first-class in every respect. Contractor is responsible for ensuring employees are appropriately trained. All materials and equipment furnished shall be the best of their respective kinds for the intended use and unless otherwise specified, same shall be new and of the latest design.
- .4 The Consultant will have the authority to reject Work that does not conform to the Contract Documents or may require special inspection or testing, whether or not such Work is to be then fabricated, installed or completed.

- .5 Failure by a Contractor to conduct its operations, means and methods and coordinate proper sequencing of the Work may cause the Owner to withhold payment or any other means deemed necessary to correct non-conforming Work.
- .6 The Owner shall engage a testing firm to perform such engineering laboratory services and on-site inspection as deemed necessary by the Owner. The testing firm will determine compliance with the requirements of the Contract Documents. This Work will not be a service to the Contractors for the performing of tests and checking of materials required of the Contractors.
- .7 Copies of test and inspection reports will be furnished to the Contractor. The laboratory and its representatives will be instructed to promptly call to the attention of the Contractor, any instance of non-compliance with the requirements of the Contract Documents. Failure to so notify the Contractor shall not relieve the Contractor of any of its responsibilities for compliance or making good workmanship or materials which are not in compliance with the requirements of the Contract Documents. The agency shall notify the Consultant and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services
- .8 Contractor's construction materials, procedures and work shall be subject to specified testing procedures and shall be in conformance with the Contract Documents as verified by Testing Agency.
- .9 Cooperate with the testing firm and provide labor to assist with sample preparations where applicable.
- .10 Except where specifically indicated to be provided by another entity as identified, inspections, tests, and similar quality control services including those specified to be performed by independent agency are the Contractor's responsibility, and costs thereof are not to be included in contract sum.
- .11 Cooperate with independent agencies performing required inspections, tests, and similar services. Provide auxiliary services as reasonably requested, including access to Work, the taking of samples or assistance with the taking of samples, delivery of samples to test laboratories, and security and protection for samples and test equipment at Project site.
- .12 Coordination: Contractor and each engaged independent agency performing inspections, tests, and similar services for project are required to coordinate and sequence activities so as to accommodate required services with minimum delay of Work and without the need of removal/replacement of work to accommodate inspections and tests. Scheduling of times for inspections, tests, taking of samples, and similar activities is Contractor's responsibility.
- .13 Where sampling and testing is required for Sections of Work listed in the Contract Documents, the tests shall be performed by an independent testing lab and paid for by the Contractor.
- .14 Test procedures to be used shall be submitted for approval of the Consultant where other than those specified are recommended by the testing agency.
- .15 Testing Agency Duties: The independent Testing Agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Owner, the Consultant and Contractors in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
- .16 Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.9 Tests and Mix Designs

- .1 Furnish test results and mix designs as requested.

1.10 Mockups

- .1 Refer to Section 01 43 39.

1.11 Equipment and Systems

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

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.1 Not Used

- .1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 Temporary utilities

### 1.2 Installation and Removal

- .1 Provide temporary utilities and controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

### 1.3 Dewatering

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

### 1.4 Water Supply

- .1 Existing sources of water can be made available to the Contractor at no charge, subject to operational requirements. Arrange for connection and pay all costs for installation, maintenance and removal. Conversions or alterations to existing sources of water to meet construction requirements are the responsibility of the Contractor.
- .2 The points of delivery and limits on amount available will be determined on site by the Owner whose written permission must be obtained before any connection is made.

### 1.5 Temporary Heating and Ventilation

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted, unless prior approval is given by the Consultant.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect Work and products against dampness and cold.
  - .3 Prevent moisture condensation on surfaces.
  - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10° C in areas where construction is in progress.
- .5 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operation of ventilation and exhaust system for time after cessation of work process



- to assure removal of harmful contaminants.
- .6 Permanent heating system of building may not be used when available, unless there are savings to the Contract Price and Consultant's written permission is obtained stating conditions of use, provisions relating to guarantees on equipment and operation and maintenance of system. Be responsible for damage to heating system if use is permitted.
  - .7 On completion of Work for which permanent heating system is used, replace filters.
  - .8 Ensure Date of Substantial Performance and warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.
  - .9 Pay costs for maintaining temporary heat, when using permanent heating system. Owner will pay utility charges when temporary heat source is existing building equipment.
  - .10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
    - .1 Conform to applicable codes and standards.
    - .2 Enforce safe practices.
    - .3 Prevent abuse of services.
    - .4 Prevent damage to finishes.
    - .5 Vent direct fired combustion units to outside.
  - .11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

#### 1.6 Temporary Power and Light

- .1 Existing sources of electric power can be made available to the Contractor. Conversions or alterations to existing sources of electric power to meet construction requirements are the responsibility of the Contractor.
- .2 The points of delivery and limits on amount available will be determined on site by the Owner whose written permission must be obtained before any connection is made.
- .3 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected.
- .4 Provide and maintain temporary lighting throughout project. Lighting levels shall be sufficient to complete work including inspections. Provide minimum lighting levels of 400 lux at work areas. Lighting levels at floors and stairs not within work areas shall be not less than 160 lux at all times during construction activity.
- .5 All equipment used shall be CSA approved.
- .6 Wiring and method of installation shall conform to local power requirements and shall be reviewed by a licensed inspector prior to use.

#### 1.7 Temporary Communication Facilities

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

### PART 2 PRODUCTS

2.1 Not Used

.1 Not used

PART 3 EXECUTION

3.1 Not Used

.1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 Construction aids.
- .2 Site storage.
- .3 Construction parking
- .4 Offices
- .5 Equipment, tool and material storage.
- .6 Sanitary facilities.
- .7 Signage.
- .8 Shoring

### 1.2 References

- .1 CSA Group (CSA)
  - .1 CAN/CSA Z321-96 (R2006) Signs and Symbols for the Workplace
  - .2 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.

### 1.2 Installation and Removal

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

### 1.3 Site Fencing

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

### 1.4 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.
- .2 Design and erect temporary enclosures where indicated or directed by the Owner, using new solid plywood hoarding, minimum 1.8 metres high. Hoarding shall be designed by a professional engineer registered in the Province of Ontario, to withstand all applied loads.
  - .1 Hoarding shall be of adequately substantial construction to serve its purpose without failure throughout the duration of use. Materials shall be suitable for the intended purpose but shall not violate requirements of applicable codes and standards.
  - .2 Use material with smooth surfaces for Work exposed to the public.
  - .3 Maintain hoarding in secure and safe condition during entire construction period.

### 1.5 Guard Rails and Barricades

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

### 1.6 Weather Enclosures

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

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

1.7 Dust Tight Screens

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

1.8 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.

1.9 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.

1.10 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.

1.11 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.

1.12 Fire Routes

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

1.13 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 This Section specifies administrative and procedural requirements for the following:
  - .1 implementation of an erosion and sedimentation control plan.

### 1.2 Related Work

- .1 Section 01 31 00 Project Management and Coordination.

### 1.3 Reference Standards

- .1 United States Environmental Protection Agency (EPA).
  - .1 2012 US EPA Construction General Permit (CGP).
- .2 EPA 832/R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, September 1992.
- .3 Local erosion and sediment control by-laws, regulations, and guidelines

### 1.4 Definitions

- .1 Erosion: Deterioration, displacement, or transportation of land surface by wind or water, intensified by land-clearing practices related to construction activities.
- .2 Rain or Rainstorm: An event defined causing the pooling of water on road or other impervious surfaces.
- .3 Sediment: Soil and other particulate matter that has been eroded and transported by storm or well production run-off water.
- .4 Snow Melt: An event in snow conditions when the temperature is above 0 degrees C or when environmental conditions causing snow on the ground to melt.

### 1.5 System Description

- .1 Prevent loss of soil during construction by storm water runoff and wind erosion.
- .2 Protect stockpiled topsoil.
- .3 Prevent sedimentation of storm water and receiving streams with storm drain inlet protection.
- .4 Prevent pollution of the air with dust and particulate matter.
- .5 Protect construction site access points to prevent the deposit of excavated materials on adjacent public property. Remove construction materials from public property promptly.
- .6 Prevent discharge of pollutants on site.

### 1.6 Regulatory Requirements

- .1 Provide environmental controls as required by applicable code and authority having jurisdiction.
- .2 Conform to municipal requirements for sediment control from excavation.

1.7 Performance Requirements

- .1 The Owner, with the design team, has established that this Project is to reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust.
- .2 Meet the requirements outlined in EPA CGP Section 2.
- .3 Identify and manage construction related pollution in compliance with all municipal, provincial, and federal Acts and regulations.

1.8 Administrative Requirements

- .1 Contractor is responsible for development, implementation and maintenance of LEED compliance ESC plan throughout all phases of construction as noted.
- .2 Comply with Section 01 31 00 for project management and coordination procedures.
- .3 Coordination: Contractor to coordinate with other work having a direct bearing on work of this section.
- .4 Startup Meeting: Contractor to convene start-up meeting prior to commencing work on the jobsite.
- .5 Construction Progress Meetings:
  - .1 Contractor to review ESC plan procedures at least monthly during construction progress meetings to ensure that objectives are being met.
- .6 Scheduling: Contractor to coordinate work with other activities at site to ensure timely and orderly progress of the work.

1.9 Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Monthly Progress Reports: Contractor to submit reports documenting implementation of the plan.
  - .1 Include photographic documentation. Refer to Section 01 32 33.

1.10 Closeout Submittals

- .1 Comply with Section 01 77 00 for closeout submittal requirements.
- .2 Contractor's Erosion and Sedimentation Control Plan Narrative including:
  - .1 A description of how the ESC plan was implemented,
  - .2 Erosion and sedimentation control measures implemented on site,
  - .3 Timing of the implementation of the plan, and
  - .4 Maintenance protocols used to ensure the proper function of control measures.
- .3 Contractor's Erosion and Sedimentation Control Trade Contractor Declaration
  - .1 Written declaration from the Contractor who implemented the plan, confirming that the ESC plan was carried out appropriately.

## PART 2 PRODUCTS

### 2.1 Not Used

- .1 Not used

## PART 3 EXECUTION

### 3.1 Preparation

- .1 Planning and coordination of the construction shall minimize sediment pollution.
- .2 Water courses to be protected at all times. Piling of soil in drainage-ways is not allowed.

### 3.2 Erosion and Sedimentation Control Requirements

- .1 Meet the requirements of the EPA CGP Section 2 covering effluent limitations applicable to all discharges from construction sites.
- .2 Erosion and Sedimentation Control Requirements (EPA CGP Section 2.1): Installation and maintenance of erosion and sediment controls to minimize the discharge of pollutants from earth-disturbing construction activities.
  - .1 Provide natural buffers or equivalent sediment controls when surface water is located within 15.25 metres of project earthwork.
  - .2 Install sediment controls along site perimeter that will receive stormwater.
  - .3 Minimize sediment track-out. Refer to work site entrance requirements.
  - .4 Control discharges from stockpiled sediment or soil. Refer to stockpiling requirements.
  - .5 Provide dust control measures to avoid pollutant discharge into surface waters.
  - .6 Minimize the disturbance of steep slopes.
  - .7 Preserve native topsoil on site, unless infeasible.
  - .8 In areas to receive landscaping or where water infiltration practices will be installed, minimize soil compaction by restricting vehicle and equipment use or use soil conditioning techniques prior to planting.
  - .9 Protect storm drain inlets.
  - .10 Maintain control measures.
- .3 Stabilization Requirements (EPA CGP Section 2.2): Stabilize stockpiled soils and other exposed portions of the site
  - .1 Meet the deadlines for initiating and completing stabilization when earth-disturbing construction activities stop, temporarily or permanently.
  - .2 Meet the criteria for stabilization, whether using vegetative or non-vegetative cover.
- .4 Pollution Prevention Requirements (EPA CGP Section 2.3): Install and maintain effective pollution prevention measures to prevent the discharge of pollutants.
  - .1 Prohibited discharges.
  - .2 General maintenance requirements.
  - .3 Pollution prevention standards.
  - .4 Emergency spill notification.
  - .5 Fertilizer discharge restrictions.

3.3 Stockpiling

- .1 Material removed from the excavation to be selectively stockpiled in areas, approved by the Consultant, where a minimum of sediment will be generated, and other damage will not result.
- .2 Prevent cleared topsoil and excavated earth stockpiled on site from being eroded by rainstorm, snow melt or wind.

3.4 Municipal Storm Water

- .1 Protect catch basins, drains, culverts, and other points of entry into municipal storm water collection systems.

3.5 Sediment Control

- .1 Limit operation of vehicles on site to paved surfaces or temporary gravel surfaces in order to avoid disturbing the soil.
- .2 Clean concrete trucks, placing and finishing tools and equipment in areas where sediment can be collected and not pollute the storm water collection system, both on and adjacent site.

3.6 Work Site Entrances

- .1 Locate gravel pads at all site access points to reduce the amount of sediment carried off the construction site by vehicles, and to collect sediment from vehicle washing.
- .2 Gravel pads to be 19 mm crushed gravel on geotextile fabric, 300 mm thick, 15 meters long by 4.5 meters wide to accommodate vehicles accessing the site.
- .3 Provide temporary water supply to wash soil from vehicle undercarriages and wheels prior to exiting the construction site.

3.7 Dewatering

- .1 Ensure dewatering pumps are directed to a silt management system, in a location approved by the Consultant, prior to entering the storm water collection system.

3.8 Field Quality Control

- .1 Inspect erosion and sediment control measures, to ensure proper functions are not damaged, each week and after storm events with more than 40 mm rainfall over a 24-hour period.
- .2 Remove sediment accumulations as required, and after each storm event.
- .3 Maintain and repair damaged, clogged and weathered materials.

3.9 Cleaning

- .1 Remove temporary erosion and sediment control devices when need for their service has ended.

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 Dielectric Separation
- .5 Tolerances for Execution of Work.
- .6 Protection of Work in progress.
- .7 Existing Utilities

### 1.2 Definition – Basis of Design

- .1 Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
  - .1 Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

### 1.3 Quality

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 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.

### 1.4 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.

**1.5     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.

**1.6     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.

**1.7     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.

**1.8     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.

1.9 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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

**1.14     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.

**1.15     Dielectric Separation**

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

**1.16     Tolerances for Execution of Work**

- .1 Unless specifically indicated otherwise, Work shall be installed plumb, level, square and straight.
- .2 Unless acceptable tolerances are otherwise specified in specification sections, or are otherwise required for proper functioning of equipment, site services and mechanical and electrical systems:
  - .1 "Plumb and level" shall mean plumb or level within 1 mm in 1m.
  - .2 "Square" shall mean not in excess of 10 seconds lesser or greater than 90 degrees.
  - .3 "Straight" shall mean within 1 mm under a 1 m long straight edge.
  - .4 "Flush" shall mean within:
    - .1 6 mm for exterior concrete, masonry and paving materials.
    - .2 1 mm for interior concrete, masonry, tile and similar surfaces.
    - .3 0.5 mm for other interior surfaces.
- .3 Allowable tolerances shall not be cumulative

**1.17     Protection of Work in Progress**

- .1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by Consultant, at no increase in Contract Price or Contract Time.
- .2 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of the Consultant.

**1.18     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.



1.19 Hazardous Materials

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

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.1 Not Used

- .1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 Safety Requirements
- .2 Fire Protection
- .3 Accident Reporting
- .4 Records on Site

### 1.2 References

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Fire Commissioners of Canada, FC 301, Standard for Construction Operations.
- .3 National Fire Protection Agency (NFPA)
  - .1 NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations
- .4 Occupational Health and Safety Act.
  - .1 R.R.O. 1990, Reg. 860: Workplace Hazardous Materials Information System (WHMIS)
  - .2 O. Reg. 632/05: Confined Spaces
- .5 Ontario Building Code.

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit to Owner and Consultant copies of the following documents, including updates issued:
  - .1 Notice of Project filed with 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 OHSA, 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

**Project:** 24015  
**Description:** Mill Courtland Community Centre Addition  
216 Mill Street, Kitchener, ON

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**SAFETY REQUIREMENTS**  
Section 01 70 03

.1 Not used

End of Section

## PART 1 GENERAL

### 1.1 Section Includes

- .1 Field Engineering survey services.
- .2 Survey services to establish and confirm inverts for Work.
- .3 Recording of subsurface conditions found.

### 1.2 References

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

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit name and address of Surveyor to Consultant.
- .3 On request of Consultant, submit documentation to verify accuracy of field engineering work.
- .4 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

### 1.4 Examination of Work and Site

- .1 Examine the site and existing building to be fully informed of their particulars as related to the Work.
- .2 Verify dimensions of completed Work in place before fabrication of Work to be incorporated with it. Ensure that all necessary job dimensions are taken for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions.
- .3 No claims for extra payment will be paid for extra work made necessary or for difficulties encountered due to conditions of the site which were visible or reasonably inferable from an examination of the site at the time prior to tender closing date and furthermore, failure of the Contractor to visit and examine the site shall be deemed a waiver of all claims for extra payment due to any condition of the site existing prior to tender closing date.
- .4 As-found damage: Record by photography and submit evidence to Consultant before commencing work, any found damaged surfaces or materials adjacent to new work, and not included under scope of this new work. Remedial work to any damage, not so recorded, shall be the responsibility of the Contractor.

### 1.5 Qualifications of Surveyor

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

### 1.6 Survey Reference Points

- .1 Existing control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Consultant.

- .4 Report to Consultant when reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.7 Survey Requirements

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

1.8 Existing Services

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings. The Contractor is responsible for coordination of all utility locates.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut off points as directed by Consultant.
- .3 Where Work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to building occupants, pedestrian and vehicular traffic.
- .4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .5 Install temporary drain plugs to prevent construction debris from blocking pipes downstream of the work.
- .6 All existing concrete floor slabs shall be scanned with Ground Penetrating Radar (GPR) prior to any cutting or breaking of concrete. Employ a qualified concrete scanning company or inspection and testing agency to scan and map floor slabs for reinforcing, plastic and metal conduit, piping, grounding cables, embedment and the like. Map all slabs and provide copies to the Owner and Consultant.

1.9 Location of Services, Equipment and Fixtures

- .1 Location of services, equipment, fixtures and outlets indicated on drawings or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and



maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance. Include existing equipment which affects or will be affected by the work.

- .3 Inform Consultant of impending installation and obtain approval for actual location.
- .4 Location of site services where required, is approximate and is based on information provided by the Owner. Undertake all locates to determine exact locations of existing services and lay out new services to avoid any conflicts with new building elements, including site improvements, building foundations and other new or existing services.
- .5 Submit field drawings and interference drawings to indicate relative position of various services and equipment. Refer to requirements for interference drawings specified elsewhere.
- .6 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided.
- .7 Prepare drawings to indicate coordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus and connections are coordinated.
- .8 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance and access are indicated and maintained.
- .9 Submit interference drawings to Owner and Consultant in accordance with Section 01 33 00.
- .10 Unless specifically indicated by the Consultant, interference drawings will be received for information only and will not be reviewed.

#### 1.10 Records

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

#### 1.11 Subsurface Conditions

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work.

### PART 2 PRODUCTS

#### 2.1 Not Used

- .1 Not used

### PART 3 EXECUTION

#### 3.1 Not Used

- .1 Not used

**Project:** 24015  
**Description:** Mill Courtland Community Centre Addition  
216 Mill Street, Kitchener, ON

**EXAMINATION AND PREPARATION**  
**Section 01 71 00**

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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
  - .5 Work by Owner or other contractor.
- .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.
  - .8 Written permission of affected other contractor.

### **1.3 Materials**

- .1 As specified and required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 25 00 - Substitution Procedures.
- .3 Requests for change in materials shall include documentation indicating conformance to project requirements and intent.

### **1.4 Definitions**

- .1 Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- .2 Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- .1 General: Comply with requirements specified in other Sections.
- .2 In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces,

use materials that visually match in-place adjacent surfaces to the fullest extent possible.

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

### **PART 3 EXECUTION**

#### **3.1 Preparation**

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

#### **3.2 General**

- .1 Carry out all cutting, fitting and patching required for the work of the Contract.
- .2 Repair all wall and floor surfaces where items have been removed.
- .3 Make good all finishes as required.
- .4 Repaint damaged wall surfaces.
- .5 Fit several parts together, to integrate with other Work.
- .6 Uncover Work to install ill-timed Work.
- .7 Remove and replace defective and non-conforming Work.
- .8 Provide cutting and patching of all openings in non-structural elements of Work as necessary to complete installation of mechanical and electrical Work. Include complete removal and replacement of such elements as necessary to provide construction access.
- .9 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .10 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .11 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools are not allowed on masonry work without prior approval.
- .12 Restore work with new products in accordance with requirements of Contract Documents.
- .13 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

- .14 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with "ULC approved firestopping material, full thickness of the construction element. Include any openings in existing building elements created by removal of existing services or equipment.
- .15 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

### 3.3 Cutting and Patching

- .1 General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
- .2 Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- .3 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- .4 Temporary Support: Provide temporary support of work to be cut.
- .5 Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- .6 Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 - Summary of Work.
- .7 Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- .8 Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - .1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - .2 Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - .3 Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - .4 Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - .5 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - .6 Proceed with patching after construction operations requiring cutting are complete.
- .9 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where

applicable.

- .1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  - .2 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - .1 Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - .2 Restore damaged pipe covering to its original condition.
  - .3 Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, colour, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
    - .1 Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  - .4 Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  - .5 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- .10 Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.4 Subfloor Levelling

- .1 Where existing flooring is to be removed from floor slabs to remain, including ceramic tile flooring, carefully remove all flooring, grout, adhesives, waterproofing membranes and the like down to the base slab. Clean, patch and repair slab where damaged with concrete or acceptable leveling compound in accordance with new flooring manufacturer's instructions and ASTM F710. Refer to original building drawings and remove and replace existing concrete floor toppings as necessary and where required.
- .2 Where new flooring is to be installed on new concrete slab or on framed floors, subfloor shall be levelled in accordance with flooring manufacturer's specifications and tolerances and with ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

### 3.5 Fire Barrier Seals

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

End of Section

## **PART 1 GENERAL**

### **1.1 Section Includes**

- .1 Progressive Cleaning
- .2 Final Cleaning

### **1.2 References**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA 241-22 Standard for Safeguarding Construction, Alteration, and Demolition Operations.

### **1.3 Project Cleanliness**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Owner. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use clearly marked separate bins for recycling.
- .7 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

## **PART 2 PRODUCTS**

### **2.1 Products**

- .1 All cleaning materials and products shall be low VOC type. Submit list of cleaning products including SDS for approval prior to commencement of cleaning operations.
- .2 Use only cleaning materials recommended by manufacturer of surface to be cleaned and recommended by cleaning material manufacturer.

### **PART 3 EXECUTION**

#### **3.1 Final Cleaning**

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .5 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.
- .6 Clean lighting reflectors, lenses, and other lighting surfaces. Clean and/or replace lamps, light fixtures, grilles and lenses.
- .7 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .8 Thoroughly vacuum clean interior of electrical equipment.
- .9 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .10 Clean and seal concrete floor surfaces with non-skid matte sealer.
- .11 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .12 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .13 Broom clean and wash exterior paved areas, walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs. Clear all drains, scuppers, gutters and downspouts.
- .16 Remove debris and surplus materials from crawl spaces and other accessible concealed spaces.
- .17 Remove snow and ice from access to building.
- .18 Under direction of Consultant, aim adjustable luminaires.

#### **3.2 Waste Management and Disposal**

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



**Project:** 24015  
**Description:** Mill Courtland Community Centre Addition  
216 Mill Street, Kitchener, ON

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**CLEANING**  
**Section 01 74 11**

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 Materials Source Separation Program.
- .8 Disposal of Wastes.
- .9 Scheduling.
- .10 Storage, Handling and Protection.
- .11 Application.
- .12 Diversion of Materials.

### 1.2 References

- .1 O. Reg. 102/94 Waste Audits and Waste Reduction Work Plans.
- .2 O. Reg. 278/05 Occupational Health and Safety Act

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit a completed Waste Management Plan (WMP) prior to project start-up.

### 1.4 Definitions

- .1 Waste Management Plan (WMP): Contractor's approved overall strategy for waste management including waste reduction workplan and materials source separation program.
- .2 Materials Source Separation Program (MSSP): Consists of a series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .3 Separate Condition: Refers to waste sorted into individual types.

### 1.5 Waste Management Goals for the Project

- .1 The Owner has established that this Project shall generate the least amount of waste possible and that processes shall be employed that ensure the generation of as little waste as possible including prevention of damage due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing over packaging and poor quantity estimating.
- .2 Of the waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling. Waste disposal in landfills or incinerators shall be minimized.

1.6 Waste Management Plan

- .1 Waste Management Plan: Submit a Waste Management Plan within 10 calendar days after receipt of Notice of Award of Contract, or prior to any waste removal, whichever occurs sooner. The Plan shall contain the following:
  - .1 Analysis of the proposed job site waste to be generated, including the types of recyclable and waste materials generated (by volume or weight). In the case of demolition, a list of each item proposed to be salvaged during the course of the project should also be prepared
  - .2 Alternatives to Land Filling: Contractor shall designate responsibility for preparing a list of each material proposed to be salvaged, reused, or recycled during the course of the Project.
- .2 Post WMP or summary where workers at site are able to review its content.

1.7 Materials Source Separation Program

- .1 The Waste Management Plan shall include a Source Separation Program for recyclable waste and shall be in accordance with the established policies currently in place at the local Municipality, and the requirements of O. Reg. 102/94.
- .2 Prepare MSSP and have ready for use prior to project start-up.
- .3 Implement MSSP for waste generated on project in compliance with approved methods and as approved by Consultant.
- .4 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- .5 Provide containers to deposit reusable and/or recyclable materials.
- .6 Locate containers to facilitate deposit of materials without hindering daily operations.
- .7 Locate separated materials in areas which minimize material damage.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

1.8 Disposal of Wastes

- .1 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .2 Provide appropriate on-site containers for collection of waste materials and debris. Containers for volatile wastes shall be closed containers and shall be removed from site daily.
- .3 Provide and use clearly marked separate bins for recycling.
- .4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.
- .5 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .6 Do not permit waste to accumulate onsite.

- .7 Burying of rubbish and waste materials is prohibited.
- .8 Disposal of waste into waterways, storm, or sanitary sewers is prohibited.

1.9 Scheduling

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

1.10 Storage, Handling and Protection

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Owner.
- .2 Materials from building demolition to be salvaged or re-used are to be removed and salvaged.
- .3 Unless specified otherwise, materials for removal become Contractor's property.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.1 Application

- .1 Do work in compliance with Waste Management Plan.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.2 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.
- .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
  - .1 CCDC 2-2020 Stipulated Price Contract including Supplementary Conditions.
- .2 OAA/OGCA Document 100 - Recommended Procedures Regarding Substantial Performance of Construction Contracts and Completion Takeover of Projects.
- .3 The Construction Act.

### 1.3 Inspection and Declaration

- .1 Contractor's Inspection: The Contractor shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents. Submit duplicate copies of the deficiency list to the Owner and Consultant.
  - .1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  - .2 Request Consultant's review.
- .2 Consultant's Review: Consultant and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
  - .1 Work has been completed and inspected for compliance with Contract Documents.
  - .2 Defects have been corrected and deficiencies have been completed.
  - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
  - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies, TSSA, ESA and other regulatory agencies have been submitted.
  - .5 Operation of systems have been demonstrated to Owner's personnel.
  - .6 Work is complete and ready for Final Review by the Consultant.
- .4 Final Inspection: when items noted above are completed, request final review of Work by Consultant, and Contractor. If Work is deemed incomplete by the Consultant, complete outstanding items and request re-review.
- .5 Declaration of Substantial Performance: when Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance. Refer to CCDC 2, General Conditions Article GC 5.4 - Substantial Performance of Work and Payment of Holdback for specifics to application.
- .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .7 Final Payment: When Consultant considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to CCDC 2, General Conditions Article GC 5.5 – Final Payment for specifics to application.

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

**PART 2 PRODUCTS**

**2.1 Not Used**

- .1 Not used

**PART 3 EXECUTION**

**3.1 Not Used**

- .1 Not used

End of Section

## PART 1 GENERAL

### 1.1 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 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.

#### 1.7 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 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.

#### 1.8 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.

#### 1.9 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 troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .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.

#### 1.10 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.

#### 1.11 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.

**1.12**     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.

**1.13**     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.

**1.14**     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.

**1.15**     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.

1.16 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 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 02 41 13.14 Asphalt Paving Removal
- .2 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 Ontario Provincial Regulations
  - .1 Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans.
  - .2 Ontario Regulation 103/94 Environmental Protection Act.
  - .3 Ontario Regulation 213/07 The Fire Code.
  - .4 Ontario Regulation 232/98 Landfilling Sites.
  - .5 Ontario Regulation 347 Environmental Protection Act, General - Waste Management.
- .3 The Workplace Health and Safety Act, and Regulations for Construction Projects.
- .4 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37
  - .2 Canadian Environmental Protection Act 1999 (CEPA), c. 33
- .5 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832/R-92-005 Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Hazardous Materials: provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
- .3 Submit plan indicating: Descriptions of and anticipated quantities of materials to be salvaged, reused, recycled and landfilled.
- .4 Submit copies of certified weigh bills, bills of lading or receipts from authorized disposal sites and reuse and recycling facilities for material removed from upon request from Consultant.

### 1.5 Quality Assurance

- .1 Preconstruction Meeting: Arrange a reconstruction Meeting: Arrange a preconstruction meeting attended by Contractor's key personnel to discuss the following:
  - .1 Verify project requirements
  - .2 Review site conditions
  - .3 Coordination with other Subcontractors affected by work of this Section
  - .4 Examine existing site conditions adjacent to demolition work, prior to start of Work
  - .5 Waste reporting requirements

- .2 Arrange for site visit with Consultant to examine existing site conditions adjacent to demolition work prior to start of Work.
  - .3 Coordination: Coordinate requirements for Waste Management and Disposal for materials being re used or recycled in accordance with Section 01 74 19.
    - .1 Divert excess materials from landfill
    - .2 Separate materials identified for recycling place in identified areas in accordance with Waste Management Plan
    - .3 Label location of salvaged material's storage areas and provide barriers and security devices
    - .4 Remove materials that cannot be salvaged for re use or recycling and dispose of in accordance with applicable codes at licensed facilities
  - .4 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEEA and applicable Provincial regulations.
  - .5 Comply with hauling and disposal regulations of Authority Having Jurisdiction.
- 1.6 Shipping, Handling and Storage
- .1 Refer to Section 01 61 00 – Common Product Requirements.
  - .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Consultant and at no cost to Owner.
  - .3 Remove and store materials to be salvaged, in manner to prevent damage.
- 1.7 Project Conditions
- .1 Protect existing site features to remain or identified for salvage or re use; make repairs and restore to a similar condition to existing where damage to these items occurs as directed by the Consultant and at no cost to Owner:
    - .1 Remove and store salvaged materials to prevent contamination.
    - .2 Store and protect salvaged materials as required for maximum preservation of material.
    - .3 Handle salvaged materials the same as new materials.
  - .2 Protect trees, plants and foliage on site and adjacent properties where indicated.
  - .3 Protect existing site features and structures, trees, plants and foliage on site and adjacent properties.
  - .4 Provide erosion and sedimentation control as specified in Section 31 23 10 and on site development drawings.
  - .5 Ensure that demolition work does not adversely affect adjacent water courses, groundwater and wildlife, or contribute to excess air and noise pollution.
  - .6 Do not dispose, of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.
  - .7 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

1.8 Waste Management and Disposal

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

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used

PART 3 EXECUTION

3.1 Preparation

- .1 Inspect site and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities, preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Separate work areas from areas occupied by the Owner and the public, as specified in Section 01 56 00.

3.2 Removal of Hazardous Wastes

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.3 Removal Operations

- .1 Remove items as indicated.
- .2 Salvage for res use existing signage, where indicated. Existing concrete sign bases shall be removed entirely.
- .3 Do not disturb items designated to remain in place.
- .4 When removing pipes under existing or future pavement area, excavate at least 300mm below pipe invert.
- .5 Removal from site: Interim removal of stockpiled material will be required by Consultant, if it is deemed to interfere with operations of Owner.
- .6 Backfill: Refer to Section 31 23 10.

3.4 Restoration

- .1 Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.

- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- .3 Restore areas within public roadways and road allowances in accordance with municipal standards.

3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

End of Section



## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 02 41 13 Selective Site Demolition
- .2 Section 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 Ontario Provincial Regulations
  - .1 Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans.
  - .2 Ontario Regulation 103/94 Environmental Protection Act.
  - .3 Ontario Regulation 213/07 The Fire Code.
  - .4 Ontario Regulation 232/98 Landfilling Sites.
  - .5 Ontario Regulation 347 Environmental Protection Act, General - Waste Management.
- .2 The Workplace Health and Safety Act, and Regulations for Construction Projects.
- .3 Department of Justice Canada (Jus):
  - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37
  - .2 Canadian Environmental Protection Act, 1999 (CEPA), c. 33

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Hazardous Materials: provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
- .3 Submit plan indicating:
  - .1 Descriptions of and anticipated quantities of materials to be salvaged, reused, recycled and landfilled.
  - .2 Schedule of selective demolition.
  - .3 Submit copies of certified weigh bills, bills of lading from authorized disposal sites and reuse and recycling facilities for material removed from upon request from Consultant.
- .4 Informational Submittals: Provide the following submittals during the course of the work:
  - .1 Certificates: Submit copies of certified weigh bills, bills of lading or receipts from authorized disposal sites and re use and recycling facilities for material removed from site.

### 1.5 Quality Assurance

- .1 Preconstruction Meeting: Arrange a preconstruction meeting attended by Contractor's key personnel to discuss the following:
  - .1 Verify project requirements
  - .2 Review site conditions
  - .3 Coordination with other Subcontractors affected by work of this Section
  - .4 Examine existing site conditions adjacent to demolition work, prior to start of Work
  - .5 Waste reporting requirements

- .2 Arrange for site visit with Consultant to examine existing site conditions adjacent to demolition work prior to start of Work.
- .3 Coordination: Coordinate requirements for Waste Management and Disposal for materials being re used or recycled in accordance with Section 01 74 19.
  - .1 Divert excess materials from landfill
  - .2 Separate materials identified for recycling place in identified areas in accordance with Waste Management Plan
  - .3 Label location of salvaged material's storage areas and provide barriers and security devices
  - .4 Remove materials that cannot be salvaged for re use or recycling and dispose of in accordance with applicable codes at licensed facilities
- .4 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA and applicable Provincial regulations.
- .5 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

1.6 Project Conditions

- .1 Protect existing site features to remain or identified for salvage or re use; make repairs and restore to a similar condition to existing where damage to these items occurs as directed by the Consultant and at no cost to Owner:
  - .1 Remove and store salvaged materials to prevent contamination.
  - .2 Store and protect salvaged materials as required for maximum preservation of material.
  - .3 Handle salvaged materials the same as new materials.
- .2 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .3 Perform pavement removal work to prevent adverse effects to adjacent watercourses, groundwater and wildlife, and to prevent excess air and noise pollution:
  - .1 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
  - .2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Authorities Having Jurisdiction.
- .4 Protect existing site features and structures, trees, plants and foliage on site and adjacent properties.
- .5 Provide erosion and sedimentation control as specified in Section 31 23 10 and on site development drawings.
- .6 Ensure that demolition work does not adversely affect adjacent water courses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .7 Do not dispose, of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.
- .8 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

1.7 Waste Management and Disposal

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

PART 2 PRODUCTS

2.1 Equipment

- .1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from string line, and capable of removing part of pavement surface to depths or grades indicated.

PART 3 EXECUTION

3.1 Preparation

- .1 Verify extent and location of asphalt identified for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities, preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Temporary Erosion and Sedimentation Control:
  - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal
- .5 Prior to beginning removal operation, inspect and verify with Consultant areas, depths and lines of asphalt pavement to be removed.
- .6 Protection: protect existing pavement not designated for removal, lighting fixtures, signage and structures from damage. In event of damage, immediately replace or make repairs to approval of Consultant at no additional cost.
- .7 Separate work areas from areas occupied by the Owner and the public, as specified in Section 01 56 00.

3.2 Removal

- .1 Remove existing asphalt pavement to lines and grades as indicated.
- .2 Demolition of pavements, curbs and gutters:
  - .1 Square up adjacent surfaces to remain in place by saw cutting or other method acceptable to the Consultant.
  - .2 Protect adjacent joints and load transfer devices.
  - .3 Protect underlying and adjacent granular materials where they are exposed and identified to remain.

- .3 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.
- .4 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
- .5 Suppress dust generated by removal process.

**3.3** Finish Tolerances

- .1 Finished surfaces in areas where asphalt pavement has been removed to be within 5 mm of grade specified but not uniformly high or low.

**3.4** Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.
- .4 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .5 Removed asphalt pavement which is to be recycled in hot mix asphalt concrete under this Contract may be stockpiled at designated asphalt plant site.

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 2020, Part 8-Safety Measures on Construction and Demolition Sites.
- .2 CSA Group (CSA)
  - .1 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .3 ASTM International (ASTM)
  - .1 ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- .4 Ontario Provincial Regulations
  - .1 Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans.
  - .2 Ontario Regulation 103/94 Environmental Protection Act.
  - .3 Ontario Regulation 213/07 The Fire Code.
  - .4 Ontario Regulation 232/98 Landfilling Sites.
  - .5 Ontario Regulation 278/05 Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.
  - .6 Ontario Regulation 347 Environmental Protection Act, General — Waste Management.
  - .7 Ontario Regulation 332/12 The Building Code.
- .5 The Workplace Health and Safety Act, and Regulations for Construction Projects.
- .6 The Contractors Health and Safety Policy.
- .7 Laws, rules and regulations of other authorities having jurisdiction.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit detailed written schedule, methodology and proposed procedures for demolition, including a Safe Work Plan for review prior to commencement of demolition.
- .3 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details clearly showing sequence of disassembly work or supporting structures and underpinning.
- .4 Drawings for structural elements of the demolition process including shoring, underpinning and installation of new lintels or beams in existing load bearing walls, shall bear signature and stamp of qualified professional engineer registered in the Province of Ontario.
- .5 Submit proposed dust-control measures.
- .6 Submit proposed noise-control measures.
- .7 Submit schedule of demolition activities indicating the following:
  - .1 Detailed sequence of demolition and removal work, including start and end dates for each activity.

- .2 Dates for shutoff, capping, and continuation of utility services.
- .8 If hazardous materials are encountered and disposed of, landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
- .9 At Project Closeout: Submit record drawings in accordance with Section 01 78 00. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions

#### 1.5 Permits

- .1 Obtain and pay for all permits and comply with all laws, rules, ordinances, and regulations relating to Demolition of Building and preservation of Public Health and Safety.
- .2 The Consultant will complete General Review during demolition in accordance with the Ontario Building Code. All other engineering required for shoring design and for other structural elements of the demolition work will be completed by the Contractor's own engineer and paid for by the Contractor.

#### 1.6 Waste Management Plan

- .1 All work of this section shall be completed in accordance with the contractors approved Waste Management Plan specified in Section 01 74 19.

#### 1.7 Definitions

- .1 Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.
- .2 Demolition Waste: Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel. The materials may include rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.
- .3 Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human or animal life; affect other species of importance to humanity; or degrade the utility of the environment for aesthetic, cultural or historical purposes.
- .4 Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively for the purpose of disposal.
- .5 Inert Solids/Inert Waste: Non-liquid solid waste including, but not limited to, soil and concrete that does not contain hazardous substances or soluble pollutants at concentrations in excess of water-quality standards established by a regional water board and does not contain significant quantities of decomposable solid waste.
- .6 Landfill: A landfill that accepts non-hazardous materials such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A landfill must have a solid waste facilities permit from the Ministry of the Environment and be in conformance to O. Reg 232/98.

- .7 Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
- .8 Remove: Remove and legally dispose of items, except those identified for use in recycling, re-use, and salvage programs.
- .9 Reuse: The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.
- .10 Solid Waste: All putrescible and non-putrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by law.

#### 1.8 Quality Assurance

- .1 Demolition Firm Qualifications: Demolition contractor shall be an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.
- .2 Regulatory Requirements: Comply with governing regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Obtain and pay for all permits required.
- .3 Pre-demolition Conference: Conduct a conference at Project site.
  - .1 Review the environmental goals of this Project and make a proactive effort to increase awareness of these goals among all labor forces on site.
  - .2 Review schedule and scheduling procedures.
  - .3 Review health and safety procedures.
  - .4 Review of Project conditions including review of record photographs.

#### 1.9 Project Conditions

- .1 Construct safety barriers, barricades, fencing and hoarding to separate public from work areas as described in Section 01 56 00.
- .2 The Owner assumes no responsibility for the actual condition of the structures to be demolished.
- .3 Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. Variations within the structures may occur by the Owner's salvage operations prior to start of demolition.

#### 1.10 Designated Substances

- .1 Refer to Designated Substances and Hazardous Building Materials Assessment, Mill Courtland Community Centre, 216 Mill Street, Kitchener, ON dated July 9, 2023 and prepared by Onward Environmental Inc..
- .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 be completed in accordance with O. Reg 278/05 and all other applicable legislation.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- .1 Provide all materials necessary for temporary shoring. On completion, remove temporary materials from site.
- .2 All building materials removed from the building shall become the property of the Contractor unless specified otherwise and shall be reused in new construction or removed from the Site.
- .3 All concrete, masonry, asphalt and similar materials shall be crushed prior to disposal.

### **2.2 Salvage**

- .1 All items of salvageable value must be salvaged.
- .2 Provide a schedule of items to be salvaged and clearly indicate which items are to be retained by Owner. Clearly identify and tag each salvageable item.
- .3 Transport salvaged items from the site as they are removed.
- .4 Items of salvageable value to the Contractor may be removed from the structure as the work progresses, if such items are not claimed by the Owner.

### **2.3 Reuse**

- .1 Salvage and reuse materials as indicated on the drawings.

### **2.4 Recycle**

- .1 All materials from demolition and land clearing which can be recycled through local municipal programs and which is not scheduled for salvage shall be sorted and separated in accordance with Regional, Provincial and Municipal standards and regulations.
- .2 Provide recycling receptacles for the duration of construction activities at the building site.

## **PART 3 EXECUTION**

### **3.1 Examination**

- .1 Survey existing conditions and correlate with requirements indicated to determine extent of demolition, salvage and recycling required.
- .2 Verify that utilities have been disconnected and capped.



- .3 Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.
- .4 Retain a licensed and qualified civil or structural engineer to provide analysis, including calculations, necessary to ensure the safe execution of the demolition work.
- .5 Perform surveys and tests as the Work progresses to detect hazards resulting from demolition activities.
- .6 Preliminary Survey:
  - .1 The Demolition Plans indicate the general extent of existing conditions based upon drawings provided by the Owner and existing site conditions. Review all areas of work to determine full extent of areas to be demolished, altered or renovated and become familiar with actual conditions and extent of work required.
  - .2 Before commencing demolition operations, examine Site and provide engineering survey to determine type of construction, condition of structure, and Site conditions. Assess strength and stability of damaged or deteriorated structures.
  - .3 Assess potential effect of removal of any part or parts on the remainder of structure before such part(s) are removed.
  - .4 Assess effects of demolition at adjacent structures and consider need for underpinning, shoring and/or bracing.
  - .5 Investigate for following conditions:
    - .1 load bearing walls and floors
    - .2 structure suspended from another
    - .3 effects of soils, water, lateral pressures on retaining or foundations walls
    - .4 presence of tanks and other piping systems
    - .5 presence of designated substances and hazardous materials.
- .7 After determining demolition methods, determine area of possible vibration. Carefully inspect beyond those adjacent areas. List potential damage areas and photograph each for record purposes before starting work.

### 3.2 Preparation

- .1 Erect and maintain dustproof and weatherproof partitions as required to prevent spread of dust, fumes and smoke to other parts of building. Maintain fire exits. On completion, remove partitions and make good surfaces to match adjacent surfaces of building.
- .2 Provide all shoring and bracing required for the execution of the work.
- .3 Ensure all sedimentation controls as required are in place prior to commencement of demolition activities.
- .4 Before commencing demolition, verify that existing water, gas, electrical and other services in areas being demolished are cut off, capped diverted or removed as required. Post warning signs on electrical lines and equipment which must remain energized to serve adjacent areas during period of demolition.
- .5 Conduct demolition operations and remove materials from demolition to ensure minimum interference with roads, streets, walks, and other adjacent occupied and utilized facilities.

- .6 Do not close or obstruct streets, walks, or other adjacent occupied or utilized facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

### 3.3 Utilities

- .1 Contact authorities or utility companies for assistance in locating and marking services passing under, through, overhead or adjacent to structure to be demolished. Such services include:
  - .1 Electrical power lines
  - .2 Gas mains
  - .3 Communication cables
  - .4 Fibre optic cables
  - .5 Water lines.
  - .6 Drainage piping (storm and sanitary).
- .2 Before disconnecting, removing, plugging or abandoning any existing utilities serving the building:
  - .1 Notify the Owner, applicable utility companies, and local authorities having jurisdiction.
  - .2 Cut off and cap utilities at the mains on the property or in the street as required by the Owner and responsible utility company. Maintain fire protection to the existing buildings at all times.
  - .3 Remove, cut off and plug, or cap all utilities within the existing building areas to be demolished, except those designated to remain

### 3.4 Protection

- .1 Erect and maintain temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Maintain such areas free of snow, ice, water and debris. Lighting levels shall be equal to that prior to erection.
- .2 Provide safe access and egress from working areas using entrances, hallways, stairways or ladder runs, protected to safeguard personnel using them from falling debris.
- .3 Do not interfere with use and activities of adjacent buildings and site. Maintain free and safe passage to and from buildings.
- .4 Where demolition operations prevent normal access to adjacent properties, provide and maintain suitable alternative access.
- .5 Provide flagmen where necessary or appropriate, to provide effective and safe access to site to vehicular traffic and protection to Owner's personnel. Refer to Division 1 for safety requirements.
- .6 Protect existing site improvements, 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 a 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, fittings and services as indicated
  - .7 Damages: Promptly repair damages to adjacent facilities caused by demolition operations.
  - .8 Prevent access to excavations by means of fences or hoardings.

### 3.9 Selective Demolition

- .1 Carefully dismantle and remove all items in as shown and as necessary to complete the work.
- .2 Salvage items scheduled for reuse or to be handed over to the Owner.
- .3 Particular attention shall be paid to prevention of fire and elimination of fire hazards which would endanger the existing buildings.
- .4 Where existing flooring is to be removed from floor slabs to remain, including ceramic tile flooring, carefully remove flooring, grout, adhesives, waterproofing membranes and the like down to the base slab. Patch and repair slab where damaged with concrete or acceptable leveling compound in accordance with new flooring manufacturer's instructions and ASTM F710. Refer to original building drawings and remove and replace existing concrete floor toppings as necessary and where required.
- .5 Return areas to condition existing prior to the start of the work unless indicated otherwise.
- .6 At exterior and interior bearing walls to be removed, include breaking out and removal of existing concrete foundations to a minimum of 200 mm below new finished floor level.

### 3.10 Handling of Demolished Materials

- .1 Conform to the approved Waste Management Plan.
- .2 Do not allow demolished materials to accumulate or be stored on-site for more than 5 days.
- .3 Do not burn, bury or otherwise dispose of rubbish and waste materials on project site.
- .4 Pallet and shrink-wrap materials scheduled for re-use and stockpile where directed on site.
- .5 Disposal: Transport demolished materials off Owner's property and legally reuse, salvage, recycle, or dispose of materials. Legally transport and dispose of materials that cannot be delivered to a source separated or mixed recycling facility to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.

- .6 Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.

### 3.11 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean adjacent streets and driveways of dust, dirt and materials caused by demolition operations.
- .3 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.
- .4 Upon completion of demolition work, remove debris, trim surfaces and leave work site clean.
- .5 Video storm and sanitary sewers and jet clean where debris may have accumulated

End of Section

## **PART 1 GENERAL**

### **1.1 General**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Sections**

- .1 Section 03 20 00 Concrete Reinforcing
- .2 Section 03 30 00 Cast-in-Place Concrete
- .3 Section 05 50 00 Metal Fabrications
- .4 Section 31 23 10 Excavating, Trenching and Backfilling

### **1.3 References**

- .1 American Concrete Institute (ACI)
  - .1 ACI 117-10 Specifications for Tolerances for Concrete Construction and Materials.
  - .2 ACI 347R-14 Guide to Formwork for Concrete
  - .3 ACI SP-4-14 Formwork for Concrete
- .2 CSA Group (CSA)
  - .1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete
  - .2 CSA B111-1974 (R2003) Wire Nails, Spikes and Staples
  - .3 CSA O86:19 Engineering Design in Wood
  - .4 CSA O121-2017 (R2022) Douglas Fir Plywood
  - .5 CSA O141:23 Canadian Standard Lumber
  - .6 CSA S269.1-16 (R2021) Falsework and Formwork

### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings showing type, extent and locations of items to be built into concrete.
  - .2 Sleeving Drawings: Submit drawings showing sleeves required through floors, roof and other structural members.
  - .3 Submit drawings showing size and spacing of conduits and piping.
  - .4 Coordinate with other Divisions prior to submittal.
  - .5 Do not commence placing sleeves, conduits, or piping before drawings have been reviewed and Consultant's comments incorporated on drawings issued to site.
  - .6 Assume responsibility for accuracy of Work. Review of submitted shop drawings does not relieve Contractor from compliance with requirements of Contract Documents.
- .3 Required by Regulatory Agencies: Submit shop drawings bearing signature and seal of Professional Engineer responsible for formwork design, as may be required by regulatory Agencies. Proceed with construction of formwork only with their approval.

### **1.5 Quality Assurance**

- .1 Obtain a copy of CSA A23.1/A23.2 and maintain on site
- .2 Design of Formwork: Assume full responsibility for complete structural design and construction of formwork in accordance with CSA S269.1 and CSA O86, as applicable.

.1 The design and engineering of the formwork, as well as its' construction, shall be the responsibility of the Contractor.

.3 Formwork shall be designed for the loads and lateral pressures outlined in the ACI publication "SP-4 Formwork for Concrete" and wind pressures and allowable stresses as set down in the National Building Code and in accordance with CSA A23.1 and A23.2. Formwork shall be of sufficient strength and rigidity to support all concrete and construction loads, taking into account proposed rate and method of pouring concrete so that the resultant finished concrete shall conform to the shapes, lines and dimensions of the members shown on the drawings.

#### 1.6 Shipping, Handling and Storage

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

.2 Protect formwork to prevent functional damage and damage to faces affecting appearance of concrete surfaces exposed to view.

#### 1.7 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Materials

.1 All materials shall be new, in accordance with referenced standards.

.2 Plywood: Douglas Fir, conforming to CSA O121. Sound undamaged sheets finished one side, fabricated especially for use as concrete form panels, with sealed edges. Minimum 17mm thickness.

.3 Lumber: Conforming to CSA O141, with grade stamp clearly visible.

.4 Chamfers: Cut from 19mm x 19mm wood, smooth with no open defects.

.5 Form Ties: snap ties, with spreader washer and 25mm break back.

.6 Void Form: Honeycomb cellular core structure manufactured from kraft fibre. Top and sides protected with wax coated corrugated board, and bottom unprotected.

.7 Round Column Fibre Forms: Sonotube "W" Coated, by Sonoco Limited.

.8 Cast in Place Architectural Forms: NEWWAVEA 510R-High single use Artforms concrete forms as manufactured by Artforms International Inc.

.9 Joint Tape: non-staining, water impermeable, self-release.

.10 Nails, Spikes and Staples: Galvanized, conforming to CSA B111.

.11 Form Release Agent: Colourless mineral oil which will not stain concrete.

.12 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 Waterstops:
  - .1 Install waterstops to provide continuous water seal.
  - .2 Do not distort or pierce waterstop in way as to hamper performance.
  - .3 Do not displace reinforcement when installing waterstops.
  - .4 Use equipment to manufacturer's requirements to field splice waterstops.
  - .5 Tie waterstops rigidly in place.
  - .6 Use only straight heat sealed butt joints in field.
  - .7 Use factory welded corners and intersections unless otherwise approved by Consultant.
- .7 Voidform: Install voidform and place 7.5 mm thick plywood over voidform, to provide firm surface for supporting reinforcement.
- .8 Round Fibre Forms:
  - .1 At concealed locations, provide uncoated fibre form.
  - .2 Provide round fibre form where indicated for piers, equipment bases, light pole bases, fence foundation and wherever indicated or required.
- .9 Adequately brace and shore formwork to sustain loads (both concrete and working loads) applied during construction.
- .10 Be responsible for safety of the structure both before and after the removal of forms, until the concrete has reached its specified 28 day strength.

#### 3.3 Built-In Work

- .1 Form openings and build in anchors, inserts, sub-frames, key-ways, sleeves, miscellaneous metal items, reglets and similar items furnished under Work of other Sections, which are indicated on Drawings and on shop drawings of other trades, and as required for proper completion of Work.

- .2 Do not embed wood in concrete.
- .3 Anchor Bolts: Tie anchor bolts securely in position to prevent movement during concrete placing. Use template to locate bolts. Verify that bolts have specified projection above concrete.
- .4 Openings or Sleeves Not Shown on Structural Drawings:
  - .1 Obtain Consultant's written approval before forming openings of sleeves through columns and beams, or through slabs within 1800 mm of their supports.
  - .2 Obtain Consultant's written approval before forming openings or sleeves larger than 200 mm square in any location.
- .5 Embedded Pipe or Conduit Not Shown or Detailed on Structural Drawings:
  - .1 Obtain Consultant's written approval before placing conduit or pipe which would be embedded in finished structure.
- .6 Confirm that built-in items that penetrate surface waterproofing are installed to meet requirements of waterproofing trade.

### 3.4 Construction Joints

- .1 Form construction and expansion joints with bulkheads to ensure straight lines. Immediately before subsequent pour at construction joint, remove bulkhead and tighten forms so that concrete surfaces will be on same plane with no overlapping of concrete.
- .2 Review with Consultant proposed location and details of construction joints in walls, columns, beams and slabs.
  - .1 Construction joints shall present appearance of normal form panel joint.
  - .2 Install continuous shear key in construction joints in walls and framed floors which are 152mm or more thick.
  - .3 Provide vertical construction joints in walls at not more than 20 metres centre to centre.
  - .4 Provide waterstops in accordance with manufacturer's instructions at construction joints in walls which retain earth. Waterstops shall be continuous.

### 3.5 Treatment of Formwork Surfaces

- .1 Form Release Agent:
  - .1 Coat formwork with form release agent before reinforcement, anchors, accessories, and other built in items are installed.
  - .2 Do not coat plywood forms pre-treated with release agent.
  - .3 On surfaces to receive finish materials, adhesives, sealers, paint or other coatings or materials, use a compatible release agent.

### 3.6 Stripping of Formwork

- .1 Strip formwork on vertical surfaces when concrete has hardened sufficiently that no damage will result from stripping operations.
- .2 Do not remove plywood formwork by jerking loose or by metal pinch bars. Use wood wedges and gradually force panels loose. Leave plywood forms in place as long as possible to permit maximum shrinkage away from concrete.
- .3 Take particular care not to damage external corners when stripping formwork.

- .4 When forms are stripped during curing period, cure and protect exposed concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.

### 3.7 Defective Work

- .1 Movement and displacement of formwork during construction, variations in excess of specified tolerances, marked and disfigured surfaces, and failure of materials or workmanship to meet requirements of this specification, and which cannot be repaired by approved methods, will be considered defective work.
- .2 Replace defective work, as directed by Consultant.
- .3 Pay for additional inspection and testing, redesign, corrective measures, and related expenses, if work has proven to be deficient.
- .4 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost.

### 3.8 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 10 00 Concrete Forming and Accessories
- .2 Section 03 30 00 Cast-in-Place Concrete
- .3 Section 04 05 19 Masonry Anchorage and Reinforcing
- .4 Section 04 22 00 Concrete Unit Masonry
- .5 Section 05 50 00 Metal Fabrications
- .6 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-22 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- .2 American Concrete Institute (ACI)
  - .1 ACI SP-66 (04) ACI Detailing Manual
- .3 CSA Group (CSA)
  - .1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete
  - .2 CSA A23.3:19 Design of Concrete Structures
  - .3 CSA G30.18:21 Carbon Steel Bars for Concrete Reinforcement
  - .4 CSA G40.20-13/G40.21-13 (R2018) General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
  - .5 CSA W186:21 Welding of Reinforcing Bars in Reinforced Concrete Construction
- .4 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC Reinforcing Steel Manual of Standard Practice

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings, including placing drawings and bar lists.
  - .2 Prepare placing drawings and bar lists in accordance with the American Concrete Institute (ACI) Detailing Manual, and the Reinforcing Steel Institute of Canada (RSIC) Reinforcing Steel Manual of Standard Practice and the typical details included with Contract Documents.
  - .3 Prepare placing drawings to minimum scale of 1:50.
  - .4 Submit placing drawings and bar lists sufficiently detailed and dimensioned to permit correct placement of reinforcement and accessories without reference to architectural or structural Drawings.
  - .5 Show reinforcement, including dowels, in elevation on placing drawings for wall reinforcement.
  - .6 Show concrete cover to reinforcement.
  - .7 Show location of construction joints.
- .3 Inspection Reports: Inspection and Testing Company shall:

- .1 Submit written reports of inspection and tests.
- .2 Distribute reports as follows:
  - .1 Consultant.
  - .2 Contractor.
- .4 Quality Assurance Submittals:
  - .1 Mill Test Report: provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
  - .2 Submit in writing proposed source of reinforcement material to be supplied.

#### 1.5 Quality Assurance

- .1 Obtain a copy of CSA A23.1/A23.2 and maintain on site.
- .2 Qualifications: Welding: Undertake welding of reinforcement only by a fabricator or Subcontractor approved by Canadian Welding Bureau to requirements of CSA W186.
- .3 Source Quality Control: Source Quality Control may be performed by an Inspection and Testing Company appointed by Consultant.
- .4 Review provided by Inspection and Testing Company does not relieve Contractor of his sole responsibility for quality control over Work. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of his responsibilities in complying with the requirements of the Specification.
- .5 Identify and correlate reinforcing steel from Canadian mills with test reports for compliance with requirements specified.
- .6 Test unidentified reinforcing steel at expense of Contractor. Perform testing for each 1 tonne or part thereof supplied for incorporation in Work.

#### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

#### 1.7 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 In accordance with reference standards.
- .2 Substitute different size bars only if permitted in writing by Consultant.
- .3 Bar Reinforcing Steel:
  - .1 Bars which are to be welded by arc-welding process: to CSA G30.18, Grade 400W.
  - .2 Other bars: to CSA G30.18, Grade 400R.
- .4 Plain round bars: to CSA G40.20-04/G40.21.

- .5 Welded Wire Fabric: to ASTM A1064/A1064M and in flat sheets, not rolls.
- .6 Cold-drawn annealed steel wire ties: to ASTM A497.
- .7 Chairs, bolsters, bar supports, spacers: to CSA A23.1.
- .8 Mechanical splices: subject to approval of Consultant.

## 2.2 Fabrication

- .1 Fabricate reinforcing steel only in permanent fabricating shop.
- .2 Fabricate reinforcing steel in accordance with shop drawings.
- .3 Tag reinforcing bars to indicate placement as designated on shop drawings.
- .4 Splices:
  - .1 Provide splices only where specifically indicated on Drawings.
  - .2 Stagger alternate mechanical splices 750 mm apart.
  - .3 Stagger alternate end bearing splices 750 mm apart.
  - .4 Install on threaded splices, plastic internal coupler thread protector and plastic bar end thread protector.

## PART 3 EXECUTION

### 3.1 Examination

- .1 Before starting this work, examine work done by others which affects this work.
- .2 Examine formwork to verify that it has been completed, and adequately braced in place.
- .3 Notify the Consultant of any conditions which would prejudice proper completion of this work.
- .4 Commencement of work implies acceptance of existing conditions.

### 3.2 Installation

- .1 Place reinforcing steel in accordance with reviewed placing drawings, typical details, and CSA A23.3.
- .2 Adequately support reinforcing and secure against displacement within tolerances permitted.
- .3 Place reinforcing steel to provide minimum spacing and proper concrete cover as noted on drawings.
- .4 Do not cut reinforcement to incorporate other Work.
- .5 Relocate or rebend bars only on written instructions of Consultant.
- .6 Tie reinforcement in place. Do not weld.

### 3.3 Adjusting

- .1 Adjust and secure reinforcement in correct position immediately before concrete is placed.

- .2 Remove contaminants which lessen bond between concrete and reinforcement.

3.4 Field Quality Control

- .1 Provide competent supervisor, with at least three years of experience in reinforcement placement, to direct placement of reinforcement.
- .2 Inspect placement of reinforcement for conformance with Drawings and Specifications, before each concrete placement, and correct as necessary.
- .3 Consultant's periodic review of selected areas of reinforcement are for verification of conformity to design concept and general arrangement only and shall not relieve Contractor of responsibility for quality control, errors, or omissions, or conformance with requirements of Contract Documents.

3.5 Defective Work

- .1 Incorrectly fabricated, misplaced or omitted reinforcement will be considered defective Work.
- .2 Replace or adjust defective reinforcement before concrete is placed as directed by Consultant.
- .3 Replace or strengthen concrete work which is deficient as a result of incorrectly fabricated, misplaced, or omitted reinforcement, which was not corrected before concrete was placed.
- .4 Pay for additional inspection and testing, redesign, corrective measures, and related expenses, if Work has proven to be deficient.

3.6 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 10 00 Concrete Forming and Accessories
- .2 Section 03 20 00 Concrete Reinforcing
- .3 Section 04 05 19 Masonry Anchorage and Reinforcing
- .4 Section 04 22 00 Concrete Unit Masonry
- .5 Section 04 27 00 Multiple Wythe Unit Masonry
- .6 Section 05 50 00 Metal Fabrications
- .7 Section 07 92 00 Joint Sealants
- .8 Section 10 80 00 Miscellaneous Specialties
- .9 Section 32 16 23 Sidewalks
- .10 Section 32 13 16 Concrete Curbs

### 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.
- .5 Government of Canada Treasury Board Secretariat (TBS)
  - .1 Standard on Embodied Carbon in Construction

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples: Submit for inspection, material samples of specified mix designs.
- .3 Concrete Mix Designs:
  - .1 Submit concrete mix designs for review. Specify intended use for each mix design.
  - .2 Review of mix design does not relieve Contractor from responsibility for compliance with Contract Documents.
  - .3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1. Mix design shall be adjusted to prevent alkali aggregate reactivity problems.
  - .4 Provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements of CSA A23.1.
  - .5 Submit written requests for use of admixtures not specified, for site mixing of concrete, and for use of bonding agents.
  - .6 Submit in writing, proposed method of in-situ strength testing.
- .4 Inspection Reports: Inspection and Testing Company shall:
  - .1 Submit written reports of inspection and tests.
  - .2 Distribute reports as follows:
    - .1 Consultant;
    - .2 Contractor.
  - .3 On concrete cylinder test reports, include:
    - .1 Specific location of concrete represented by sample
    - .2 Design strength.
    - .3 Unit weight of sample
    - .4 Class of exposure
    - .5 Aggregate size and mixtures incorporated
    - .6 Date, hour and temperature at time sample taken
    - .7 Percentage air content
    - .8 Test strength of cylinder
    - .9 Type of failure if test fails to meet specification.

#### 1.5 Quality Assurance

- .1 Obtain a copy of CSA A23.1/A23.2 and maintain on site.
- .2 Pre-Construction Conference:

- 
- .1 At least 35 days prior to the start of concrete construction schedule, conduct a meeting to review proposed mix designs and to discuss detailed requirements of the proposed concrete operations. Review requirements for submittals, coordination, and availability of materials. Establish work progress and sequencing schedules and procedures for material testing, inspection and certifications.
  - .3 Source Quality Control:
    - .1 Both source quality control, and field quality control specified in Article 1.5.4, may be performed by an Inspection and Testing Company appointed by Consultant.
    - .2 Review provided by Inspection and Testing Company does not relieve the Contractor of his sole responsibility for quality control over Work. Performance or non- performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of his responsibilities in complying with the requirements of the Specification.
    - .3 Inspection and Testing Company shall be certified under CSA A283, Qualification Code for Concrete Testing Laboratories, for Category 1 Certification.
    - .4 Payment for specified Work performed by Inspection and Testing Company will be made from Cash Allowance.
    - .5 Payment for additional tests (including testing of structure and its performance and load testing) required by changes of materials or mix design requested by Contractor, and failure of completed Work to meet specified requirements, shall be made at Contractor's expense.
    - .6 Perform Work of source quality control in accordance with CSA A23.2 and to include:
      - .1 Verification that ready-mix supplier is qualified to supply concrete in accordance with Specification.
      - .2 Review of proposed concrete mix designs.
      - .3 Sampling, inspection, and testing of materials as may be required.
  - .4 Field Quality Control:
    - .1 Inspection and Testing Company, when appointed as specified for Source Quality Control, shall perform sampling, inspection and testing of concrete work at site.
    - .2 Perform sampling, inspection and testing in accordance with CSA A23.2, and to include:
      - .1 Making of standard slump tests.
      - .2 Obtaining of three standard specimens for strength tests from each 100 m of concrete, or fraction thereof, of each mix design of concrete placed in any one day. In addition, for slabs-on-grade, obtain beam specimens for determination of modulus of rupture.
      - .3 Verification that test specimens are stored within an enclosure, maintained at specified temperatures.
      - .4 Making compression tests of each set of three specimens, one at 7 days and two at 28 days; modulus of rupture tests at 90 days.
      - .5 Verification of air content of air-entrained concrete.
        - .1 For Class of exposure F-1, and C-2, test at frequency in accordance with CSA A23.1.
        - .2 Make first test before placing any concrete.
        - .3 After stable air content has been established, frequency of tests will be determined by Consultant.
        - .4 For other Classes of exposure, test at time of obtaining strength test specimens.
    - .3 Inspection for Tolerances:
      - .1 Confirm that concrete work meets specified tolerance requirements.
      - .2 Use the elevation survey records of elevations of finished concrete surfaces specified in Section 03 10 00 and this section as basis for judging compliance.
      - .3 Use approved aluminum straightedge to judge compliance with specified slab tolerances, except use dipstick equipment where F-number tolerance is specified.
    - .4 Slabs-on-Grade:
      - .1 Observe application of curing compound to sample slab, recording rate of application.

- .2 Monitor on a random basis acceptable to the Consultant, that slab is being saw cut before slab temperature starts to fall.
- .3 Qualifications: Floor finishing shall be undertaken only by contractors with at least 10 years of experience.
- .4 Sample of Finish Flooring:
  - .1 Finish an area of floor slab where directed by Consultant to provide sample of finish for approval.
  - .2 Protect new sample area until finish is approved.
  - .3 If liquid membrane curing compound is to be used on Project, determine and apply correct quantity required to meet rate of coverage recommended by manufacturer for measured test area.
  - .4 Approved sample will provide standard by which subsequent finishing will be judged and will be incorporated into Work.

#### 1.6 Tolerances

- .1 In accordance with ACI 117 and CSA A23.1.
- .2 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 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.
- .9 Premoulded Joint Fillers: Bituminous impregnated fiber board: to ASTM D1751.
- .10 Sealant: Refer to Section 07 92 00 – Joint Sealants
- .11 Mechanical Anchors: 'Kwik' Bolts, 'Cinch' Anchors or Parabolts.
- .12 Weep hole tubes: plastic.
- .13 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .14 Stair Tread Inserts:
  - .1 Abrasive stair tread inserts for exterior concrete steps as specified in Section 10 80 00.

## 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 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.
- .6 Concrete supplier to provide documentation indicating the requirements of TBS Standard on Embodied Carbon in Construction have been met.

## 2.3 Admixtures

- .1 Chemical Admixture: To ASTM C494. Incorporate water-reducing admixture, type WN, in all concrete.
- .2 Air Entraining Agent: To ASTM C260. Incorporate air-entraining agent in addition to chemical admixture in concrete of relevant Class of exposure, in accordance with CSA A23.1, Clause 15, Table 10.
- .3 Chloride: Do not use calcium chloride or admixtures containing chloride in concrete.

## 2.4 Concrete Toppings

- .1 Provide topping with minimum 28 day compressive strength of 32 MPa.

## 2.5 Premixed Grout

- .1 Non-Shrink Metallic: Non-catalyzed metallic grout to ASTM C1107, Compressive strength at 28 days: 48 MPa.
- .2 Non-Shrink, Non Stain, Non-Metallic: to ASTM C1107. Compressive strength at 28 days: 59 MPa.
- .3 Flowable Grout: High-tolerance Non-shrink, Non-metallic shrinkage compensating grout to ASTM C1107. Compressive strength at 28 days: 59 MPa.

### **PART 3 EXECUTION**

#### **3.1 Examination**

- .1 Before starting this work, examine work done by others which effects this work.
- .2 Notify Consultant of any condition which would prejudice proper completion of this work.
- .3 Confirm that surfaces on which concrete is to be placed are free of frost and water before placing.
- .4 Confirm that reinforcement, dowels, control joints, inserts and all other built in work are in place and secured.
- .5 Commencement of work implies acceptance of existing conditions.

#### **3.2 Treatment of Formed Surfaces**

- .1 Conform to the requirements of CSA A23.1, and as additionally specified herein.
- .2 Treat concrete surfaces which will be exposed or painted in the completed building to provide a "Smooth Rubbed Finish" in accordance with CSA A23.1, uniform in colour and texture.
- .3 Plugs at Recessed Ties:
  - .1 Clean tie holes to remove all foreign matter.
  - .2 Coat plugs by dipping in adhesive and insert in hole.
  - .3 Remove excess adhesive immediately with thinner which will not stain concrete, as recommended by manufacturer.
- .4 Obtain Consultant's approval of finished exposed concrete and grind or otherwise correct to the satisfaction of the Consultant.

#### **3.3 Placing Concrete**

- .1 Place concrete in accordance with requirements CSA A23.1/A23.2.
- .2 Notify Consultant and inspection and testing firm at least 24 hours prior to commencement of concrete placing operation and 24 hours before wall forms are closed in.
- .3 Obtain Geotechnical Engineer's confirmation that thickness, elevation and compaction of sub-grade meets specifications before placing concrete.
- .4 Do not place concrete in water or open frozen surfaces.
- .5 Remove contaminants which lessen concrete bond to reinforcement before concrete is placed.
- .6 Maintain accurate records of cast in place concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
- .7 Ensure that reinforcement, inserts, embedded items, formed expansion joints and the like, are not disturbed during concrete placement.
- .8 Joint fillers:

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Consultant.
- .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .3 Locate and form isolation, construction and expansion joints as indicated.
- .4 Install joint filler.
- .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .9 Provide construction joint as indicated on the drawings. Ensure dowels are adequately anchored and placed at right angles to the joint before placing concrete.
- .10 Place floor slabs to depth indicated on the drawings with 25 MPa minimum concrete unless otherwise noted on drawings but consistent with minimum cement content specified for exposed floors in this specification.
- .11 Sloping Surfaces and Slabs: commence concrete placement at bottom of sloping surfaces.

### 3.4 Finishing Concrete

- .1 Perform finishing operations on plastic concrete surfaces in accordance with CSA A23.1, and as specified herein.
- .2 Refer to the drawings for floor finishes and coverings.
- .3 Screed the top of rough floor slabs to an even level or sloping surface at the proper elevation to receive the finish or topping specified on the drawings and in finish schedule.
- .4 Provide a smooth steel trowel finish on all areas scheduled to receive a covering, or painted finish.
- .5 Exposed Floor Surfaces: Provide hard, smooth, dense, steel troweled surface, free from blemishes, and of uniform appearance.
- .6 Non-slip Surfaces: Provide swirl trowel or broom finish of texture acceptable to Consultant.
- .7 Curb Edging: Finish external corners of curbs rounded and smooth.
- .8 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.
- .9 Stair Tread Non-Slip Inserts:
  - .1 Install one non-slip insert specified in Section 10 80 00 at each tread and landing; place 40 mm from edge of nosings and extend for full width of nosings except for 80 mm at each end.
  - .2 Install in accordance with manufacturer's instructions.

### 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/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 Project Conditions

- .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 07 71 23 Manufactured Gutters and Downspouts
- .2 Section 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 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
  - .2 CSA A23.4 -16 (R2021) Precast Concrete-Materials and Construction

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit manufacturer's product literature.

### 1.5 Protection

- .1 Protect bench marks and existing structures, lawns, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic.

### 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 Place materials defined as hazardous or toxic waste in designated containers.

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Cement, white cement material, aggregates, water, admixtures: to CSA-A23.4 and CSA-A23.1.
- .2 Use same brands and source of cement and aggregate for entire project to ensure uniformity of colouration and other mix characteristics.
- .3 Reinforcing steel: to CSA G30.16.
- .4 Forms: to CSA-A23.4.

## 2.2 Precast Concrete Splash Blocks

- .1 Precast Concrete Splash Block conforming to CSA A23.4:
  - .1 35 MPa Concrete at 28 days
  - .2 Sulphate resistant
  - .3 Grade 400 reinforcement
  - .4 Basis of Design Product:
    - .1 Armtec SP50603 (311 x 610 mm)
- .2 Locate at all scupper locations and all sump pit discharges.

## 2.3 Fill Materials

- .1 Levelling course: 6 mm diameter crushed limestone.
- .2 Sub-surface gravel: Pit-run, crushed natural stone, free from shale, clay, friable materials and debris.
- .3 Surface Gravel (exposed): Clean natural stone, free from clay, shale and organic matter, 19mm to 38mm size.
- .4 Sand: Clean natural river or bank sand, free from silt, clay, loam friable or soluble materials, and organic matter.
- .5 Crushed Stone: Angular crushed natural limestone, free from shale, organic matter and debris, maximum stone size 12mm (75% passing).
- .6 Sub-soil: Free from roots, rock larger than 76 mm in size and building debris.

## PART 3 EXECUTION

### 3.1 Preparation

- .1 Determine extent of modification required to existing surface conditions to accommodate new splash pads.
- .2 Locate splash pads to ensure best drainage away from building and the least interference with landscape or building elements such as shrubs, walkways, windows etc.
- .3 Perform minor excavations as required to sub-surface for final grades.
- .4 Carefully remove existing sod and retain for replacement as required.
- .5 Firmly compact sub-soil to receive any required fill.
- .6 Provide a compacted gravel bed of minimum 100 mm depth beneath new splash pads.
- .7 Gravel levelling base to extend minimum 75 mm past splash pads.

**3.2     Installation**

- .1 Provide precast splash pads where required and shown on drawings to ensure positive drainage away from building at downspout or drain outlet locations.
- .2 Install Splash Pads as per manufacturer's specifications.
- .3 Place splash pads on compacted material to fully support concrete with no hollows or bows below.
- .4 Ensure required 3% slope.
- .5 Install Concrete Mounting Brackets as per manufacturer's specifications

**3.3     Cleaning**

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

End of Section



## **PART 1 GENERAL**

### **1.1 General**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Sections**

- .1 Section 04 22 00 Concrete Unit Masonry
- .2 Section 05 12 23 Structural Steel
- .3 Section 05 50 00 Metal Fabrications

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- .2 CSA Group (CSA)
  - .1 CSA A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  - .2 CSA S304-14 (R2019) Design of Masonry Structures.
  - .3 CAN/CSA A371-14 (R2019) Masonry Construction for Buildings.
  - .4 CSA G30.3-M1983 (R1998) Cold-Drawn Steel Wire for Concrete Reinforcement.
  - .5 CSA G30.18-09 (R2014) Carbon Steel Bars for Concrete Reinforcement
  - .6 CSA W186-M1990 (R2016) Welding of Reinforcing Bars in Reinforced Concrete Construction
- .3 American Concrete Institute (ACI)
  - .1 Detailing Manual
- .4 Reinforcing Steel Institute of Canada (RSIC)
  - .1 Reinforcing Steel Manual of Standard Practice

### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.
- .3 Shop Drawings:
  - .1 Submit shop drawings for all masonry reinforcing. Include placing drawings, bar lists and details. Indicate clearly reinforcing bar sizes, spacing, bending details, lap details, dowels to adjacent construction location and quantities of reinforcement.
  - .2 Prepare placing drawings and bar lists in accordance with the American Concrete Institute (ACI) Detailing Manual, and the Reinforcing Steel Institute of Canada (RSIC) Reinforcing Steel Manual of Standard Practice, the typical details included with Contract Documents.
  - .3 Prepare placing drawings to minimum scale of 1:50.
  - .4 Submit placing drawings and bar lists sufficiently detailed and dimensioned to permit correct placement of reinforcement and accessories without reference to architectural or structural Drawings.
  - .5 Show reinforcement, including dowels, in elevation on placing drawings for wall reinforcement.
  - .6 Show cover to reinforcement
  - .7 Show location of construction joints.

1.5 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.6 Waste Management and Disposal

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

**PART 2 PRODUCTS**

2.1 Materials

- .1 All metal components: hot dipped zinc galvanized to CSA S304 unless otherwise indicated.
- .2 Bar Reinforcement: To CSA A371 and CSA G30.18, grade 400R, deformed billet steel bars.
- .3 Wire Reinforcement: To CSA A371 and CSA G30.3.
  - .1 Masonry Veneer Walls: To CSA A370, hot dipped galvanized to ASTM A153, Class B2, 4.76 mm wire diameter, to suit overall wall thickness. BL-42 Ladder Reinforcement and System 2000 Seismic Adjustable Tie by Blok-Lok Ltd.
  - .2 Interior walls: hot dipped galvanized to CSA S304
    - .1 4.76 mm wire diameter hot dipped galvanized to CSA S304 for interior bearing walls.
    - .2 3.66 mm wire diameter bright wire finish, standard duty for interior non-bearing walls and partitions
    - .3 Truss Type: Blok-Trus BL-30 by Blok-Lok Ltd. for non-vertically reinforced walls
    - .4 Ladder Type: Blok-Trus BL-10 by Blok-Lok Ltd. for vertically reinforced walls
- .4 Equivalent products as manufactured by the following manufacturer's may be used subject to submission and acceptance by the Consultant of technical data:
  - .1 Hohmann and Barnard Inc.
- .5 Epoxy Adhesive: Hilti HIT-HY 2270 Adhesive anchor.

2.2 Fabrication

- .1 Fabricate reinforcing in accordance with CSA A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.
- .2 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.
- .3 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 Bond walls of two or more wythes using ladder type reinforcement in accordance with CSA S304, CSA A371 and as indicated.
- .2 Tie masonry veneer to backing in accordance with CSA S304, CSA A371 and as indicated.

### 3.4 Reinforced Lintels and Bond Beams

- .1 Reinforce masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA S304.

### 3.5 Metal Anchors

- .1 Do metal anchors as indicated.

3.6 Lateral Support and Anchorage

- .1 Do lateral support and anchorage in accordance with CSA S304 and as indicated.
- .2 Anchor new masonry to existing with steel dowels as indicated. Drill into existing masonry and set reinforcing bars in epoxy adhesive in accordance with manufacturer's instructions.

3.7 Control Joints

- .1 Terminate reinforcement 25 mm short of each side of control joints unless otherwise indicated.
- .2 Control joints shall be stepped to avoid cutting lintel beams. Under no circumstance shall the control joints be placed to compromise the bearing for the lintel.

3.8 Field Bending

- .1 Do not field bend reinforcement except where indicated or authorized by Consultant.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.9 Field Touch Up

- .1 Touch up damaged and cut ends of galvanized reinforcement steel with compatible finish to provide continuous coating.

3.10 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 10 00 Concrete Forming and Accessories
- .2 Section 03 20 00 Concrete Reinforcing
- .3 Section 03 30 00 Cast-in-Place Concrete
- .4 Section 04 05 19 Masonry Anchorage and Reinforcing
- .5 Section 05 12 23 Structural Steel
- .6 Section 05 50 00 Metal Fabrications
- .7 Section 06 10 00 Rough Carpentry
- .8 Section 07 84 00 Firestopping
- .9 Section 07 92 00 Joint Sealants
- .10 Section 08 11 00 Metal Doors and Frames
- .11 Section 09 21 16 Gypsum Board
- .12 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C90-22 Standard Specification for Loadbearing Concrete Masonry Units
  - .2 ASTM C129-22 Standard Specification for Nonloadbearing Concrete Masonry Units
  - .3 ASTM C150/C150M-22 Standard Specification for Portland Cement
  - .4 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes.
  - .5 ASTM D2240-15(2021) Standard Test Method for Rubber Property—Durometer Hardness.
  - .6 ASTM D5249-10(2021) Standard Specification for Backer Material for Use with Cold and Hot Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.
- .2 CSA Group (CSA)
  - .1 CSA A23.1-14/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  - .2 CSA A165 Series-14 (R2019) CSA Standards on Concrete Masonry Units.
  - .3 CSA A179-14 (R2019) Mortar and Grout for Unit Masonry
  - .4 CSA A371-14 (R2019) Masonry Construction for Buildings.
  - .5 CSA S304-14 (R2019) Design of Masonry Structures.
- .3 Canadian Concrete Masonry Producers Association (CCMPA) Quality Assurance Program.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Data: Submit manufacturer's printed product literature, specifications and data sheets
- .3 Submit the following samples:
  - .1 Two (2) of each type of concrete masonry units specified.
  - .2 Two (2) of each type of masonry accessory specified.
- .4 Submit shop drawings for all masonry reinforcing. Include placing drawings, bar lists and details. Indicate clearly reinforcing bar sizes, spacing, bending details, lap details, dowels to adjacent construction location and quantities of reinforcement.

- .5 Submit engineered temporary bracing design drawings for temporary support of masonry walls. Drawings shall be prepared by, and bear the seal of a Professional Engineer, licensed in the Province of Ontario.
- .6 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .7 Inspection Reports: Inspection and Testing Company shall submit reports of inspections and tests.
  - .1 Distribute inspection reports as follows:
    - .1 Consultant.
    - .2 Structural Engineer
    - .3 Contractor.

#### 1.5 Quality Assurance

- .1 The masonry sub-contractor shall have a minimum of five years of continuous documented Canadian experience in work of the type and quality shown and specified. Proof of experience shall be submitted when requested by the Consultant and shall be subject to the approval of the Consultant.
- .2 Pre-installation meeting: conduct pre-installation meeting to verify project requirements manufacturer's instructions and manufacturer's warranty requirements.
- .3 Field Quality Control:
  - .1 Inspection and testing will be carried out by Testing Laboratory designated by Owner.
  - .2 Payment for specified Work performed by Inspection and Testing Company will be made from Cash Allowance.
  - .3 Inspection and Testing Company shall perform sampling, inspection and testing of masonry work at site, in accordance with referenced standards, including but not limited to the following:
    - .1 Masonry Placement Inspection
    - .2 Reinforcing Steel Placement
    - .3 Grout and Mortar Testing
    - .4 CMU Testing
  - .4 Review provided by Inspection and Testing Company does not relieve Contractor of his sole responsibility for quality control over Work. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of his responsibilities in complying with the requirements of the Specification.
  - .5 Provide access to Work for inspectors.

#### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .3 Materials shall be kept clean and dry.
- .4 Deliver cement, lime and mortar ingredients with manufacturer's seal and labels intact.

- .5 Cementitious material and aggregates shall be stored in accordance with the requirements of CSA A23.1.
- .6 Exposed units which become stained or chipped, surface marked or scratched, and materials which are affected by inadequate protection shall be replaced, at no additional expense to the Owner.

#### 1.7 Project Conditions

- .1 Provide heat enclosures and heat as required.
- .2 Work to be undertaken shall be carried out according to CAN3-A371, Clause 5.15.2.
- .3 Maintain temperature of mortar between 5 ° C and 50 ° C until batch is used.
- .4 Keep masonry dry using secure waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven snow, rain and dirt, until masonry work is completed and protected by flashings or other permanent construction.
- .5 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

#### 1.8 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 Masonry Units: Concrete Block: Modular, conforming to CCMPA requirements and CSA A165.1.
  - .1 H/20/A/M concrete masonry units to be used at all load bearing masonry walls.
  - .2 H/15/A/M concrete, masonry units, at all other locations unless noted otherwise.
  - .3 SS/15/A/M semi-solid concrete masonry units to be used at all 2 hour rated fire walls.
  - .4 Refer to drawings for Fire Resistance Ratings. Type of concrete and block to conform to Table 5.0, Fire Resistance Rating of Concrete Block in Hours, of the Canadian Concrete Masonry Producers Association Handbook.
  - .5 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.
  - .6 Exposed block shall all be made by one manufacturer and shall be uniform in colour, shade and texture.
- .2 Bar Reinforcement, wire reinforcement and ties: as specified in Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .3 Control Joint Filler: to ASTM D5249-10, Type 1, Round, flexible, continuous-length, nonabsorbent, nongassing, nonstaining, and nonshrinking. Extruded from a cross-linked polyethylene. Flexible foam, heat-Resistant Backer Rod. 9.5 mm thick by width of wall.
- .4 Pre-manufactured Masonry Control Joint: Pre-manufactured polyvinylchloride control joints may be used in lieu of the specified built-up type of joint.

- .5 Mortar: Conforming to CSA A179.
  - .1 Use same brand of material and source of aggregate for entire project.
  - .2 Aggregate: CSA A179, fine grain aggregates.
  - .3 Cement: normal Portland to ASTM C150, Type 10.
  - .4 Water shall be clean, potable and free of deleterious amounts of acid, alkalies, or organic materials.
  - .5 Hydrated Lime: Type 'S' to ASTM C207.
  - .6 Type 'S' mortar shall be used for all concrete block masonry work.
  - .7 Proprietary Mortar Mixes: conform to mix requirements specified
  - .8 Mortar colour for concrete unit masonry work shall be grey.
  - .9 Admixtures of any kind are not allowed.
- .6 Grout: to CSA A179, Table 3: Premixed, non-shrink non-metallic grout.
- .7 Other materials not specifically described but required for a complete and proper installation of masonry, shall be as selected by the Contractor subject to approval by the Consultant

## 2.2 Mixes

- .1 Mixing: Prepare and mix mortar materials under strict supervision, and in small batches only for immediate use.
- .2 Mix proprietary mortars in strict accordance with manufacturer's instructions to produce the specified mortar types in accordance with CSA A179. Do not use re-tempered mortars.
- .3 Take representative samples for testing consistency of strength and colour according to CSA A179.

## 2.3 Damp Course and Flashings

- .1 Peel and stick modified SBS bitumen membrane reinforced with proprietary glass screen, minimum thickness of 1.0 mm.
- .2 Lap Sealant: recommended by flashing manufacturer.

## 2.4 Accessories

- .1 Mechanical Fasteners: As recommended by manufacturer of material to be fastened, and in accordance with the reference standards, corrosion resistant.

# PART 3 EXECUTION

## 3.1 Examination

- .1 Examine work of other trades for defects or discrepancies and report same in writing to Consultant.
- .2 Installation of any part of this work shall constitute acceptance of such surfaces as being satisfactory.

## 3.2 General



- .1 Do masonry work in accordance with CSA A371 except where specified otherwise.
- .2 A competent masonry foreman shall supervise and direct the work and only skilled masons shall execute the work of this Section.
- .3 Coordinate work of this Section with others such as, field welding of anchors to steel work, insulation application, and the like. Prepare all items for built-in as the work proceeds, either supplied and installed by other trades or installed under this Section.
- .4 Unless otherwise indicated on the drawings, all interior masonry partitions shall extend from floor level to the underside of floor or roof structures above.

### 3.3 Installation

- .1 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .2 Lay out coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- .3 Lay block with webs to align plumb over each other with thick ends of webs up. The top course of all partitions which do not pass through a ceiling or up to the underside of a roof deck shall have the open cells filled solid.
- .4 Cut exposed block with power driven abrasive cutting disc or diamond cutting wheel for flush mounted electrical outlets, grilles, pipes, conduits, leaving 3 mm maximum clearance.
- .5 Fill all vertical and bed joints, including plain end faces, through the entire wall thickness solidly with mortar.
- .6 Do not break bond of exposed walls where partitions intersect and if bond would show through on exposed face of walls. Bond these partitions to walls they intersect with prefabricated intersection masonry reinforcement in each course.
- .7 Bond intersecting block walls in alternate courses.
- .8 Terminate non load bearing walls within 20 mm of structure above unless indicated otherwise.
- .9 Where walls are pierced by structural members, ducts, pipes, fill voids with mortar to within 20 mm of such members.
- .10 Buttering corners of units, throwing mortar droppings into joints, deep or excessive furrowing of bed joints, is not permitted. Do not shift or tap units after mortar has taken initial set. Where adjustment must be made after mortar has started to set, remove mortar and replace with fresh supply.
- .11 Do not wet concrete masonry before or during laying in wall.
- .12 Bed and vertical joints shall be evenly and solidly filled with mortar.
- .13 Provide reinforced bond beams where indicated on structural drawings.

- .14 Provide vertical reinforcement as indicated on structural drawings. Fill all reinforced cores solid with grout as indicated. Provide cleanout port at bottom of each grouted core when required by Consultant.

### 3.4 Exposed Masonry

- .1 Do not use chipped, cracked or stained, and otherwise damaged units or unsatisfactory material in exposed and load bearing masonry walls.
- .2 Lay all joints 10 mm thick (uniform). All joints shall be full of mortar except where specifically designated to be left open.
- .3 All joints shall be slightly concave. Use sufficient force to press mortar tight against masonry units on both sides of joints. Remove excess material or burrs left after jointing by means of a trowel or rubbing with burlap bag.
- .4 Provide bullnose block at all exposed masonry corners.

### 3.5 Tolerances

- .1 Tolerances in notes to Clause 5.3 of CSA A371 apply.

### 3.6 Reinforcement

- .1 Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.

### 3.7 Concrete Masonry Lintels

- .1 Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .2 Lintels in non-load-bearing walls shall be constructed with special bond or lintel block units unless shown otherwise on plans. Lintels shall bear 200 mm minimum and bearing shall be isolated with two layers of heavy asphalt coated paper.
- .3 Reinforcing steel in lintels shall be 2 x 20 M bars minimum specified under Section 04 05 19 - Masonry Anchorage and Reinforcing, or as noted on drawings.
- .4 Concrete fill for lintels shall be 25 MPa or as noted on the drawings. Concrete shall be as specified in Section 03 30 00.

### 3.8 Loose Steel Lintels

- .1 Install loose steel lintels. Centre over opening width.
- .2 Lintels supplied under Section 05 50 00 – Metal Fabrications.

### 3.9 Control Joints

- .1 Provide continuous joints as indicated and at spacing not to exceed 6000 mm c/c unless noted otherwise on drawings.
- .2 Break vertical mortar bond with extruded neoprene gasket or building paper.

- .3 Prime control joint to prevent drying out of caulking material.

### 3.10 Support of Loads

- .1 Use 25 MPa concrete unless specified otherwise on the Drawings, where concrete fill is used in lieu of solid units.
- .2 Use grout to CSA A179 where grout is used in lieu of solid units.
- .3 Install building paper below voids to be filled with grout. Keep paper 25 mm back from face of units.

### 3.11 Lateral Support and Anchorage

- .1 Do lateral support and anchorage of masonry in accordance with CSA S304.1 and as indicated.

### 3.12 Grouting

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

### 3.13 Temporary Wall Bracing

- .1 Design and provide all required temporary engineered wall bracing.
- .2 Brace masonry walls to resist wind pressure and other lateral loads during construction period.
- .3 Provide temporary bracing of masonry work during and after erection until mortar has cured and permanent lateral support is in place

### 3.14 Built-ins

- .1 Build in items required to be built into masonry and provided by other Sections, including bearing plates, door frames, anchor bolts, sleeves and inserts. Build in items to present a neat, rigid, true and plumb installation. Leave wall openings required for ducts, grilles, pipes and other items.
- .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- .3 Brace door jambs to maintain plumb. Fill voids between masonry and metal frames with masonry mortar or insulation, as indicated on drawings or as required to provide a neat, finished appearance.
- .4 Set wall plates on masonry in non-shrink grout in accordance with manufacturer's instructions.
- .5 Do all cutting, fitting, drilling, patching and making good for other trades in masonry work.

### 3.15 Protection

- .1 Protect masonry units from damage resulting from subsequent construction operations.
- .2 Use protection materials and methods which will not stain or damage masonry units.

- .3 Remove protection materials upon Substantial Performance, or when risk of damage is no longer present.

3.16 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Allow mortar droppings on unglazed concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.
- .3 Remove mortar from concrete floor slabs and leave entire area vacuum clean.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 20 00 Concrete Reinforcing
- .2 Section 03 30 00 Cast-in Place Concrete
- .3 Section 04 05 19 Masonry Anchorage and Reinforcing
- .4 Section 04 22 00 Concrete Unit Masonry
- .5 Section 05 50 00 Metal Fabrications
- .6 Section 06 10 00 Rough Carpentry
- .7 Section 07 21 13 Building Insulation
- .8 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .9 Section 07 92 00 Joint Sealants
- .10 Section 08 11 00 Metal Doors and Frames

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C90-22 Standard Specification for Loadbearing Concrete Masonry Units
  - .2 ASTM C129-22 Standard Specification for Nonloadbearing Concrete Masonry Units
  - .3 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes
  - .4 ASTM C216-23 Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
  - .5 ASTM D2240-15(2021) Standard Test Method for Rubber Property-Durometer Hardness
  - .6 ASTM D5249-10(2021) Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
- .2 American Concrete Institute (ACI)
  - .1 ACI 530.1-05/ASCE 6-05/TMS 602-05 Specification for Masonry Structures.
- .3 CSA Group (CSA)
  - .1 CSA A82-14 (R2018) Fired Masonry Brick Made from Clay or Shale.
  - .2 CSA A165 Series-14 (R2019) CSA Standards on Concrete Masonry Units.
  - .3 CSA A179-14 (R2019) Mortar and Grout for Unit Masonry
  - .4 CSA A3000-18 Cementitious Materials Compendium
  - .5 CSA A371-14 (R2019) Masonry Construction for Buildings.
  - .6 CSA S304-14 (R2019) Design of Masonry Structures
- .4 Canadian Concrete Masonry Producers Association (CCMPA) Quality Assurance Program.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit full range of manufacturer's standard colour samples of coloured mortar for selection of colours by the Consultant.
- .3 Data: Submit manufacturer's printed product literature, specifications and data sheets
- .4 Submit the following samples:
  - .1 Two of each type of 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.
- .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, 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 Facebrick: burned clay, extruded to CSA A82.1 and ASTM C216, ASW grade.

- .1 Glen-Gery through body brick
- .2 Size: Modular 92 x 57 x 194 mm.
- .3 Colour: Brown Smooth Iron Spot.

##### .3 Masonry Reinforcement: Bar Reinforcement, wire reinforcement and ties: as specified in Section 04 05 19.

##### .4 Control Joint Filler: to ASTM D5249, Type 1, Round, flexible, continuous-length, nonabsorbent, non-gassing, non-staining, and non-shrinking. Extruded from a cross-linked polyethylene. Flexible foam, heat-Resistant Backer Rod. 9.5 mm thick by width of wall: Sealtight Cera-Rod by W. R. Meadows Canada Limited.

##### .5 Pre-manufactured Masonry Control Joint: Pre-manufactured polyvinyl chloride control joints may be used in lieu of the specified Built-up type of joint. Control joints as manufactured by the following are acceptable:

- .1 Wall-Tite by Blok-Lok Limited
- .2 Rapid Control Joint- Wide Flange by Dur-O-Wall Limited
- .3 Flexible PVC Masonry Control Joint by Greenstreak

##### .6 Mortar and Grout:

- .1 Conforming to CSA A179
- .2 Use same brand of material and source of aggregate for entire project.
- .3 Aggregate: CSA A179 coarse sharp clean sand, free from salt, alkaline or other organic substances, specifically graded for masonry use.
- .4 Cement: To CSA A3000, masonry cement. Type 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. Colour will be selected by the Consultant.
    - .1 Coloured mortar: colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample.
  - .11 Admixtures of any kind are not allowed except as specified for coloured mortar.
  - .12 Grout: to CSA A179, Table 3.
  - .13 Premixed, non-shrink non-metallic grout: Non Shrink Grout by C.P.D., V3 Grout by W.R. Meadows of Canada, NS Grout by Euclid.
  - .14 Parging Mortar: Type N, to CSA A179.
- .7 Other Materials: all other materials not specifically described but required for a complete and proper installation of masonry, shall be as selected by the Contractor subject to approval by the Consultant.

## 2.2 Mixes

- .1 Mixing: Prepare and mix mortar materials under strict supervision, and in small batches only for immediate use. Mix proprietary mortars in strict accordance with manufacturer's instructions to produce the specified mortar types in accordance with CSA A179. Do not use retempered mortars.
- .2 Admixtures: in accordance with manufacturer's printed directions.
- .3 Use mortar within 2 hours after mixing at temperatures of 26 °C, or 2-1/2 hours at temperatures under 10 °C.
- .4 Take representative samples for testing consistency of strength and colour according to CSA A179.

## 2.3 Damp Course and Flashings

- .1 Fully compatible with air barrier membrane specified in Section 07 27 13. Self-adhesive modified SBS bitumen membrane reinforced with proprietary glass screen, minimum thickness of 1.0 mm:
  - .1 Vedagard Non-slip by Bakor Inc.
  - .2 Perm-A-Barrier Wall Flashing by W.R. Grace & Co.
  - .3 Mel-Dek by W.R. Meadows
  - .4 Enverge Flashguard by Firestone.
- .2 Lap Sealant: recommended by flashing manufacturer.
- .3 Surface primers and conditioners as recommended by membrane manufacturer.



## 2.4 Accessories

- .1 Cavity Vents and Weepholes: purpose made PVC vents, with pest resisting design, size to suit masonry units. Cell-Vent with mortar net, or Mor-Control by Dur-O-Wal Inc. Colour to match mortar colour.
- .2 Cell vents: polypropylene plastic, honeycomb design.
  - .1 Size: to suit.
  - .2 Colour: as selected by Consultant.
- .3 Mortar diverters: shaped and sized to suit cavity spaces.
  - .1 Manufactured from recycled material.
- .4 Grout Screens: 6 mm square monofilament screen fabricated from high-strength, non-corrosive polypropylene polymers to isolate flow of grout in designated areas.
- .5 Mechanical Fasteners: As recommended by manufacturer of material to be fastened, and in accordance with the reference standards, corrosion resistant.
- .6 Packing Insulation: loose glass fibre insulation or mineral wool with minimum density of 17.6 kg/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 construction shall be erected as shown on the drawings of exterior clay brick veneer and concrete block back-up with a nominal 127 mm cavity and 102 mm rigid insulation.
- .2 Veneer in double wythe masonry wall construction shall be tied to block backup together with adjustable truss type masonry reinforcing as specified in Section 04 05 19.
- .3 Bond walls of two or more wythes and tie masonry veneer to backing in accordance with NBC, CSA S304, CSA A371, and as indicated.
- .4 Masonry units shall be laid up in running bond unless indicated otherwise.
- .5 Place continuous dampcourse and flashing membrane at the bottom of all exterior walls, including at bottom of walls and over all openings. Extend flashing from exterior face of exterior wythe, turned up backing face minimum 150 mm and built into the first horizontal block joint or bonded to sheathing with adhesive, unless otherwise indicated. Lap all joints 150 mm and seal with adhesive.
- .6 Jointing: allow joints to dry just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints.

### 3.5 Air Barriers and Insulation

- .1 Apply air barriers and insulation over exterior face of concrete block inner wythe as specified in Sections 07 27 13 and 07 21 00. Do not proceed with veneer application until 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 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 Control Joints

- .1 Provide continuous joints as indicated.
- .2 Joints shall be full height and thickness of wall and shall be 10 mm wide.
- .3 Break vertical mortar bond with extruded neoprene gasket or building paper.
- .4 Prime control joint to prevent drying out of caulking material.

### 3.10 Concrete Masonry Lintels

- .1 Install reinforced concrete block lintels over openings in masonry walls where steel or reinforced concrete lintels are not indicated.
- .2 End bearing: not less than 200 mm.
- .3 Refer to Section 04 05 19 and drawings.

### 3.11 Loose Steel Lintels

- .1 Install loose steel lintels. Centre over opening width. Lintel sizes indicated on structural drawings and supplied under Section 05 50 00.

3.12 Grouting

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

3.13 Support of Loads

- .1 Use 20 MPa concrete unless specified otherwise on the Drawings, where concrete fill is used in lieu of solid units. Refer to structural drawings.
- .2 Use grout to CSA A179 where grout is used in lieu of solid units.
- .3 Install building paper below voids to be filled with grout. Keep paper 25 mm back from face of units.

3.14 Lateral Support and Anchorage

- .1 Refer to Section 04 05 19.

3.15 Temporary Wall Bracing

- .1 Design and provide all required temporary engineered wall bracing.
- .2 Brace masonry walls to resist wind pressure and other lateral loads during construction. Bracing of all masonry walls during construction and prior to completion of supporting structures is a mandatory requirement.

3.16 Built-Ins

- .1 Build in items provided by other Sections, including bearing plates, door frames, anchor bolts, sleeves, inserts and loose steel lintels. Build in items to present a neat, rigid, true and plumb installation. Leave wall openings required for ducts, grilles, pipes and other items.
- .2 Fill voids between masonry and metal frames with masonry mortar or insulation, as indicated on drawings or as required to provide a neat finished appearance.
- .3 Set wall plates on masonry in non-shrink grout in accordance with manufacturer's instructions.
- .4 Do all cutting, fitting, drilling, patching and making good for other trades in masonry work.
- .5 Consultant's approval shall be obtained before cutting.

3.17 Protection

- .1 Keep masonry dry using secure waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from snow, rain and dirt, until masonry work is completed and protected by flashings or other permanent construction.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Protect masonry units from damage resulting from subsequent construction operations.
- .4 Use protection materials and methods which will not stain or damage masonry units.

- .5 Remove protection materials upon Substantial Performance of the Work, or when risk of damage is no longer present.

3.18 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Obtain and follow material manufacturer's written instructions for Cleaning. Test sample area, 3.0 m x 3.0 m, to judge effectiveness of cleaning procedures.
- .3 Keep wall clean and free of mortar stains during laying.
- .4 Protect windows, trim and metal.
- .5 Remove mortar with wood paddles and scrapers before wetting. Saturate masonry with clean water and flush off loose mortar and dirt. Clean masonry work using water, scrubbing brushes and wood paddles only.
- .6 Remove mortar from concrete floor slabs and finished surfaces.
- .7 Leave entire area vacuum clean.

End of Section

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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 22 00 | Concrete Unit Masonry         |
| .3 | Section 04 27 00 | Multiple Wythe Unit Masonry   |
| .4 | Section 05 31 00 | Steel Deck                    |
| .5 | Section 05 41 00 | Structural Metal Stud Framing |
| .6 | Section 05 50 00 | Metal Fabrications            |
| .7 | 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-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .4 ASTM A307-21 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
  - .5 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .6 ASTM A1011/A1011M-23 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  - .7 ASTM F3125/F3125M-22 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 G40.20/G40.21-13 (R2018) General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
  - .2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA S16:19 Design of Steel Structures.
  - .4 CSA S136-16 North American Specification for the Design of Cold Formed Steel Structural Members
  - .5 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel Structures.
  - .6 CSA-W48.1-M1991 (R1998) Carbon Steel Covered Electrodes for Shielded Metal Arc Welding
  - .7 CSA-W55.3-08 (R2013) Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .8 CSA W59-18 Welded Steel Construction (Metal Arc Welding).
  - .9 CSA W178.1-18 Certification of Welding Inspection Organizations.
  - .10 CSA W178.2-18 Certification of Welding Inspectors.
- .3 American Welding Society (AWS)
- .1 AWS A2.4:2020 Standard Symbols for Welding, Brazing, and Nondestructive Examination
- .4 Structural Steel Painting Council

- .1 SSPC-SP 6-91 Commercial Blast Cleaning.
- .5 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
  - .1 CISC/CPMA 1-73a Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .6 American Institute of Steel Construction (AISC)
  - .1 Code of Standard Practice for Steel Buildings and Bridges, Section 10, Architectural Exposed Structural Steel, latest edition.
- .7 The National Building Code of Canada.

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop and erection drawings. Submit typical details of connections and any special connections for review before preparation of shop drawings. Assume responsibility for the accuracy of Work. Review of submitted shop drawings is to ensure only that the Contract Documents are being correctly interpreted.
- .3 Professional Engineer responsible for connection design shall sign and seal each shop drawing.
- .4 Show on shop drawings the size, spacing, and the location of structural steel members; connections; attachments; reinforcing; anchorage and required inserts; and all necessary plans, elevations and details.
- .5 Show splice locations and details.
- .6 Welded connections shall be designated by welding symbols in compliance with AWS A2.4:2020 and indicate clearly net weld lengths.
- .7 Submit design calculations if requested by the Consultant.
- .8 Submit diagrams showing methods of erection.
- .9 Field Work Drawings shall be submitted as shop drawings.
- .10 Notify Consultant in writing of any deviations in shop drawings from the requirements of the Contract Documents.
- .11 Submit a schedule of fabrication to the Consultant and the Testing Agency, prior to commencement of fabrication.

#### 1.5 Qualifications

- .1 Undertake welding and/or welding inspection by welders fully approved to one or more of the reference codes and standards where applicable.

#### 1.6 Quality Assurance

- .1 Connections:
  - .1 Connections designed by Engineer: Submission of shop drawings for connection which have been detailed on Drawings shall represent acceptance by Contractor that connection can be executed successfully.



- .2 Design of other connections which cannot be selected from standard designs tabulated in CISC Handbook of Steel Construction shall be by a Professional Engineer, licensed in the Province of Ontario, experienced in structural steel connection design.
- .3 Consultant will review connection arrangement to verify general conformance with overall design concept of structure.
- .4 Connection design engineer shall be insured for professional liability in accordance with section 74 subsection (1) of Regulation 941 of the Ontario Professional Engineers Act. The alternative of compliance with subsection (2) is not acceptable.
- .5 Provide connections adequate to resist reaction of beam, when beam is loaded to maximum flexural capacity under uniformly distributed load, unless reaction or connection detail is shown on Drawings.
  - .1 Provide flexible beam connections for unrestrained members in accordance with CSA S16.1, unless shown otherwise on Drawings.
  - .2 Select connections, wherever possible, from standard designs tabulated in current edition of CISC Handbook of Steel Construction, except that length of beam web angles shall not be less than half the depth of beam, and single angles shall not be used.
  - .3 Provide direct connections to flanges of spandrel beams (exterior perimeter beams) to restrain twisting.
- .2 Design:
  - .1 Connections:
    - .1 Provide bolted or welded connections, unless shown otherwise on Drawings.
    - .2 Use high strength bolts to ASTM F3125 for all connections.
    - .3 Use slip resistant (friction-type) connections for bolted joints designed to resist reversible forces.
    - .4 Provide tension adjustment hardware at rod type bracing and at flat bar type bracing.
    - .5 Do not permit connections to encroach on clearance lines required for installation of Work of other Sections.
  - .3 Random Splicing: Obtain in writing from Consultant, prior to commencement of shop drawings, special requirements that will be imposed as a necessary condition of acceptance of members with randomly located butt welded splices.
  - .4 All edge perimeter angles and bent plates installed at roof framing level shall be joined by butt weld splices designed for full tension capacity of members being joined.

#### 1.7 Tolerances

- .1 In addition to tolerances specified in CSA S16, erect shelf angles and sash angles attached to steel frame within a tolerance of 3 mm plus or minus, with abutting ends of members at the same level.

#### 1.8 Inspection and Testing

- .1 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.
- .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 CSA-G40.20/G40.21, Grade 300W.
- .6 Shop Coat Paint:
  - .1 Interior structural steel: To meet specified requirements of CISC/CPMA 1-73a and compatible with Master Painters Institute INT 5.1S or 5.1X Institutional low odour/low VOC semi-gloss finish. Colour to be grey.
- .7 Galvanizing: hot dipped with zinc coating to CSA G164, ASTM A123 or ASTM A153.

## PART 3 EXECUTION

### 3.1 Fabrication

- .1 Fabricate work of this Section in compliance with CSA S16, and as specified following.
- .2 Connections:
  - .1 Make bolted or welded connections.
  - .2 Use high strength bolts unless otherwise noted on Drawings.
  - .3 Use friction type high strength bolts for the connections of bracing members (diagonal kickers) resisting the effects of applied lateral loads. Provide tension adjustment at flat bar and rod type lateral bracing.
  - .4 Do not permit connections to encroach on the clearance lines required for the installation of work of this Section.
- .3 Beam Connections:
  - .1 Provide beam connections adequate to resist the reactions produced by the framing or load conditions.
  - .2 Provide beam to column connections that apply vertical reaction with negligible eccentricity at the connecting face of the column, such as single or double beam web connections, end plate connections or un-stiffened seats, unless otherwise shown on Drawings. Submit for review, in advance of the preparation of shop drawings, connections which do not meet these requirements.
  - .3 Provide connections complying with the requirements of the CISC Handbook of Steel Construction, except that the length of beam web angles shall not be less than half the depth of the beam and single angles shall not be used.
  - .4 Provide direct connections to flanges of spandrel beams to restrain twisting.

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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 05 12 23      Structural Steel
- .2 Section 05 50 00      Metal Fabrications
- .3 Section 06 10 00      Rough Carpentry

1.3      References

- .1 ASTM International, (ASTM)
  - .1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .2 CSA Group (CSA)
  - .1 CSA S16:19 Design of Steel Structures
  - .2 CSA S136-16 North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2009), Update No. 2 (2010)
  - .3 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel Structures.
  - .4 CSA W48:23 Filler Metals and Allied Materials for Metal Arc Welding
  - .5 CSA W55.3-08 Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .6 CSA W59-18 Welded Steel Construction (Metal Arc Welding)
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.181-99 Ready-Mixed Organic Zinc-Rich Coating
- .4 Canadian Sheet Steel Building Institute (CSSBI)
  - .1 CSSBI 10M Standard for Steel Roof Deck.

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.
- .3 Submit design calculations if requested by Consultant.

1.5      Design Requirements

- .1 Design steel deck using limit states design in accordance with CSA S136 and CSSBI 10M.
- .2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, and uplift as indicated.
- .3 Deflection under specified live load not to exceed 1/240 of span, except that when gypsum board ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.

- .4 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CSA S16.

#### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

#### 1.7 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 Sheet Steel: ASTM A653 minimum Grade 230 with a base steel design thickness or 0.76 mm or greater and a minimum zinc-iron alloy coating designation of ZF75.
- .2 Closures: in accordance with manufacturer's recommendations.
- .3 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.
- .4 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

#### 2.2 Types of Decking

- .1 Deck shall conform to the depths noted on the drawings.
- .2 Steel roof deck: to CSSBI 10M non-cellular, interlocking side laps. Base steel thickness, depth & profile as shown on the drawings.

### 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 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

### 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 27 00 Multiple Wythe Unit Masonry
- .3 Section 05 12 23 Structural Steel
- .4 Section 06 16 43 Gypsum Sheathing
- .5 Section 07 21 13 Building Insulation
- .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 42 30 Solid Phenolic Wall Panels
- .10 Section 07 46 13 Preformed Metal Siding
- .11 Section 07 92 00 Joint Sealants
- .12 Section 08 50 00 Aluminum Doors, Windows and Screens
- .13 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-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM A792/A792M-22 Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
  - .3 ASTM A879/A879M-22 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 S16.1:19 Design of Steel Structures.
  - .3 CSA S136:16 North American Specification for the Design of Cold-Formed Steel Structural Members
  - .4 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel Structures.
  - .5 CSA W59-18 Welded Steel Construction (Metal-Arc Welding).
  - .6 CSA W178.1-18 Certification of Welding Inspection Organizations
  - .7 CSA W178.2-18 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 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.
- .5 Design lintels over all openings in accordance with the National Building Code.
- .6 Design components or assemblies to accommodate specified erection tolerances.
- .7 Member spacing shall not exceed the spacing indicated on the drawings.
- .8 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.
- .9 Connections between lightweight steel framing members shall be by bolts, welding or sheet metal screws.
- .10 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.
- .11 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.
- .12 Neglect contribution of sheathing to restrain member rotation and translation perpendicular to the minor axis.
- .13 Design bracing system to limit lateral deflections of building components under wind or seismic load to height/500.
- .14 Use bolts, welding or sheet metal screws to make connections between lightweight framing members.
- .15 Determine sheet metal screw capacities in accordance with CSA S136.

- .16 Design top and bottom tracks to transfer joint and member loads, but not less than one gauge size thicker than the wall stud thickness.
- .17 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 06 16 43 – Gypsum Sheathing.

# 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 06 16 43.

### 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 22 00 Concrete Unit Masonry
- .3 Section 04 27 00 Multiple Wythe Unit Masonry
- .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-22 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
  - .2 ASTM A123/A123M-17 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .4 ASTM A307-21 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - .5 ASTM A385/A385M-22 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
  - .6 ASTM A1008/A1008M-23e1 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High Strength Low Alloy, High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
  - .7 ASTM A1011/A1011M-23 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  - .8 ASTM C1107/C1107M-20 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
  - .9 ASTM D1187/D1187M-97(2018) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
  - .10 ASTM D6386-22 Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
  - .11 ASTM F3125/F3125M-23 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
- .3 CSA Group (CSA)
  - .1 CSA G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA-S16.1-M Limit States Design of Steel Structures.

- .4 CSA S136-12 Cold Formed Steel Structural Members.
- .5 CSA W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel Structures.
- .6 CSA W59-18 Welded Steel Construction
- .7 CSA W178.1-18 Certification of Welding Inspection Organizations
- .8 CSA W178.2-18 Certification of Welding Inspectors
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.40-97 Anticorrosive Structural Steel Alkyd Primer
  - .2 CAN/CGSB 1.181-99 Ready Mixed, Organic Zinc Rich Coating.
- .5 Canadian Sheet Steel Building Institute (CSSBI)
- .6 Steel Structures Painting Council, Systems and Specifications Manual.
  - .1 CISC/CPMA 1-73a-1975 A Quick drying One-coat Paint for Use on Structural Steel.
  - .2 CISC/CPMA 2-75-1975 A Quick Drying Primer for Use on Structural Steel.

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit Shop and Erection Drawings for review.
  - .2 Verify site dimensions before proceeding with shop fabrication and to suit field conditions and field openings.
  - .3 Show and describe in detail all the work of this Section including large scale detail of members and materials, of connection and jointing details, and of anchorage devices, dimensions, thicknesses, description of materials, metal finishing, as well as all other pertinent data and information, including type, size and description of all fasteners and anchors.
  - .4 Indicate connections to building structure.
  - .5 Shop drawings for all metal fabrications shall be stamped and signed by a Professional Engineer registered in the Province of Ontario. Each submission of the shop drawings shall bear the seal of the Engineer.

#### 1.5 Qualifications

- .1 Work of this Section shall be executed by a firm thoroughly conversant with laws and regulations which govern and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturers specializing in this work and having a minimum ten (10) years proven experience in the fabrication of high quality metal fabrications. Use workmen skilled in work of this Section.
- .2 Welding shall be performed by trades persons certified by The Canadian Welding Bureau under CSA Standard W47.1.

#### 1.6 Design Requirements

- .1 Design metal stair, handrail, guardrail, 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 Machine Bolts and Nuts: ASTM Standard A307-10 low carbon steel externally and internally threaded standard fasteners. 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 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.
- .5 Sheet Steel: (Commercial Quality) ASTM A1008 stretcher leveled or temper rolled.

- .6 Gratings: Welded steel type WB, galvanized. Bearing bars shall be 38 x 4.5 mm at 29 mm centres.
- .7 Steel Pipe: ASTM A53 Schedule 40, Grade B.
- .8 Welding Materials: CSA W59.
- .9 Welding Electrodes: CSA W48 Series.
- .10 Sulphur: Commercial Grade for setting of steel posts.
- .11 Grout: non-shrink, non-metallic, non-stain, flowable, to ASTM C1107, 15 MPa at 24 hours.
- .12 Isolation Coating: Alkali resistant bituminous paint to ASTM D1187.
- .13 Adhesive Anchors: HILTI or Rawl Epoxy Adhesive Anchors sized to suit loading conditions, suitable for substrate. Adhesive to be low VOC type (maximum 250 g/l) to SCAQMD Rule 1168-03, Adhesives and Sealants Applications.

## 2.2 Finishes

- .1 Primers: All primers for metal fabrications are to be factory applied under the requirements of this Section. Refer to Finish Schedules in Section 09 91 23 for types of primers required for each application. Colour to be grey.
- .2 Pre Paint Finish: For galvanized surfaces to be exposed and finish painted, to ASTM D6386.
- .3 Galvanizing: hot dipped with zinc coating to CSA G164, ASTM A123 or ASTM A385.
  - .1 Bolts, nuts, washers, iron, and steel hardware components shall be galvanized in accordance with CSA G164 or ASTM A153.
  - .2 Galvanized coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips: Galvanized after all welding and grinding complete. No welding or grinding of galvanized products allowed.
- .4 Zinc Rich Primer: zinc rich, organic, ready mix to CAN/CGSB 1.181. Low VOC type.

## PART 3 EXECUTION

### 3.1 Fabrication

- .1 Fabricate to reviewed shop drawings and in general to details, sizes and materials indicated on drawings and specified herein.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Fabricate work complete with all components required for anchoring; bolting or welding to structural frame; standing free or resting in frames or sockets; in a safe and sure manner.
- .4 Where possible fit and shop assemble various sections of the work and deliver to site in largest practicable sections. Where shop fabricating is not possible, make trial assembly in shop.
- .5 Ensure exposed welds are continuous for length of each joint.
- .6 Grind and fill all welds after inspection and acceptance and leave ready for prime painting.

- .7 Fill all open joints, depressions, seams with metallic paste filler or by continuous brazing or welding and grind smooth to true sharp arises and profiles.
- .8 Fit joints and intersecting members accurately. Make work in true planes with adequate fastenings.
- .9 Supply all fastenings, anchors, accessories required for fabrication and erection of work of this Section. Make thread dimensions such that nuts and bolts will fit without re-threading or chasing threads.
- .10 Welding shall be done by the shielded metal-arc method in accordance with the requirements CSA W59.. The welding operators shall be currently certified under CSA W47.1 for the work they are performing.
- .11 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.
- .12 Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter. Where weld material is deposited in two or more layers, each layer shall be cleaned before the next layer is deposited. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by approved methods.
- .13 Appearance, quality of welds made, methods of correcting defective work shall be in accordance with CSA W59.

### 3.2 Shop Painting

- .1 Cleaning Steel:
  - .1 Clean steel, whether it is to be painted or not, to the degree required by CISC/CPMA 1-73a, except as specified below.
  - .2 Prepare galvanized items scheduled to be painted in accordance with the requirements of Section 09 91 23, and ASTM D6386.
  - .3 Steel to receive a shop or field paint finish shall be cleaned in accordance with Sections 09 91 23 or SSPC SP6, whichever produces a surface which has less rust and mill scale.
  - .4 Clean steel which is specified to be painted to CISC/CPMA 2-75 in accordance with that Standard.
  - .5 Clean steel which is specified to receive an organic zinc-filled epoxy primer, or zinc-rich paint, or inorganic zinc primer, in accordance with SSPC-SP 6, Commercial Blast Cleaning.
  - .6 Clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.
- .2 The following surfaces shall not be painted:
  - .1 Surfaces and edges to be field welded. If painted, remove paint for field welding for a distance of at least 50 mm on all sides of the joint, to ensure proper fusion of the metal.
  - .2 The contact surfaces of friction type connections assembled by high strength bolts.
  - .3 Portions of steel members which are to be encased in or in contact with concrete or masonry.
  - .4 Galvanized items not specifically indicated to be painted.
- .3 Preparation and priming of all metal work which will be exposed to view and which is scheduled to be finish painted, shall be in accordance with the requirements of Section 09 91 23.
- .4 All other concealed or unpainted ferrous metal work shall be given one prime paint coat type CGSB 1.40 and in accordance with CISC/CPMA 2-75. Work paint into all corners and all joints. Metal parts in contact shall be primed before shop assembly. Priming damaged during erection or through lack

of protection shall be cleaned and touched up.

- .5 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 ° C.
- .6 Metals in contact with other dissimilar metals, concrete or masonry materials shall be insulated or separated from one another to prevent corrosion, staining or electrolysis by use of bituminous paint.

### 3.3 Galvanizing

- .1 Steel members, fabrications, and assemblies shall be galvanized after fabrication by the hot dip process in accordance with CSA G164 or ASTM A123.
- .2 Galvanizing of architecturally exposed steel shall be completed by a company recognized in the application of High Quality galvanized finishes and in accordance with ASTM A385.
- .3 Prepare metals to be galvanized and painted in accordance with requirements of ASTM D6386.
- .4 Bolts, nuts, washers, iron, and steel hardware components shall be galvanized in accordance with CSA G164 or ASTM A153.
- .5 Coating Requirements:
  - .1 Weight: the weight of the galvanized coating shall conform to Table 1 of CSA G164, ASTM A123 or ASTM A153 (as appropriate).
  - .2 Surface Finish: The galvanized coating shall be continuous, adherent, as smooth and evenly distributed as possible and free from any defect that is detrimental to the stated end use of the coated article. The integrity of the coating shall be determined by visual inspection and coating thickness measurements.
  - .3 Adhesion: the galvanized coating shall be sufficiently adherent to withstand normal handling.

### 3.4 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 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 Railings

- .1 Definition: the term railing shall be taken to mean balustrades, guards, rails and handrails.
- .2 Design and fabricate railings to conform to all applicable Ontario Building Code requirements.
- .3 Unless otherwise indicated, fabricate railings as follows:
  - .1 Fabricate handrails and guardrails as detailed.
  - .2 Pipe rails shall have an outside diameter of not more than 38 mm. Close open ends of tubular members with welded steel plugs.
  - .3 Extend handrails horizontally at top and bottom of each ramp not less than 305 mm beyond top of ramp and 610 mm at bottom of ramp..
  - .4 Support railings at each end, and at maximum 1070 mm centres unless indicated otherwise or required to meet loading requirements of the Ontario Building Code.
  - .5 Minimum wall thicknesses of tubular railings: 2.5 mm.
  - .6 At corners, angles and intersections, cope or mitre railings, weld and grind smooth.
- .4 Exterior railings as detailed, galvanized.

### 3.8 Ladders

- .1 Conform to Ministry of Labour and Ontario Building Code requirements where applicable.
- .2 Unless otherwise detailed, construct ladders as follows:
  - .1 Stringers shall be minimum 19 x 38 mm steel bar extending from 150 mm above floor or roof, to minimum 1220 mm above top rung.
  - .2 Rungs shall be 19 mm solid steel bars, 400 mm long, spaced at 300 mm o.c. vertically and welded to stringers.
  - .3 Attach stringers to walls with 10 mm x 38 mm steel bar yokes, U-shaped, spaced at maximum 1220 mm o.c. vertically. Locate centre line of rungs not less than 150 mm from face of walls.
  - .4 Provide safety cages to Ministry of Labour standard details where indicated.
  - .5 Where indicated, provide horizontal and vertical returns or stringers.
  - .6 Exterior ladders shall be galvanized. Rungs all have knurled rungs or non-slip finish.
  - .7 Interior ladders shall be prime painted. Rungs shall have knurled rungs or non-slip finish.
  - .8 Ladder access platform shall be steel grating type.

### 3.9 Vanity Support Brackets

- .1 Provide supports to vanities and shelves where indicated, constructed of 3.0 mm steel plate with 38

mm wide horizontal and vertical legs formed to profile indicated. Locate supports at end of vanity, as detailed.

- .2 Finish: Shop coat primer. Fabrications in wet areas to be shot blasted and painted with zinc rich primer.

### 3.10 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.

### 3.11 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.

### 3.12 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.



### 3.13 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.

### 3.14 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.

### 3.15 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean exposed prefinished and plated items 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 22 00 Concrete Unit Masonry
- .4 Section 05 50 00 Metal Fabrications
- .5 Section 06 17 53 Shop Fabricated Wood Trusses
- .6 Section 06 20 00 Finish Carpentry
- .7 Section 07 21 13 Building Insulation
- .8 Section 07 26 00 Vapour Retarders
- .9 Section 07 52 00 Modified Bituminous Roofing
- .10 Section 08 11 00 Metal Doors and Frames

### 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-23 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 F1667-21a 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 O141:23 Canadian Standard 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 Certified Wood: Submit listing of wood products and materials used, produced from wood obtained from forests certified by FSC Accredited Certification Body in accordance with FSC-STD-01-001.

#### 1.5 Quality Assurance

- .1 Sawn lumber shall be identified by the grade stamp of an association or independent grading agency certified by the Canadian Lumber Standards Accreditation Board.

#### 1.6 Shipping, Handling and Storage

- .1 Protect materials, under cover, both in transit and on the site.
- .2 Store materials to prevent deterioration or the loss or impairment of their structural and other essential properties. Do not store materials in areas subject to high humidity and areas where masonry and concrete work are not completely dried out.
- .3 Store sheathing materials level and flat, in a dry location. Protect panel edges from moisture at all times.

#### 1.7 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 Timber Material shall be 'Grade Stamped'.
- .2 CSA Z809 or FSC Certified.
- .3 Construction Lumber: To CSA O141 Softwood Lumber graded to NLGA Standard Grading Rules for Canadian Lumber, published by the National Lumber Grades Authority. All lumber shall bear grade stamps. Moisture content of softwood lumber not to exceed 19% at time of installation.
  - .1 Framing lumber, plates, furring, blocking, No. 1 SPF.
  - .2 Nailing strips, furring and strapping: No. 4 S-P-F.
  - .3 Fitment framing: No. 1 S-P-F.
- .4 Canadian Softwood Plywood: to CSA O151-M, standard construction, good one or both sides as required, thickness as shown or specified.
  - .1 Douglas Fir Plywood: To CSA O121-M, standard construction, good one side, thickness as shown on the drawings.
  - .2 Plywood used for exposed interior work shall have select grade veneer, one or both faces where exposed, with fire retardant finish. Fire retardant shall be in accordance with CAN/CSA-080.1, and all treated materials shall bear a ULC approval stamp.
  - .3 Poplar Plywood: to CSA 0153, standard construction.
  - .4 Mat formed structural panel board (oriented strand board): to CSA O437, square edge, 12.7 mm thickness.

- .5 Lumber for Exterior Fences and Enclosures: No. 1 Grade Eastern White Cedar, NLGA Clear or better, Rough sawn.
- .6 Nails, Spikes and Staples: To ASTM F1667.
- .7 Bolts: 12.5 mm diameter, galvanized, complete with nuts and washers.
- .8 Proprietary Fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
- .9 Nailing Discs: flat caps, minimum 25 mm diameter, minimum 0.627 mm thick, sheet metal, formed to prevent dishing.
- .10 Roof Sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy.
- .11 Exterior hardware for fences: Hot dipped galvanized, heavy duty as indicated on the drawings and as required
- .12 Wood Preservative to CSA O80 SERIES.
- .13 Adhesive: Contractors gun grade cartridge loaded wood adhesive, general purpose, to ASTM D2559.
- .14 Building Paper: to CAN2-51.32-M, 15# asphalt impregnated paper.
- .15 Galvanizing: to CSA-G164. Use galvanized fasteners, and hardware for exterior work, preservative treated lumber, and materials in contact with concrete or masonry.

### **PART 3    EXECUTION**

#### **3.1        Installation**

- .1 Workmanship
  - .1 Execute work using skilled mechanics according to best practice, as specified here.
  - .2 Lay out work carefully and to accommodate work of other trades. Accurately cut and fit; erect in proper position true to dimensions; align, level, square, plumb, adequately brace, and secure permanently in place. Join work only over solid backing.
- .2 Rough Hardware: Include rough hardware such as nails, bolts, nuts, washers, screws, clips, hangers, connectors, strap iron, and operating hardware for temporary enclosures.
- .3 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 Roof Sheathing:
  - .1 Roof sheathing shall be 12.5 mm thick Douglas Fir plywood.
  - .2 Install roof sheathing in accordance with requirements of the Ontario Building Code.

- .3 Support edges of roof sheathing between framing members, with aluminum 'H' Clips.
  - .5 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.
  - .6 Electrical Equipment Backboard: provide backboards for mounting electrical equipment as indicated. Use 19 mm thick fir face veneer fire retardant softwood plywood on 19 x 38 mm furring around perimeter and at maximum of 305 mm intermediate spacing.
    - .1 Install plywood backboards with countersunk screws.
  - .7 Blocking: Provide solid wood backing to support millwork, cabinetwork, equipment, fixtures, railings and accessories and the like, as required. Coordinate with work of other Sections and install all required backing. Any such equipment mounted on gypsum wallboard assemblies or similar assemblies shall be adequately supported.
    - .1 Provide solid wood blocking in all partitions where wall stops are specified in the hardware schedule.
  - .8 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.
  - .9 Fencing and Enclosures:
    - .1 Construct fencing and enclosures as detailed on the drawings.
    - .2 Lay out fence post locations and coordinate installation of concrete footings with Section 03 30 00. Fence posts shall be evenly spaced between terminal or corner posts.
    - .3 Build all items plumb, square and level. Use galvanized hardware and fasteners.
- 3.1 Cleaning
- .1 Proceed in accordance with Section 01 74 11 – Cleaning.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 41 00 Structural Metal Stud Framing
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 92 00 Joint Sealants
- .4 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C473-19 Standard Test Methods for Physical Testing of Gypsum Panel Products
  - .2 ASTM C518-21 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .3 ASTM C1002-22 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - .4 ASTM C1177/C1177M-17 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
  - .5 ASTM C1280-18 Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
  - .6 ASTM C1396/C1396M-17 Standard Specification for Gypsum Board
  - .7 ASTM D3273-21 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
  - .8 ASTM D6329-98(2023) Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers
  - .9 ASTM E72-22 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
  - .10 ASTM E84-23d Standard Test Method for Surface Burning Characteristics of Building Materials
  - .11 ASTM E96/E96M-22ae1 Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
  - .12 ASTM E136-22 Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C
- .2 Gypsum Association (GA)
  - .1 GA-253 Application of Gypsum Sheathing.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 ULC S114 – 18 Standard Method of Test for Determination of Non-combustibility in Building Materials
  - .2 CAN/ULC-S741-08 Standard for Air Barrier Materials
  - .3 CAN/ULC S742-20 Standard for Air Barrier Assemblies
- .4 National Building Code of Canada (NBCC)

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Manufacturer's specifications and installation instructions for each product specified.

## 1.5 Quality Assurance

- .1 Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.
- .2 Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- .3 Mockups: Build mockups to set quality standards for materials and execution[ and for preconstruction testing].
  - .1 Build integrated mockups of exterior wall assembly 14 sq. m incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
  - .2 Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
  - .3 Include junction with roofing membrane, building corner condition and foundation wall intersection.
  - .4 If Consultant determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.
  - .5 Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Consultant specifically approves such deviations in writing.
  - .6 Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Performance.
  - .7 Testing Agency Qualifications:
    - .1 For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- .4 Preinstallation Conference
  - .1 Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

## 1.6 Performance Requirements

- .1 Fire-Resistance Ratings: As tested in accordance with ASTM E119 or CAN/ULC-S101; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- .2 Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 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 Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

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 Materials

- .1 Glass Mat Exterior Gypsum Sheathing: to ASTM C1177, 15.9 mm thick, 1219 mm wide x 2440 mm long, square edge.
  - .1 Weight: 13.2 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 25.85 kPa, dry.
  - .4 Flexural Strength, Parallel (ASTM C473): 119 kg/m, 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 Accessories

- .1 Screws: ASTM C1002, corrosion resistant treated. Length of screws to penetrate framing minimum 13 mm.

PART 3 EXECUTION

3.1 Examination

- .1 Verification of Conditions:
  - .1 Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

3.2 Installation

- .1 General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.
- .2 Install work level to tolerance of 1:1200.
- .3 Do not install damaged or damp boards.



3.3 Protection

- .1 Protect gypsum sheathing installations from damage and deterioration until installation of cladding materials.

3.4 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 06 10 00 Rough Carpentry

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A90/A90M-21 Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
  - .2 ASTM A653/A653M-23 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 O80 Series Wood Preservation.
  - .2 CSA O86-14.1 Engineering Design in Wood
  - .3 CSA O141-05 Softwood Lumber
  - .4 CSA S307-M1990 (R2001) Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
  - .5 CSA S347-14 Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
- .3 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber.
- .4 Truss Plate Institute of Canada (TPIC)
  - .1 Truss Design Procedures and Specifications for Light Metal Plate Connected Trusses (Limit States Design)

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Each shop drawing submission shall bear signature and stamp of professional Engineer registered or licensed in the Province of Ontario.
  - .1 Indicate TPIC truss design procedure and CSA O86 Engineering Design in Wood and specific CCMC Product Registry number of the truss plates.
  - .2 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.
  - .3 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.
  - .4 Indicate arrangement of webs or other members to accommodate ducts and other specialties.
  - .5 Show lifting points for storage, handling and erection.
  - .6 Show location of lateral bracing for compression members.

1.5 Design Requirements

- .1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA O86.
- .2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.
- .3 Design trusses, bracing and bridging in accordance with CSA-O86.1 for loads indicated and minimum uniform and minimum concentrated loadings stipulated in NBC commentary.
- .4 Limit live load deflection to 1/360th of span where plaster gypsum board ceilings are hung directly from trusses.
- .5 Limit live load deflections to 1/240th of span unless otherwise specified or indicated.
- .6 Provide camber for trusses as indicated.

1.6 Qualifications of Manufacturers

- .1 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

1.7 Quality Control

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.
- .2 Certify preservative and fire retardant treated wood in accordance with CSA-O80 Series.

1.8 Quality Assurance

- .1 Provide Certificate of Quality Compliance from truss manufacturer upon completion of fabrication.
- .2 Provide Certificate of Quality Compliance upon satisfactory completion of installation.

1.9 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Store trusses on job site in accordance with manufacturer's instructions. Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.

1.10 Waste Management and Disposal

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

1.11 Warranty

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of two years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Lumber: Spruce (S-P-F) species, No. 1 grade, softwood, S4S, with maximum moisture content of 19% at time of fabrication and to following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Fastenings: to CSA O86.1.
  - .1 Plates: 1.006 mm minimum thickness galvanized sheet steel, minimum yield strength of minimum ultimate tensile strength of 48 ksi, 1.25 oz. zinc coating: ASTM A90.
- .3 Lateral Support: As required by truss manufacturer, and as shown on drawings.

### 2.2 Fabrication

- .1 Fabricate wood trusses in accordance with reviewed shop drawings.
- .2 Provide for design camber and roof slopes when positioning truss members.
- .3 Ensure members are accurately cut to length, angle and true to line to ensure tight joints.
- .4 Connect members using metal connector plates.

## PART 3 EXECUTION

### 3.1 Erection

- .1 Erect wood trusses in accordance with reviewed erection drawings.
- .2 Indicated lifting points to be used to hoist trusses into position.
- .3 Make adequate provisions for handling and erection stresses.
- .4 Exercise care to prevent out-of-plane bending of trusses.
- .5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.
- .6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.
- .7 Do not cut or remove any truss material without approval of Consultant.
- .8 Remove chemical and other surface deposits on treated wood, in preparation for applied finishes.

### 3.2 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools and equipment on completion of

**Project:** 24015  
**Description:** Mill Courtland Community Centre Addition  
216 Mill Street, Kitchener, ON

**SHOP FABRICATED WOOD TRUSSES**  
**Section 06 17 53**

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installation.

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 06 61 16 Solid Surfacing
- .5 Section 07 92 00 Joint Sealants
- .6 Section 08 11 00 Metal Doors and Frames
- .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
- .11 Section 12 30 00 Upholstery

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E1333-22 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emissions Rates from Wood Products Using a Large Chamber.
  - .2 ASTM F1667-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .2 CSA Group (CSA)
  - .1 CSA B111-1974 (R2003) Wire Nails, Spikes and Staples.
  - .2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA O112 SERIES-M1977 (R2006) Standards for Wood Adhesives
  - .4 CSA O121-17 Douglas Fir Plywood.
  - .5 CSA O141:23 Canadian Standard Lumber.
  - .6 CSA O151-17 (R2022) Canadian Softwood Plywood
  - .7 CSA O153-13 (R2017) Poplar Plywood.
  - .8 CSA Z760-94 (R2001) Life Cycle Assessment
- .3 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 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.
- .6 National Hardwood Lumber Association (NHLA)
  - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.
- .7 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2005.
- .8 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1168-03 Adhesives and Sealants Applications

1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings.
  - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
  - .2 Indicate materials, thicknesses, finishes and hardware.

1.5 Quality Assurance

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, 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.

2.2 Panel Materials

- .1 Douglas Fir Plywood (DFP): to CSA O121, standard construction.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .2 Canadian Softwood Plywood (CSP): to CSA O151, standard construction.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.

2.3 Accessories

- .1 Rough Hardware: Bolts, lag screws, anchors, nails and expansion shields required to secure this

portion of work. Rough hardware hot dip galvanized conforming to latest edition of CSA G164. All fasteners used in damp or wet areas to be suitable for use in corrosive environment. Use hot dipped galvanized or other material approved by the Consultant.

- .2 Nails and staples: to ASTM F1667 galvanized.
- .3 Wood screws: to CSA B35.4 plain type and size to suit application.
- .4 Stainless Steel hardware: Type 316 Stainless steel for exposed or wet locations, tamper proof.
- .5 Splines: wood or metal to suit application.
- .6 Adhesive: recommended by manufacturer, waterproof type, maximum VOC limit 30 g/L SCAQMD Rule 1168 - Adhesives and Sealants Applications.

### **PART 3 EXECUTION**

#### **3.1 Construction**

- .1 Fastening:
  - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
  - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
  - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
  - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Interior and exterior frames: Set frames with plumb sides, level heads and sills, and secure.

#### **3.2 Fabrication**

- .1 General:
  - .1 Field measure all dimensions.
  - .2 Fabricate all finish carpentry items to AWMAC premium grade, and in accordance with the reviewed shop drawings.
  - .3 Set nails and screws, apply stained plain wood filler to indentations, sand smooth and leave ready to receive finish.
  - .4 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.

#### **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.

#### 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

## 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 06 61 16 Solid Surfacing
- .5 Section 07 92 00 Joint Sealants
- .6 Section 09 21 16 Gypsum Board
- .7 Section 09 91 23 Interior Painting
- .8 Section 12 30 00 Upholstery

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM F1667/F1667M-21a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .2 Architectural Woodwork Manufacturer's Association of Canada (AWMAC)
  - .1 Architectural Woodwork Standards Manual
- .3 American National Standards Institute (ANSI)
  - .1 ANSI A208.1-2009 Particleboard
  - .2 ANSI/NPA A208.2-2009 Medium Density Fibreboard (MDF)
  - .3 ANSI/NEMA LD 3-2005 High-Pressure Decorative Laminates (HPDL)
- .4 CSA Group (CSA)
  - .1 CSA O112 SERIES-M1977 (R2006) Wood Adhesives
  - .2 CSA O151-17 (R2022) Canadian Softwood Plywood
  - .3 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 full range of manufacturer's standard plastic laminates for selection by the Consultant.
  - .2 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 is 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 Plywood:
  - .1 Soft Plywood: to CSA O151-M Standard Grade, solid two sides. Use in concealed locations
- .4 Particleboard: Meeting requirements of AWMAC's STANDARDS (NAAWS). To ANSI A208.1 , minimum density of 720kg/m3 Grade "R".
- .5 MDF: Medium Density Fiberboard meeting requirements of AWMAC's STANDARDS (NAAWS).
- .6 Edgeband
  - .1 For plastic laminate casework: High Pressure Decorative Laminate (HPDL).
- .7 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 P.Lam 1
    - .1 Manufacturer: Wilsonart
    - .2 Colour: Fawn Cyprus 820BK
    - .3 Finish: 16 Casual Rustic
  - .6 P.Lam 2
    - .1 Manufacturer: Abet Laminati
    - .2 Colour: Giallo Savana 862
    - .3 Finish: SEI Standard
- .8 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.
- .9 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.
- .10 Stainless Steel: Type 316 with AISI No. 4 finish, 1.80 mm thick.
- .11 Cabinet Hardware: Products listed are a standard of acceptance. Products by other manufacturers, of equal quality and similar appearance may also be accepted subject to review and approval by Consultant.
  - .1 Draw bolt fasteners: Knappe & Vogt KV 516
  - .2 Recessed Shelf Standard:
    - .1 Knappe & Vogt KV 255, Zinc, finish.
    - .2 Knappe & Vogt KV 256AL Series Aluminum Shelf Support Clip
  - .3 Hinges: Blum concealed hinges, 125° clip and 125° opening with self-closing spring. Soft close. Full or half overlay. Nickel plated steel.
  - .4 Cabinet Pulls: Richelieu D-Pull No: 30134-170, 96 mm c.c. brushed stainless steel.
  - .5 Catches: Type optional with manufacturer.
  - .6 Cabinet Locks: CCL 0737 pin tumbler MK & KA by room.
  - .7 Drawer Slides: Knappe & Vogt 8450FM Soft-Close Full-Extension Drawer Slide
  - .8 Door and Drawer Bumpers: "Quietex" bumpers.
  - .9 Desk Grommet Cable Outlet: Richelieu 9004490 plastic cable grommet with removable cap.
  - .10 Coat Rod: Commercial grade steel; long-lasting, corrosion resistant finish. Meets and/or exceeds ANSI/BHMA weight load requirements.
    - .1 Round Closet Rod Tubing, Outside Diameter: 25 mm;
    - .2 KV Model 770 1: 2.7 mm wall thickness; inside diameter: 21 mm;
    - .3 Finish: Brilliant Chrome; premium double-plated finish, seamless, pit-free.
    - .4 KV Model 735 Wall Mount Flanges.
  - .11 Adjustable desk or table legs: IKEA or Richelieu. Black.
  - .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 Construction Type: Frameless
- .3 Cabinet and door interface: Flush overlay.

- .4 Exposed joints and edges:
  - .1 Uniformly space exposed joints unless otherwise indicated.
- .5 Mechanical Fasteners:
  - .1 Inconspicuously locate mechanical fasteners. Wherever possible, conceal fastenings.
  - .2 Countersink nail heads.
  - .3 Where exposed to view, countersink screw and bolt heads and fill holes with matching wood plugs.
  - .4 Cutting and fitting: make cut-outs in work of this Section as required to accommodate work of other Sections.
  - .5 Make provisions in cabinetwork to accept built-in appliances, provided by others.

## 2.3 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 Rout gables for pilaster strips where adjustable shelving is required.
- .8 Construct shelving with edge moulding to match. Shelving to cabinetwork to be adjustable unless otherwise noted.
- .9 Apply moisture repellent sealer to concealed backs of cabinetwork.
- .10 Install cabinet hardware in accord with hardware manufacturer's directions. Unless otherwise indicated, provide each door with pull and with minimum two hinges.
- .11 Install rubber wiring grommets at work surfaces where indicated.
- .12 Coordinate installation of wiring for electrical work with Electrical.

## 2.4 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.

2.5 Solid Surface Countertops

- .1 As specified in Section 06 61 16.

2.6 Finishes

- .1 All exposed exterior surfaces: plastic laminate as indicated. Colours selected by the Consultant.
- .2 All exposed interior surfaces: melamine unless indicated otherwise.
- .3 Cabinet and case backs unexposed to view shall be back primed with one coat of moisture repellent sealer.
- .4 Apply finishes in accordance with the AWMAC Manual.
- .5 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.
- .6 Cut equipment cutouts shown on plans using templates provided.

- .1 Radius internal corners at least 3 mm and chamfer edges.
- .2 Where core edge is to remain exposed, cover with plastic laminate edging.
- .3 Where core edge is to be concealed, seal with sealer.
  
- .10 Where access is required to valves and other mechanical and electrical components, located behind cabinetwork, provide removable plywood access panels of size required and secure with four brass screws.
  
- .11 Provide for wiring and cable management systems wiring grommets as indicated on the drawings.
  
- .12 Apply mildew resistant silicone sealant to perimeter of all countertops as specified in Section 07 92 00.
  
- 3.3 Adjustment
  - .1 Adjust all moving and operating parts to function smoothly and correctly.
  - .2 Fill and retouch all nicks, chips and scratches. Replace all un-repairable damaged items.
  - .3 Replace damaged components which, in the opinion of the Consultant, cannot be satisfactorily repaired.
  
- 3.4 Cleaning
  - .1 Proceed in accordance with Section 01 74 11 – Cleaning.
  - .2 Upon completion of installation, clean installed items of pencil and ink marks and broom clean the area of operation.

End of Section



## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 06 40 00 Architectural Woodwork
- .2 Section 07 92 00 Joint Sealants

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 CSA Group (CSA)
  - .1 CSA O151-17 Canadian Softwood Plywood
- .3 Architectural Woodwork Institute (AWI)
  - .1 AWI/AWMAC/WI's Architectural Woodwork Standards
- .4 International Surface Fabricators Association (ISFA)
  - .1 ISFA 2-01 (2013) Classification and Standards for Solid Surfacing Material
- .5 American National Standards Institute (ANSI)
  - .1 ANSI ICPA-SS-1 (2001) Performance Standard for Solid Surface Materials

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Include detailed specification of construction and fabrication, manufacturer's installation instructions, and manufacturer's detailed recommendations for handling, storage, installation, protection, and maintenance.
- .3 Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, terminations, and cutouts.
  - .1 Show locations and details of joints.
  - .2 Show direction of directional pattern, if any.
- .4 Samples:
  - .1 Full range of colours and patterns for initial selection by Consultant.
  - .2 Samples of three colours, 76 x 76 mm for final selection by Consultant.
- .5 Certificates: For the following certifications:
  - .1 United States Food and Drug Administration (FDA) compliance for food contact materials described in 21 CFR 174 to 21 CFR 190.
  - .2 ANSI/NSF 51 "food zone" and FDA "direct-food contact" compliant.
- .6 Provide maintenance data for solid surface material countertops for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

### 1.5 Quality Assurance

- .1 Source Limitations: Obtain materials and products from single source.

- .2 Fabricator Qualifications: Certified solid surface fabricator/installer.
- .3 Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated. Acceptable to or licensed by manufacturer.

1.6 Field Conditions

- .1 Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.
- .2 Coordinate locations of utilities that will penetrate countertops or backsplashes.

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 Handle in a manner to prevent breakage. Brace parts if necessary. Transport in the near vertical position with finished face toward finished face. Do not allow finished surfaces to rub during shipping and handling.
- .4 Store in racks in near vertical position. Prevent warpage and breakage. Store Inside away from direct exposure to sunlight.

1.8 Waste Management and Disposal

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

1.9 Warranty

- .1 Furnish manufacturer's 10-year material warranty.

**PART 2 PRODUCTS**

2.1 Manufacturer

- .1 Basis of Design:
  - .1 Solid Surface 1 (SS1)
    - .1 Wilsonart "Bluestone 9074EA"
  - .2 Solid Surface 2 (SS2)
    - .1 Wilsonart "Chilled Earth 9228SS"

2.2 Solid Surface Material

- .1 Composition Solid-Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1 and ISFA-2.
- .2 Panel thickness: 12.7 mm.
- .3 Panel weight: 21.5 kg/m<sup>2</sup>

- .4 Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - .1 Flame-Spread Index: 25 or less.
  - .2 Smoke-Developed Index: 50 or less.
  - .3 Flammability: To NFPA 101, Class A.
- .5 Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

## 2.1 Accessories

- .1 Adhesive for Bonding to other products: as recommended by solid surface material manufacturer.
- .2 Sealant for Countertops: Comply with applicable requirements in Section 07 92 00.
- .3 Heat Reflecting Tape: Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- .4 Insulating Fabric: Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

## 2.2 Fabrication

- .1 Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI Architectural Woodwork Standards.
- .2 Grade: Premium.
- .3 Configuration:
  - .1 Front: Pencil round edge 3.0 mm radius.
  - .2 Backsplash and side splash: Pencil round edge 3.0 mm radius.
- .4 Countertops: 12.7 mm thick, solid surface material with front edge built up with same material.
- .5 Backsplashes: 12.7 mm thick, solid surface material.
- .6 Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- .7 Fabricate with loose backsplashes and end splashes for field assembly.
- .8 Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated on reviewed shop drawings.
  - .1 Joint Locations: Not within 76 mm of a cutout or cooktop, 25 mm from inside corner for conventional seams, and not where countertop sections less than 900 mm long would result, unless unavoidable.
- .9 Cutouts and Holes:
  - .1 Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
    - .1 Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop.

- .2 Provide vertical edges, rounded to 10 mm radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom.
  - .2 Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
  - .3 Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
- .10 Window Stools: Fabricate solid surface window stools as detailed. Stools shall be minimum 13 mm thick with matching 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.

### PART 3 EXECUTION

#### 3.1 Examination

- .1 Examine substrates to receive solid surfacing. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.
- .2 Verify that substrates supporting solid surfacing are plumb, level, and flat to within 3.0 mm/3.0 metres.

#### 3.2 Preparation

- .1 Precondition solid surfacing in accordance with manufacturer's printed instructions.

#### 3.3 Installation

- .1 Install components plumb and level, in accordance with reviewed shop drawings, Project installation details, and manufacturer's printed instructions.
- .2 Joints between adjacent pieces of surfacing shall be flush, tight fitting, level, and neat. Securely join adjacent pieces with manufacturer's adhesive. Fill joints level to polished surface.
- .3 Install countertops level to a tolerance of 3 mm in 2.4 m, 6 mm maximum. Do not exceed 0.4 mm difference between planes of adjacent units.
- .4 Fasten countertops by adhering with 100-percent silicone material in dab format (not bead format) to base units into underside of countertop at 457 to 610 mm o.c. Shim as needed to align subtops in a level plane.
- .5 Align adjacent surfaces and, using adhesive in colour to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- .6 Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- .7 Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

- .8 Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- .9 Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- .10 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.
- .11 Apply mildew resistant sealant to perimeter of all countertops and window stools as specified in Section 07 92 00.

3.4 Protection

- .1 Protect surfaces from damage until date of Substantial Performance. Repair or replace damaged components that cannot be repaired to Consultant's satisfaction.

3.5 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- 1. Section 06 10 00 Rough Carpentry
- 2. Section 07 42 30 Solid Phenolic Wall Cladding
- 3. Section 07 46 13 Preformed Metal Siding

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM B117-19 Standard Practice for Operating Salt Spray (Fog) Apparatus
  - .2 ASTM D570-22 Standard Test Method for Water Absorption of Plastics
  - .3 ASTM D638-22 Standard Test Method for Tensile Properties of Plastics
  - .4 ASTM D695-23 Standard Test Method for Compressive Properties of Rigid Plastics
  - .5 ASTM D790-17 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
  - .6 ASTM D792-20 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
  - .7 ASTM G155-21 Standard Practice for Operating Xenon Arch Light Apparatus for Exposure of Materials

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit Shop Drawings for work of this Section. Ensure to include size, spacing and location of thermal clips.
  - .1 Shop drawings shall be reviewed and sealed by an engineer licensed in the Province of Ontario.
- .3 Submit thermal clip manufacturer's written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

### 1.5 Quality Assurance

- .1 Provide work of this Section executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- .2 Mock-Ups: Construct minimum 10 m<sup>2</sup> mock-up sample at Project location designated by Consultant for review. Once reviewed with no objections recorded, sample remains part of finished work and used as a quality reference standard for balance of Project.

## PART 2 PRODUCTS

### 2.1 Manufacturers

- .1 Acceptable Manufacturer:

.1 Cascadia Windows Ltd., Cascadia Clip; [www.cascadiaclick.com](http://www.cascadiaclick.com)

## 2.2 Performance/Design Criteria

- .1 Provide thermal spacers that meet or exceed following physical properties when tested in accordance with standards specified herein:
  - .1 Tensile Strength and Modulus: Minimum 411 MPa tensile and 169 MPa modulus when tested to ASTM D638.
  - .2 Flexural Strength and Modulus:
    - .1 Lengthwise Control: Minimum 441 MPa (64,000 psi) flexural and 13 MPa modulus when tested to ASTM D790.
    - .2 Crosswise Control: Minimum 127 MPa (18,400 psi) flexural and 8 MPa modulus when tested to ASTM D790.
  - .3 Compressive Strength:
    - .1 Lengthwise: Minimum 205 MPa when tested to ASTM D695.
    - .2 Crosswise: Minimum 83 MPa when tested to ASTM D695.
  - .4 Water Absorption: Maximum 0.09% when tested to ASTM D570.
  - .5 Density and Specific Gravity: Maximum 0.067 lbs/cu in density and 1.854 sp.gr 23/23° specific gravity when tested to ASTM D792.
  - .6 Accelerated Weathering: No cracking, checking, crazing, erosion or other characteristics that might affect performance after 2000 hours of accelerated weathering when tested to ASTM G155.
  - .7 Salt Spray: No cracking, checking, crazing, erosion or other characteristics that might affect performance after 3000 hours of salt spray exposure when tested to ASTM B117.
- .2 Structural Design: Employ a licensed engineer specified herein to:
  - .1 design components for work of this Section requiring structural performance.
  - .2 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.

## 2.3 Materials

- .1 Sub-Framing Thermal Spacer: 100% Pultruded glass fibre and thermoset polyester resin insulation clip.
  - .1 Thermal Spacer thickness for top, base and web: 4.8 mm nominal.
  - .2 Thermal Spacer Depth: As indicated on Contract Drawings.
    - .1 Depth Tolerance: +/-0.127 mm.
  - .3 Basis of Design: "Cascadia Clip" by Cascadia Windows Ltd.
- .2 Spacer Fasteners: High hex head washer head with sharp twin threaded design of heat-treated corrosion resistant coated steel.
  - .1 Fastener for Cast-In-Place Concrete and Concrete Masonry Units: 1/4 - 14 x 96mm long concrete screw with hex head. Fasteners to be supplied by Cascadia, minimum 38 mm longer than Clip depth to allow for sheathing and penetration into concrete or concrete masonry unit.
    - .1 Permitted Product: "Concrete Screw with DT2000 or NZF3000 coating" by Leland Industries Inc.
    - .2 Embedment Depth: 38 mm, except when into hollow concrete masonry unit, not less than 25 mm.
- .3 Cladding Support Sub-Framing:
  - .1 Material Basis-of-Design: Minimum 1.214 mm (18 ga), 33 ksi, factory-punched sheet steel with fastener holes to match fibreglass thermal spacers.

- .2 Corrosion Resistant Coating on Sub-Framing: Galvalume AZM 150 (AZ 50)
- .3 Sub-Framing Profiles: As shown on design drawings. Typically, Z-profile for vertically oriented sub-framing and hat-profile for horizontally oriented sub-framing, and additionally as required by cladding manufacturer or cladding structural engineer.
- .1 Typical Sub-Framing Depth: 25 mm.

### PART 3 EXECUTION

#### 3.1 Examination

- .1 Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.
- .2 Commencement of work implies acceptance of previously completed work.

#### 3.2 Preparation

- .1 Pre-drill concrete or concrete masonry unit substrate to 13 mm deeper than anticipated embedment depth of fastener into substrate.
- .2 Use drill diameter approximately 1.6 mm less than screw diameter in accordance with fastener manufacturer's written recommendations.
- .3 Sub-Framing: Ensure thermal spacer type is selected to accommodate orientation of vertical and horizontal sub-framing.

#### 3.3 Installation

- .1 Install thermal spacers in accordance with spacer manufacturer's written recommendations.
- .2 Thermal Spacer Installation:
  - .1 Clip thermal spacer to Z-girt and hat track at centres determined using Cascadia Clip Calculator <http://www.cascadiawindows.com/tools/cascadia-clip-calculator>.
  - .2 Installation sequence for spacers, sub-framing and insulation: See <https://www.cascadiawindows.com/products/cascadia-clip#installation> for sequencing.
- .3 Pre-punch holes or pre-drill holes in Z-girts and tracks to accommodate fasteners.

#### 3.4 Site Quality Control

- .1 Site Tests and Inspections: Structural Inspection: Ensure a licensed engineer specified herein inspects work of this Section during erection/installation and submits sealed and signed Field Review Report within 5 Days of site visit.
- .2 Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant.

#### 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 04 27 00 Multiple Wythe Unit Masonry
- .3 Section 05 41 00 Structural Metal Stud Framing
- .4 Section 06 10 00 Rough Carpentry
- .5 Section 06 16 43 Gypsum Sheathing
- .6 Section 07 05 43 Thermal Clips
- .7 Section 07 21 23 Loose Fill Insulation.
- .8 Section 07 26 00 Vapour Retarders
- .9 Section 07 27 00 Vapour Permeable Air Barriers
- .10 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .11 Section 07 42 30 Solid Phenolic Wall Panels
- .12 Section 07 52 00 Modified Bituminous Roofing
- .13 Section 07 92 00 Joint Sealants
- .14 Section 08 11 00 Metal Doors and Frames
- .15 Section 08 50 00 Aluminum Doors, Windows and Screens
- .16 Section 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C518-21 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .2 ASTM C578-22 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
  - .3 ASTM C1620-16(2023) Standard Specification for Aerosol Polyurethane and Aerosol Latex Foam Sealants
  - .4 ASTM D1621-16(2023) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
  - .5 ASTM E1677-19 Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls
  - .6 ASTM E84-24 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 Underwriters Laboratories (UL)
  - .1 UL 1715 - Fire Test of Interior Finish Material
- .5 Canadian General Services Board (CGSB)
  - .1 CGSB 71-GP-24M Adhesive, Flexible, for Bonding to Cellular Polystyrene Insulation.
- .6 Uniform Building Code (UBC)
  - .1 UBC 26-3 Room Fire Test Standard for Interior of Foam Plastic Systems

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit insulation manufacturer's product literature including specified physical properties for each type of insulation specified.
- .3 Submit installation instructions.
- .4 Submit certification that product complies with specification requirements and is suitable for the use indicated.

#### 1.5 Environmental Requirements

- .1 Insulation shall not be produced with, or contain, any of the regulated CFC compounds listed in the Montreal Protocol of the United Nations Environmental Program.

#### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .3 Deliver material to the site in the original unbroken packages bearing the name of manufacturer.
- .4 Store materials in an approved manner at the site preceding application and protect from damage at all times.
- .5 Remove damaged or deteriorated materials from site.

#### 1.7 Waste Management and Disposal

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

### 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. HFO blowing agents. Thickness as detailed, 400 x 2440 mm boards with butt edges. Material shall have the following characteristics when tested to the reference standards:
  - .1 Compressive Strength: ASTM D1621: 210 kPa.
  - .2 Water Absorption: ASTM D2842: maximum 0.7% by volume.
  - .3 Water Absorption: ASTM C272: maximum 0.1% by volume.
  - .4 Water Vapour Permeance, ASTM E96: 52 ng/Pa•s•m<sup>2</sup>
  - .5 Thermal resistance RSI: ASTM C518: 0.88/25 mm
- .1 Basis of Design: Soprema XPS-30

## 2.2 Extruded Polystyrene Masonry Cavity Wall Insulation

- .1 Provide continuous extruded polystyrene insulation (sheathing), unfaced Type V per ASTM D1621.
- .2 Performance/ Design Criteria
  - .1 Type IV per ASTM C578
  - .2 Compressive Strength: 25 psi, minimum per ASTM D1621.
  - .3 Thermal Resistance (180 day real-time aging as mandated by ASTM C578, measured per ASTM C518 at mean temperature of 75F): R-5.0 per inch of thickness, with 90% lifetime limited warranty on thermal resistance.
  - .4 Water Absorption (ASTM C272): Maximum 0.30 percent by volume.
  - .5 Surface Burning Characteristics (ASTM E84): Flame spread less than 25; smoke developed less than 450, certified by independent third-party testing agency.
  - .6 Contains no HCFCs.
  - .7 Zero ozone depleting blowing agent that has warming potential (100 years) of less than 750.
  - .8 Provide RSI 0.88 per 25 mm of thickness; 102 mm thick unless otherwise indicated; 1220 x 2440 mm; square edge.
- .3 Basis of Design: Owens Corning Foamular 250 XPS.
- .4 Adhesive as recommended by Manufacturer.

## 2.3 Exterior Wood and Metal Stud Wall Insulation

- .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 °C: 0.71 m<sup>2</sup>K/W.
  - .3 Density: 32 kg/m<sup>3</sup> to ASTM C167.
  - .4 Recycled content: 40 % minimum.
  - .5 Basis of Design: Rockwool Comfortbatt

## 2.4 Loose Fill Insulation

- .1 Loose fill attic insulation as specified in Section 07 21 23.

## 2.5 Batt Insulation

- .1 Fibreglass friction fit batts or mineral fibre to CAN/ULC 702.1 Type 1, width and thickness as shown on details:
  - .1 Owens Corning ProPink Wall Insulation, unfaced.
  - .2 Owens Corning Thermafiber Ultrabatt
  - .3 Roxul Batt Insulation.

## 2.6 Acoustic Insulation

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

## 2.7 Spray Foam Insulation

- .1 Spray Foam Insulation: to ASTM C1620, one component expanding polyurethane or polyisocyanurate foam, ULC approved and compatible with rigid insulating materials, with Class 1 fire rating to ASTM E84 for window and door frame application:
  - .1 Ultra Seal PF-100 Gun Foam by Nuco Inc.
  - .2 Handi-Foam by Fomo Products Inc.
  - .3 Pinkseal by Owens Corning.
  - .4 Hilti CF 812 Window and Door Pro.

## 2.8 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.

## PART 3 EXECUTION

### 3.1 Installation – General

- .1 Install insulation of types indicated, or, where not indicated, as appropriate, to provide a continuously un-interrupted building envelope in accordance with the requirements of the reference standards.
- .2 Install insulation after building substrate materials are dry.
- .3 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .4 Fit insulation tightly around all structural angles, penetrations and other protrusions.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly; offset vertical joints.
- .6 Insulation board materials shall be free from chipped or broken edges.
- .7 Sizes of materials shall be consistent with the module of the system.
- .8 Do not enclose or conceal insulation until it has been inspected by the Consultant.

### 3.2 Perimeter Insulation

- .1 Do not proceed with installation until concrete surfaces are dry and cured, and water proofing membranes have been inspected and approved.
- .2 Install perimeter insulation vertically just prior to backfilling.

- .3 Prime porous concrete surfaces.
- .4 Apply adhesive in gobs or pads to the back of the insulation board in accordance with manufacturer's instructions. Joints shall be left dry with joints brought into tight contact. Apply insulation to the wall with a slight sliding motion to ensure good contact.
- .5 Protect insulation from damage until time for backfilling.
- .6 Following backfilling and prior to placement of underslab vapour barriers, install horizontal insulation. Install rigid insulation at perimeter of all exterior walls and for extent as indicated. Tightly butt joints.

### 3.3 Extruded Polystyrene Masonry Cavity Wall Insulation

- .1 Verify manufacturer recommended cure time for air and water barrier system before installing continuous insulation board.
- .2 Install extruded polystyrene insulation boards over the exterior air & vapour barrier layer in accordance with manufacturers' written recommendations.
- .3 Install insulation board in maximum sizes to minimize joints.
- .4 Locate joints square to framing members. Center joints over framing. Provide additional framing as necessary.
- .5 Stagger joints a minimum of one stud space from adjacent joints.
- .6 Insulation board edges shall be butted together tightly and fit around openings and penetrations. Install square edges to fit square and tight.
- .7 Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.
- .8 Apply single layer of insulation boards to produce thickness indicated.
  - .1 Compatible Adhesive
    - .1 Apply compatible adhesive to substrate per adhesive manufacturer, air barrier manufacturer, and insulation manufacturer recommendations.
    - .2 Install XPS insulation in adhesive while wet.
    - .3 Hold insulation securely in place until adhesion is satisfactory.
    - .4 Application rate and spacing shall be evenly distributed and minimum necessary per jobsite conditions as required by Insulation and adhesive manufacturers to hold the continuous insulation in place until exterior masonry veneer can be installed in accordance with Section 04 27 00 requirements.

### 3.4 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.

3.5 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.

3.6 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 06 10 00 Rough Carpentry
- .2 Section 07 21 13 Building Insulation
- .3 Section 07 26 00 Vapour Retarders

### 1.3 References

- .1 CSA Group (CSA)
  - .1 CSA B149.1:20 Natural Gas and Propane Installation Code
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 51.34-M86 Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Underwriters' Laboratories of Canada (ULC)
  - .1 ULC 604-2016 Standard for Factory-Built Type A Chimneys
- .4 Canadian Construction Materials Centre (CCMC) Product Evaluation

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit product data sheets for system materials. Include product characteristics, performance criteria, and limitations.
- .3 Submit proof of manufacturer's CCMC Listing and listing number.
- .4 Manufacturer's Instructions: indicate special handling criteria, installation sequence and cleaning procedures.

### 1.5 Quality Assurance

- .1 Provide Certification of Coverage and Application Chart in accordance with ULC 702 Appendix A, certified by Applicator's signature that the information is correct.

### 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 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
- .2 Ventilation:
  - .1 Ventilate area of work by use of approved portable supply and exhaust fans.

- .2 Provide continuous ventilation during and after insulation application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 3 days after completion of insulation installation.

- .3 Protection

- .1 Provide temporary enclosures to prevent dust from contaminating air beyond application area.
  - .2 Protect adjacent surfaces and equipment from damage by fall-out, and dust.

## 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 Loose Fill Insulation: to CAN/ULC-S702.1, asbestos-free, formaldehyde -free. CCMC evaluation listing number 12851-L or equivalent
  - .1 Type 5 - blowing wool, suitable for application by means of pneumatic equipment. Non-corrosive, non-combustible.
    - .1 Owens Corning ProPink Fibreglas Blown Insulation.
    - .2 Johns Manville JM Climate Pro
    - .3 Certaineed Insulsafe XC Fibre Glass Blowing Insulation.

### 2.2 Attic Rafter Vents

- .1 Owens Corning Raft-R-Mate® Attic Rafter Vents or ADO Duravent Rafter Vents:
  - .1 Dimensions 572 x 1220 mm
  - .2 Air Channel Depth 138 mm
  - .3 Net-Free Air Flow 144 cm<sup>2</sup>
  - .4 Material Extruded Polystyrene

## PART 3 EXECUTION

### 3.1 Installation

- .1 Comply with requirements of CAN/ULC S702.2.
- .2 Install rafter vents in accordance with manufacturer's instructions against the underside of the roof deck, between roof trusses or rafters, to maintain free airflow channel from the eave vent to the attic space to prevent insulation from spilling over top of exterior wall and causing blockage of soffit vents, and to prevent displacement of insulation by wind entering vents.
- .3 Pneumatically place loose fill insulation above ceiling between joists to provide minimum thermal resistance value RSI as indicated.
- .4 Ensure ceiling areas exposed to outside air are insulated.
- .5 Ensure unobstructed air circulation to eave vents. Install baffles as indicated to prevent insulation from spilling over top of exterior wall and causing blockage of soffit vents, and to prevent displacement of insulation by wind entering vents.



- .6 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of ULC 604 type A chimneys and CSA B149.1 type B and L vents.

### 3.2 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Remove insulation material spilled during installation and leave work area ready for application of wall board.

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 21 23 Loose Fill Insulation
- .6 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .7 Section 07 42 30 Solid Phenolic Wall Panels
- .8 Section 07 46 13 Preformed Metal Siding
- .9 Section 07 50 00 Modified Bituminous Roofing
- .10 Section 07 92 00 Joint Sealants
- .11 Section 09 21 16 Gypsum Board
- .12 Section 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E96/E96M-22ae1 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(2023) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
  - .5 ASTM F1249-20 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
- .2 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 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 06 16 43 Gypsum Sheathing
- .4 Section 07 21 13 Building Insulation
- .5 Section 07 42 30 Solid Phenolic Wall Panels
- .6 Section 07 46 13 Preformed Metal Siding
- .7 Section 07 52 00 Modified Bituminous Roofing
- .8 Section 07 62 00 Sheet Metal Flashing and Trim
- .9 Section 07 92 00 Joint Sealants
- .10 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 Sheet
  - .2 ASTM D903-98(2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
  - .3 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .4 ASTM E96/E96M-22 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(2021) 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 E2178-21a Standard Test Method for Determining Air Leakage Rate and Calculation of 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.m2.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):
      - .1 41 lbf /182N MD
      - .2 29 lbf /129N CD
    - .7 Surface Burning Characteristics (ASTM E84):
      - .1 Flame Spread: Class A
      - .2 Smoke Development: Class A
  - .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 Low Application Temperature: -7 ° C.

#### 2.4 Mastics & Termination Sealants

- .1 As recommended by manufacturer.



### PART 3 EXECUTION

#### 3.1 Manufacturer's Instructions

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

#### 3.2 General

- .1 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

#### 3.3 Examination

- .1 Examine all surfaces to ensure conformance to the manufacturer's recommended surface conditions.

#### 3.4 Preparation

- .1 Prepare substrate surfaces in accordance with air barrier material manufacturer's instructions.
- .2 All surfaces which are to receive flexible air barrier must be smooth, clean, dry, frost-free and in sound condition. All moisture, frost, grease, oils, loose mortar, dust, or other foreign materials which may impede the adhesion of the air barrier must be removed.
- .3 New mortar must be cured 14 days and must be dry before air barrier membrane is applied.
- .4 Concrete must be cured 28 days and dry before air barrier membrane is applied.
- .5 Remove any and all sharp protrusions and repair any defects such as spalled or loose aggregate areas.
- .6 Do not proceed with air barrier application until all substrate defects are repaired.

#### 3.5 Installation

- .1 Install air barrier materials continuously over substrate in accordance with manufacturer's instructions. Partial application is not acceptable, and the insulation specified elsewhere is not intended to perform as the sole air barrier.
- .2 Prime surfaces and apply membrane in strict accordance with manufacturer's printed directions.
- .3 Primed surfaces not covered by air barrier membrane during the same working day must be reprimed.
- .4 Apply membrane by heating the surface in contact with the substrate with a trigger-activated propane torch, type as recommended by the manufacturer.
- .5 Cut sheet membrane into manageable sizes, position membrane for alignment prior to removing protective film.
- .6 Install membrane horizontally, in a shingle fashion starting at lowest point. Position membrane and remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and

side laps. Promptly roll the membrane surface and all laps with a countertop roller to ensure proper surface bond and effect the seal.

- .7 Tie-in to window frames, door frames, roofing systems, cladding, concrete walls, and at the interface of dissimilar materials as indicated or as necessary to achieve a continuous air seal throughout the building envelope. Seal with air barrier tape. Refer to manufacturer's standard details.
- .8 All joints, interconnections, and penetrations of the air barrier components including lighting fixtures shall be indicated on manufacturer's standard details.
- .9 Ensure all projections are properly sealed with a trowel or caulk application of specified sealant.

### 3.6 Inspection and Repair

- .1 Inspect membrane thoroughly before covering and make any corrections to punctures, tears, voids and other obvious defects which would impede the membrane from performing as intended.
- .2 Notify Consultant when sections of work are complete so as to allow for review prior to installation of insulation. Remove, replace or repair materials not satisfactory to the Consultant and wait for re-inspection before covering work.

### 3.7 Cleaning and Protection

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Protect air barrier materials from damage during installation and the remainder of the construction period, according to material manufacturer's written instructions.
- .3 Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the material manufacturer.
- .4 Clean adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 04 27 00 Multiple Wythe Unit Masonry
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 21 13 Building Insulation
- .4 Section 07 27 00 Vapour Permeable Air Barriers
- .5 Section 07 52 00 Modified 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 D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  - .2 ASTM D624-00(2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
  - .3 ASTM D4541-22 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
  - .4 ASTM E96/E96M-22ae1 Standard Test Methods for Water Vapor Transmission of Materials
  - .5 ASTM E330/E330M-14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - .6 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
  - .7 ASTM E1186-22 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
  - .8 ASTM E2178-21a Standard Test Method for Air Permeance of Building Materials
  - .9 ASTM E2357-18 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.

## PART 2 PRODUCTS

- 2.1 Material
- .1 Materials: as required to achieve specified performance criteria; meeting specified reference standards and functionally compatible with adjacent materials and components.
  - .2 Air barrier membrane components and accessories must be obtained as a single source from the membrane manufacturer to ensure total system compatibility and integrity.
- 2.2 Membranes
- .1 Self-adhered air barrier membrane shall SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, and having the following physical properties:
    - .1 Thickness: 1.0 mm minimum.
    - .2 Air leakage: <0.01 L/s.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 Sopraseal Stick 1100T by Soprema

### 2.3 Adhesives and Primers

- .1 As recommended by manufacturer.

### 2.4 Mastics and Termination Sealants

- .1 As recommended by manufacturer.

## PART 3 EXECUTION

### 3.1 Manufacturer's Instructions

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 3.2 General

- .1 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

### 3.3 Examination

- .1 Examine all surfaces to ensure conformance to the manufacturer's recommended surface conditions.

### 3.4 Preparation

- .1 Prepare substrate surfaces in accordance with air barrier material manufacturer's instructions.
- .2 All surfaces which are to receive flexible air barrier must be smooth, clean, dry, frost-free and in sound condition. All moisture, frost, grease, oils, loose mortar, dust, or other foreign materials which may impede the adhesion of the air barrier must be removed.
- .3 New mortar must be cured 14 days and must be dry before air barrier membrane is applied.
- .4 Concrete must be cured 28 days and dry before air barrier membrane is applied.
- .5 Remove any and all sharp protrusions and repair any defects such as spalled or loose aggregate areas.
- .6 Do not proceed with air barrier application until all substrate defects are repaired.

### 3.5 Installation

- .1 Install air barrier materials continuously over substrate in accordance with manufacturer's instructions. Partial application is not acceptable, and the insulation specified elsewhere is not intended to perform as the sole air barrier.
- .2 Prime surfaces and apply membrane in strict accordance with manufacturer's printed directions.

- .3 Primed surfaces not covered by air barrier membrane during the same working day must be reprimed.
- .4 Apply membrane by heating the surface in contact with the substrate with a trigger-activated propane torch, type as recommended by the manufacturer.
- .5 Cut sheet membrane into manageable sizes, position membrane for alignment prior to removing protective film.
- .6 Install membrane horizontally, in a shingle fashion starting at lowest point. Position membrane and remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps. Promptly roll the membrane surface and all laps with a countertop roller to ensure proper surface bond and effect the seal.
- .7 Tie-in to window frames, door frames, roofing systems, cladding, concrete walls, and at the interface of dissimilar materials as indicated or as necessary to achieve a continuous air seal throughout the building envelope. Seal with air barrier tape. Refer to manufacturer's standard details.
- .8 All joints, interconnections, and penetrations of the air barrier components including lighting fixtures shall be indicated on manufacturer's standard details.
- .9 Ensure all projections are properly sealed with a trowel or caulk application of specified sealant.

### 3.6 Inspection and Repair

- .1 Inspect membrane thoroughly before covering and make any corrections to punctures, tears, voids and other obvious defects which would impede the membrane from performing as intended.
- .2 Notify Consultant when sections of work are complete so as to allow for review prior to installation of insulation. Remove, replace or repair materials not satisfactory to the Consultant and wait for re-inspection before covering work.

### 3.7 Cleaning and Protection

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Protect air barrier materials from damage during installation and the remainder of the construction period, according to material manufacturer's written instructions.
- .3 Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the material manufacturer.
- .4 Clean adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 31 13 Asphalt Shingles
- .3 Section 07 92 00 Joint Sealants

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  - .2 ASTM D903-98(2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
  - .3 ASTM D1970/D1970M-21 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
  - .4 ASTM D3767-03(2020) Standard Practice for Rubber—Measurement of Dimensions
  - .5 ASTM E96/E96M-22ae1 Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
  - .6 ASTM G90-23 Standard Practice for Performing Accelerated Outdoor Weathering of Materials Using Concentrated Natural Sunlight

### 1.4 Submittals

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

### 1.5 Quality Assurance

- .1 Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.
- .2 Manufacturer: Minimum 10 years experience producing roofing underlayment.
- .3 Installer: Minimum 2 years experience with installation of similar underlayment.

### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .3 Deliver materials and products in unopened factory labeled packages. Protect from damage.
- .4 Cover materials and store in dry condition between temperatures of 5 ° and 32 ° C. Do not store at elevated temperatures as that will reduce the shelf life of the product.



### 1.7 Waste Management and Disposal

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

## PART 2 PRODUCTS

### 2.1 Manufacturer

- .1 Manufacturer: GCP Applied Technologies, Inc, 62 Whittemore Avenue, Cambridge, MA 02140, Toll Free 866-333-3726, [www.gcpat.com](http://www.gcpat.com)

### 2.2 Materials

- .1 Self-Adhering Sheet Membrane Roof Underlayment: Provide Grace Ice and Water Shield by GCP Applied Technologies, Inc. with the following characteristics:
  - .1 Material: Cold applied, self-adhering membrane composed of a high strength polyethylene film coated on one side with a layer of rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene.
  - .2 Color: Gray-black.
  - .3 Membrane Thickness: 1.02 mm ASTM D3767 procedure A (Section 9.1).
  - .4 Tensile Strength, Membrane: 1720 kN/m<sup>2</sup> ASTM D412 (Die C modified).
  - .5 Elongation, Membrane: 250% ASTM D412 (Die C modified).
  - .6 Low Temperature Flexibility: Unaffected @ -29°C ASTM D1970.
  - .7 Adhesion to Plywood: 525 N/m ASTM D903.
  - .8 Permeance (Max): 2.9 ng/m<sup>2</sup>s Pa ASTM E96
  - .9 Material Weight Installed (Max): 1.3 kg/m<sup>2</sup>.
  - .10 Primer: Water-based Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.
  - .11 Code and Standards Compliance:
    - .1 Underwriters Laboratories Inc. Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).
    - .2 Underwriters Laboratories Inc. Classified Sheathing Material Fire Resistance Classification with Roof Designs: P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P732, P734, P736, P742, P803, P814, P818, P824
    - .3 ICC ESR-1677 approval according to AC-48 Acceptance Criteria for Self-Adhered Underlayments used as Ice Barriers.
    - .4 Canadian Construction Materials Centre (CCMC) 13670-L

## PART 3 EXECUTION

### 3.1 Examination

- .1 Prior to start of installation, inspect existing conditions to ensure surfaces are suitable for installation of roofing underlayment. Verify flashing has been installed. Starting work indicates installers acceptance of existing conditions.

### 3.2 Installation

- .1 Installation: Install roofing underlayment over entire sloped surfaces as indicated on the Contract Drawings. Strictly comply with manufacturer's installation instructions including but not limited to the following:
  - .1 Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.
  - .2 Do not install underlayment on wet or frozen substrates.

- .3 Install when surface temperature of substrate is a minimum of 5 degrees C and rising.
- .4 Remove dust, dirt, loose materials and protrusions from deck surface.
- .5 Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.
- .6 Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.
- .7 Side laps minimum 89 mm and end laps minimum 152 mm following lap lines marked on underlayment.
- .8 Patch penetrations and damage using manufacturer's recommended methods.

### 3.3 Protection

- .1 Protection: Protect from damage during construction operations and installation of roofing materials. Promptly repair any damaged or deteriorated surfaces.
- .2 Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired in the opinion of the Consultant.
- .3 Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protective film and reclean as necessary immediately before final acceptance

### 3.4 Cleaning

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

End of Section

## **PART 1 GENERAL**

### **1.1 General**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Sections**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 30 10 Roof Underlayment
- .3 Section 07 62 00 Sheet Metal Flashing and Trim
- .4 Section 07 71 23 Manufactured Gutters and Downspouts

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM D3018/D3018M-22 Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules
- .2 CSA Group (CSA)
  - .1 CSA A123.5-16 Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules
  - .2 CAN/CSA-A123.2-03 (R2018) Asphalt-Coated Roofing Sheets
  - .3 CAN/CSA A123.3-05 (R2015) Asphalt Saturated Organic Roofing Felt
  - .4 CAN/CSA A123.51-14 Asphalt Shingle Application on Roof Slopes 1:6 And Steeper
  - .5 CSA B111-1974 (R2003) Wire Nails, Spikes and Staples
  - .6 CSA B272-93 (R2000) Prefabricated Self-Sealing Roof Vent Flashings
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.4-M89 Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing
  - .2 CAN /CGSB-37.5-M89 Cutback Asphalt Plastic Cement
  - .3 CAN/CGSB-51.32-M77 Sheathing, Membrane, Breather Type
- .4 Canadian Roofing Contractors' Association (CRCA)
  - .1 Roofing Specifications Manual

### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit to the Consultant, duplicate samples of manufacturer's standard colour range of full size specified shingles.
- .3 Submit manufacturer's installation instructions for ridge vents.
- .4 Submit colour samples for metal flashings.

### **1.5 Quality Assurance**

- .1 The Contractor for this work shall have had previous successful experience on projects of similar size and complexity. The Contractor's crew shall be under the supervision of a competent and experienced Supervisor at all times.

### **1.6 Shipping, Handling and Storage**

- .1 Refer to Section 01 16 00 – Common Product Requirements.

- .2 Deliver and store materials undamaged in original containers with manufacturer's label and seals intact. All materials shall be protected from moisture and shall not be placed in direct contact with the earth.
- .3 Provide and maintain dry, off-ground weatherproof storage.
- .4 Remove only in quantities required for same day use.

1.7 Waste Management and Disposal

- .1 Refer to Section 01 74 10 – Cleaning.

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.
  - .1 Defects include but are not limited to leaking, failure to stay in place, lifting, loosening, curling, splitting, or deterioration.
- .2 Furnish an additional manufacturer's warranty for the asphalt shingles for 30 years.

PART 2 PRODUCTS

2.1 Materials

- .1 Composite Shingles: To ASTM D3018 Type I – Self-Sealing, UL Certification of ASTM D3462, ASTM D3161/UL997 110-mph Wind Resistance and UL Class A Fire Resistance, glass fiber mat base, ceramically coloured/UV resistant mineral surface granules across entire face of shingle; algae-resistance; two piece laminate shingle. Colour to be selected by the Consultant.
  - .1 CertainTeed Landmark Shingles.
  - .2 BP Mystique 42 Shingles.
  - .3 GAF Industries Timberline Shingles.
- .2 Shingles meeting or exceeding the above specification, in colours satisfactory to the Consultant,
- .3 Starter Strip: 1 layer of shingles or smooth roll roofing to CSA A123.2 Type S.
- .4 Underlayment and Eave Protection: Refer to Section 07 30 10..
- .5 Cement:
  - .1 Plastic Cement to CAN/CGSB-37.5
  - .2 Lap Cement to CAN/CGSB-37.4
- .6 Flashings, 0.7 mm minimum, unless noted otherwise prefinished galvanized sheet steel, Stelco or Dofasco 5000 series. Colour to be selected by Consultant.
- .7 Drip Edge: 100 mm wide mill finish aluminum drip edge in maximum practical lengths.
- .8 Roof Vents:
  - .1 Ridge ventilators: CertainTeed 304 mm Filtered Continuous ridge ventilators. Vents shall be constructed with an external baffle to deflect wind and weather over the vent and have weep holes placed on 100 mm centers for water shedding from the cap shingles mounted to the top

- of the vent. The vent shall be manufactured from polypropylene resin capable of passing ASTM G155 advanced weathering test with less than a 10% variance. The vent shall be capable of the cap shingles being fastened with a nail gun set to 100 PSI without breakage. The vent shall be constructed with a minimum of 10 pre-formed nail bosses for positioning the vent on the roof. Individual vent openings shall be sized to be no wider than 6 mm. The vent shall have integral ribbing to maintain the structural integrity of the vent during cap shingling and maintain the vent profile when installed.
- .2 CSA Certified roof vents, aluminum construction with aluminum screen flashing Dimensions: 380 x 425 mm, Opening Size: 228 mm, Net Free Area: 0.33 m<sup>2</sup>. Model RV-51 by AM Conservation Group Inc. or approved equal. Colour to match shingles.
  - .9 Nails to CSA B111 large head, galvanized steel or aluminum roofing nails of sufficient length to penetrate 19 mm into existing deck.
  - .10 Stack jacks (vent pipe flashings): To CSA B272, Model SJ-45 aluminum stack jacks supplied by Thaler Metal Industries Ltd. or approved equivalent, applicable at all plumbing vent pipes. Sleeves supplied by other trades will not be acceptable.

### **PART 3 EXECUTION**

#### **3.1 Existing Conditions**

- .1 Inspect substrate for soundness and report any damaged material to the Consultant.
- .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 immediately removal of such installed work.

#### **3.2 Workmanship**

- .1 Workmanship shall be of the highest quality. Use only competent mechanics and execute work in accordance with drawings and specifications.
- .2 Regard the manufacturer's printed recommendations and specifications as the minimum requirement for materials, methods and workmanship not otherwise specified.
- .3 Maintain roofing equipment in good working order.
- .4 Unsuitable or damaged materials shall immediately be removed from the site.

#### **3.3 Application**

- .1 Do asphalt shingle work in accordance with CAN3-A123.51 except where specified otherwise.
- .2 Install drip edge along eaves, overhanging 12 mm, with minimum 100 mm flange extending onto roof decking. Nail to deck at 400 mm on centre.
- .3 Install valley flashings.

- .4 In accordance with referenced standards and manufacturer's instructions, install waterproof underlayment over entire roof area. Refer to Section 07 30 10.
- .5 Install roof vents in accordance with O.B.C. requirements.
- .6 Flash and seal all around existing roof penetration in accordance with CRCA standard details.

3.4 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 05 12 23 Structural Steel
- .2 Section 05 50 00 Metal Fabrications.

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM B209/B209M-21a Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit manufacturer's product data and installation instructions for custom perforated metal architectural designs, including manufacturer's SPEC-DATA product sheet. Include material, finish, available thicknesses and opening sizes.
- .3 Shop Drawings:
  - .1 Submit shop drawings detailing installation procedures, including layout, dimensions, anchorage, reinforcement, connections, supports and support placement.
- .4 Samples:
  - .1 Submit 305 x 305 mm sample of perforation pattern in required material thickness. Sample to include formed edges per system design and finish as specified.
- .5 Quality Assurance:
  - .1 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
  - .2 Manufacturer's Instructions: Manufacturer's installation instructions.
- .6 Manufacturer's Field Reports: Indicate and interpret test results for compliance with performance requirements.
- .7 Provide maintenance data for Perforated Metal Wall Panels for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00.

### 1.5 Quality Assurance

- .1 Qualifications:
  - .1 Fabricator Qualifications: Fabrication performed in quality controlled manufacturing environment by experienced fabricators with references indicating multiple satisfactory experiences fabricating perforated metals as required for this project.
- .2 Mock-Ups: Build mock-up representative of perforated metal wall panel 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 1.0 metres high and include the materials and accessories proposed for use.

1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Delivery, Storage and Protection:
  - .1 Deliver materials in original sealed manufacturer's packaging.
  - .2 Store materials in dry, secure location.
  - .3 Store in accordance with manufacturer's written 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 one year from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.
- .2 Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- .3 Finish Warranty: 5 year warranty Powder Coat Finish.

**PART 2 PRODUCTS**

2.1 Manufacturer

- .1 Basis of Design Manufacturer: Hendrick Architectural, 1 Seventh Ave., Carbondale, PA 18407; Telephone: (877) 840-0881, (570) 282-1010; Fax: (570) 282-1506; E-mail: arch@hendrickcorp.com; website: [www.hendrickarch.com](http://www.hendrickarch.com).
- .2 Basis of Design Product: Hendrick Architectural H-Clad MD System.

2.2 Materials

- .1 Aluminum: To ASTM B209.
  - .1 Thickness: .125 thick 5052-H32 / .190 thick 5052-H32
  - .2 Sheet Size: Maximum size per manufacturer's span chart
  - .3 Shape: Formed panel edges per design details
  - .4 Finish: Powder coated.
  - .5 Colour: Black.
- .2 Perforations: Round: 19 mm diameter holes, 25.4 mm spacing, 51 % open area, Staggered.
- .3 Panel Margins: 19/29 mm min. margins all 4 sides
- .4 Fasteners: Stainless steel HWH w/ rubber washer
  - .1 305 mm o.c. – long legs only



- .5 Sub-framing: 122 mm x 89 x 6 mm vertical aluminum tee w/ 6 mm aluminum angle brackets running continuous.
- .6 Sub-framing Fasteners: All stainless steel hardware

### **PART 3 EXECUTION**

#### **3.1 Manufacturer's Instructions**

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and manufacturer's data sheets.

#### **3.2 Examination**

- .1 Site Verification of Conditions:
  - .1 Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.
  - .2 Examine area to receive architectural metalwork for compliance with installation clearances.

#### **3.3 Installation**

- .1 Install in compliance with manufacturer's product data, including product technical bulletins, application and installation instructions.
- .2 Erect metalwork square, plumb, straight and true.
- .3 Provide suitable means of anchorage as recommended by manufacturer.
- .4 Match exposed fastening devices to attached metalwork.
- .5 Provide components and setting templates to appropriate trades for placement in concrete or masonry.

#### **3.4 Field Quality Control**

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application and protection of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Protect installed product finish surfaces from damage during construction.

#### **3.5 Cleaning and Protection**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 After installation and prior to final acceptance, inspect metalwork for any damage. Repair or replace damaged installed products.
- .3 Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove protective coverings.

- .4 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 12 23 Structural Steel
- .2 Section 05 41 00 Structural Metal Stud Framing
- .3 Section 05 50 00 Metal Fabrications
- .4 Section 06 10 00 Rough Carpentry
- .5 Section 07 05 43 Thermal Clips
- .6 Section 07 21 13 Building Insulation
- .7 Section 07 27 00 Vapour Permeable Air Barriers
- .8 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .9 Section 07 62 00 Sheet Metal Flashing and Trim
- .10 Section 07 92 00 Joint Sealants
- .11 Section 08 11 00 Metal Doors and Frames
- .12 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM B117-19 Standard Practice for Operating Salt Spray (Fog) Apparatus
  - .3 ASTM B209/B209M-21a Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - .4 ASTM B211/B211M-23 Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
  - .5 ASTM B221-21 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - .6 ASTM C297/C297M-16 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
  - .7 ASTM C1166-21 Standard Test Method for Flame Propagation of Dense and Cellular Elastomeric Gaskets and Accessories
  - .8 ASTM D395-18 Standard Test Methods for Rubber Property—Compression Set
  - .9 ASTM D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
  - .10 ASTM D624-00(2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
  - .11 ASTM D746-20 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
  - .12 ASTM D1037-12(2020) Standard Test Methods for Evaluating Properties of Wood Base Fiber and Particle Panel Materials
  - .13 ASTM D1149-18 Standard Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment
  - .14 ASTM D1761-20 Standard Test Methods for Mechanical Fasteners in Wood
  - .15 ASTM D1929-23 Standard Test Method for Determining Ignition Temperature of Plastics
  - .16 ASTM D2240-15(2021) Standard Test Method for Rubber Property—Durometer Hardness

- .17 ASTM D2247-15(2020) Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
- .18 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
- .19 ASTM E119-22 Standard Test Methods for Fire Tests of Burning Construction and Materials
- .20 ASTM E330/E330M-14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- .21 ASTM G155-21 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102-18 Surface Burning Characteristics of Building Materials and Assemblies
  - .2 ULC 114-18 Standard Method of Test for Determination of Non-combustibility in Building Materials
  - .3 ULC 134-13 Standard Method of Fire Test of Exterior Wall Assemblies
  - .4 ULC 135-16 Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter)
- .3 International Organization for Standardization (ISO):
  - .1 ISO 105:2013 Textiles - Tests for Colour Fastness
  - .2 ISO 178:2010 Plastics - Determination of Flexural Properties
  - .3 ISO 527-1:2012 Plastics - Determination of Tensile Properties - Part 1: General Principles
- .4 American Architectural Manufacturers Association (AAMA):
  - .1 AAMA 509-09 Voluntary Test and Classification Method for Drained and Back Ventilated Rain Screen Wall Cladding Systems
- .5 Canadian Construction Materials Centre (CCMC)
  - .1 CCMC 13549-R Technical Guide 07 193 Sheathing Membrane - Breather Type

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit manufacturer's data sheets covering the care and recommended maintenance procedures for incorporation into maintenance manuals.
- .3 Shop Drawings: Submit shop drawings of panel systems, components, façade material, panel layout and accessories to the Consultant for review.
- .4 Samples:
  - .1 Submit for approval 100mm x 150mm sample of proposed colour and texture for Consultant's approval.
  - .2 Submit full size samples of accessories as requested by Consultant.
- .5 Delegated Design Submittals: Furnish complete design calculations and details, fabrication and erection shop drawings and site review for solid phenolic wall panels, bearing the seal of a Professional Engineer registered in the province of Ontario, in accordance with applicable Building Code and Contract Documents.
- .6 Provide maintenance data for Solid Phenolic Wall Panels for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00.

#### 1.5 Quality Assurance

- .1 Qualifications: Provide proof of qualifications when requested by Consultant:

- .1 Manufacturer / Supplier: Obtain materials from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties.
  - .2 Installers: Execute Work of this Section using qualified personnel skilled in installation of work of this Section, having a minimum of five years proven experience of installations similar in material, design, and extent to that indicated for this Project.
  - .2 Pre-Construction Conference: Arrange a site meeting attended by the Contractor, the Subcontractor, the Consultant, materials suppliers, and other relevant personal before commencement of work for this Section.
    - .1 Review methods and procedures related to installation, including manufacturer's written instructions;
    - .2 Examine substrate conditions for compliance with manufacturers installation requirements;
    - .3 Review temporary protection measures required during and after installation.
  - .3 Coordination: Coordinate the Work of this Section with the installation of gypsum sheathing board and air barrier; Sequence work so that installation of solid phenolic panels and support framing coincides with installation of substrate preparation without causing delay to the Work.
  - .4 Mock-ups: Construct mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution in accordance with Section 01 45 00-Quality Control and as follows:
    - .1 Build mock-up of typical wall section, incorporating the panel and finish, support framing and anchoring, breathable membrane, substrate materials, and adjacent materials including flashing, doors, windows and trim.
      - .1 Notify Consultant a minimum seven days prior to mock-up construction.
    - .2 Review and acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Consultant specifically notes such deviations in writing.
    - .3 Once reviewed by Consultant, acceptable mock-up can form a permanent part of the Work and will form the basis for acceptance for the remainder of the project.
  - .5 Remove and replace materials found not acceptable at no cost to Owner or Consultant.
- 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 Delivery: At the time of delivery, visually inspect all materials for damage. Remove damaged materials from the site immediately.
- 1.7 Project Conditions
- .1 Site Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings where materials outlined in this Section are indicated to fit walls and other construction.
  - .2 Establish dimensions and proceed with materials outlined in this Section where field measurements cannot be made without delaying the work; allow for site trimming and fitting.

- .3 Ambient Conditions: Install materials outlined in this Section after completion of work by other Sections is complete, and all penetrations are watertight; to provide adequate dry, clean, level, and plumb surfaces for installation and adhesion.

#### 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 Provide manufacturer's ten year warranty from date of production to maintain the mechanical qualities, water tightness and frost resistance, providing the panels are correctly installed on a ventilated construction according to the installation procedures of the manufacturer.
- .3 Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

### PART 2 PRODUCTS

#### 2.1 Manufacturers

- .1 Basis-of-Design: Materials specified in this Section are based on MEG | Material Exterior Grade" as supplied by ABET USA Inc; N48W37031 E. Wisconsin Ave PO Box 88 Oconomowoc, WI 53066; Tel: 1-800-223-2238; web: <https://abetlaminati.com>

#### 2.2 Performance Requirements

- .1 General Performance: Solid phenolic engineered façade wall panel assemblies shall comply with performance requirements without failure due to defects in manufacture, fabrication, installation, or other defects in construction.
- .2 Delegated Design: Design solid phenolic engineered façade wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- .3 Performance classified based on AAMA 509 test and classification method for drained and back ventilated rain screen wall cladding systems. This method determines the degree of wetting of the water resistive barrier and the available ventilation / drying of a drained and back ventilated cavity.
- .4 Structural Performance: Provide solid phenolic engineered façade wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E330:
  - .1 Wind Loads: To be based on local building code.
  - .2 Deflection Limits: Solid phenolic wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/60 of the span.

- .5 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - .1 Temperature Change (Range): Minus 29 °C to plus 82 °C ambient; 82 °C material surfaces.
- .6 Design to accommodate, by means of control joints, movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to in fills or racking of joints.

## 2.3 Materials

- .1 Solid Phenolic Engineered Facade Panels:
  - .1 Solid phenolic engineered exterior façade panel: rigid homogenous flat panel manufactured utilizing thermosetting resins reinforced with cellulose fibers, produced under high temperature and pressure and with integral properties and fire resistive qualities for use as an exterior façade material. A decorative surface of cellulose fibre integrated on both sides as part of the phenolic process.
  - .2 Panel Core: Fire retardant black core.
  - .3 Mounting Configuration: Prepare panels for exposed rivet installation.
  - .4 Application:
    - .1 Exterior and Interior Facades
  - .5 Thickness:
    - .1 10mm
  - .6 Dimensions:
    - .1 3050mm x 1300mm
  - .7 Surface Burning Characteristics:
    - .1 Meets CAN/ULC S134.
    - .2 Flame Spread: Class A, ASTM E84.
    - .3 Smoke Development: Less than 450, ASTM E84.
    - .4 Ignition Temperature: Greater than 350 degree C above ambient, ASTM D1929.
    - .5 Meets local building code for Potential Heat of Building Materials, NFPA 259.
    - .6 Meets local building codes for Fire Resistant Assemblies, ASTM E119.
    - .7 Meets local building codes for NFPA 268.
  - .8 Physical Characteristics:
    - .1 Modulus of Elasticity: 9000 MPa minimum, ISO 178.
    - .2 Tensile Strength: 60 Mpa minimum, ISO 527-2.
    - .3 Flexural Strength: 80 Mpa minimum, ISO 178.
    - .4 Thermal Conductivity (K value):
      - .1 8mm – 1.666 btu-in/hr-ft<sup>2</sup> – F
      - .2 10mm – 1.566 btu-in/hr-ft<sup>2</sup> – F
    - .5 Solid phenolic engineered façade wall panels shall be capable of meeting conditions of acceptance within limits and under conditions indicated, based on testing according to:
      - .1 ASTM G155 - Accelerated Weathering
      - .2 ASTM E330 - Structural Performance
      - .3 ASTM C297 - Bond Strength
      - .4 ASTM D1037 - Flexural Strength
      - .5 ASTM B117 - Salt Spray
      - .6 ASTM D2247 - Water Resistance
      - .7 ASTM D1761 - Fastener Pull-through
      - .8 ASTM 518 - Thermal Transmission

- .9 Finish:
  - .1 Colour Stability: The decorative surface shall comply with classification, 3- 5 measured with the grey scale according to ISO 105:A02.
  - .2 Panels with integrated colour both sides, complete with UV-protective film applied on both sides.
  - .3 Finish: Matte
  - .4 Colour:
    - .1 Colour Type 1: 871 Grigio Scuro
    - .2 Colour Type 2: 1824 Blu Amorgos
- .10 Basis of Design Product:
  - .1 Products: Abet USA Inc. EF (exposed) system components made in the USA. Includes J channels, Hat channels and colour matched SFS D12 fasteners
- .2 Substructure:
  - .1 Vertical Girts:
    - .1 Vertical girts supporting panels shall be minimum 1.2 mm thick, galvanized zinc-coated steel to ASTM A653 with Grade A coating Z275. Painted black.
    - .1 Shop Primers: Provide primers that are compatible with paint systems specified in Section 09 91 13.
    - .2 Preformed galvanized metal sheet, 1.2 mm thick, minimum base steel nominal thickness, notched or perforated for drainage.
    - .3 Girt locations as determined and approved by structural engineer, to align with modular panel fasteners spaced based on manufacturer's panel load data.
    - .4 Front fastened systems:
      - .1 Girts behind panels to be vertical to allow vertical ventilation.
      - .2 Preformed black galvanized steel girts to be used at inside and outside corners to ensure corners are straight and closed visually and used at intermediary panel locations and where panels come together.
    - .5 Cavity behind panel: Minimum 25mm of unrestricted space.
    - .6 gap between panels: Minimum of 8mm to allow for expansion and contraction.
    - .7 EPDM Rubber Separation Strip: Designed and supplied by Engineered Assemblies to be installed between the panel and the vertical girt to allow movement between panel and support system, meeting the following:
      - .1 Shore "A" Hardness: ASTM D2240.
      - .2 Compression Set, 22h at 100°C: ASTM D395.
      - .3 Ozone Resistance, 100 mPa 100h @ 40°C 20%
      - .4 Elongation: ASTM D1149.
      - .5 Tensile Strength: ASTM D412.
      - .6 Elongation at Rupture: ASTM D412.
      - .7 Tear Strength: ASTM D624.
      - .8 Brittleness Temperature at -40°C: ASTM D746.
      - .9 Flame Propagation, Option II; ASTM C1166.
      - .10 Substructure to account for control joints of building to ensure a girt is not connected across the control joint.
      - .11 Install panels across one set of vertical girts to ensure that expansion and contraction of the substrate is controlled within framing members.
  - .2 Thermal Clips: as specified in Section 07 05 43
    - .1 Clip Depth: As indicated on Contract Drawings.
  - .3 Vertical Clip Spacing:
    - .1 As required by Engineered Design.



- .3 Fasteners:
  - .1 Colour matched stainless steel rivets, as per Engineered Assemblies recommendations. No dissimilar materials allowed, in selection of fasteners.
  - .2 All holes are pre-drilled at same diameter.
  - .3 Fixed holes include a stainless steel grommet on the rivet stem.
  - .4 Floating holes have rivet only.
- .4 Bird and Vent Screen: Continuous bird and vent screen located at top and bottom of panel system, where opening is minimum 25 mm wide, with minimum 50% free air flow, manufactured by Engineered Assemblies from perforated aluminum, painted black.
- .5 Flashings: Prefinished steel as specified in Section 07 62 00.
  - .1 Flashings at edges, top and bottom of panel system as per Contract Drawings.
- .6 Vapour Permeable Air Barrier Membrane: As specified in Section 07 27 00.
- .7 Insulation: As specified in Section 07 21 13.
- .8 Sheathing Board: As specified in Section 06 16 43.

### **PART 3 EXECUTION**

#### **3.1 Examination**

- .1 Verification of Conditions:
  - .1 Examine substrates to receive work and surrounding adjacent surfaces for conditions affecting installation. Coordinate with related sections to ensure proper dimensions are maintained.
  - .2 Verify site dimensions by accurate field measurements so that work will be accurately designed, fabricated and fitted to the structure.
  - .3 All penetrations through the façade for the work of other trades shall be fitted with a watertight sleeve. Verify flashings are in place, sealed with waterproof membrane and covered with building membranes.
  - .4 Maintain sheathing membrane integrity.
- .2 Notify Contractor in writing of any conditions that are not acceptable.
- .3 Proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

#### **3.2 Installation**

- .1 Erect panel system in accordance with manufacturer's instructions and reviewed shop drawings.
- .2 Erect panels in straight lines, true, level and plumb. Maintain dimensions required by manufacturer for minimum distances from edge for holes and penetrations.
- .3 Space at top and bottom of each wall minimum 25 mm, as per manufacturer's details.
- .4 Installation to allow for thermal expansion of the panel. Provide a minimum of 10 mm space between each panel on all four sides, allowing for expansion.

- .5 Holes are pre-drilled as per manufacturer's written instructions, in locations recommended by panel manufacturer. Provide pre-drilled holes a minimum distance between 20 mm and 38 mm from all edges of panel.
- .6 Size of rivets as per manufacturer's written instructions. No other types of fasteners are approved. All exposed rivets shall be coated to match panel finish, as provided by the panel manufacturer.
- .7 Install panels with joints centered over framing. Install all rivets straight to the panel and in a consistent manner.
- .8 Do not install using damaged, warped or misaligned material.
- .9 Where panels fit into accessories, allow room for expansion.
- .10 Finished installation shall be properly secured, free of rattles, distortions, waviness, and protrusions, damaged or chipped components.
- .11 Cut and flash wall penetrations with metal flashing.
- .12 Install breathable sheathing membrane in accordance to manufacturer's instructions. No penetrations are to be left in installed membrane.

### 3.3 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Progress Cleaning: Leave work area clean at the end of each workday, ensuring safe movement of passing pedestrians.
- .3 Final Cleaning: At completion of installation, clean all surfaces so they are free of foreign matter using cleaners recommended by material manufacturer.
- .4 Restore panels and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Consultant, remove and replace damaged panels with new at no additional cost to the Owner.
- .5 Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 12 23 Structural Steel
- .2 Section 05 41 00 Structural Metal Stud Framing
- .3 Section 05 50 00 Metal Fabrications
- .4 Section 06 10 00 Rough Carpentry
- .5 Section 07 05 43 Thermal Clips
- .6 Section 07 21 13 Building Insulation
- .7 Section 07 27 13 Modified Bituminous Sheet Air Barriers.
- .8 Section 07 62 00 Sheet Metal Flashing and Trim
- .9 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 Metal Cladding: Exterior Corrugated Wall Panel:
  - .1 Vicwest 7/8" Corrugated
  - .2 C.N.T. 0.76 mm.
  - .3 Zinc Coating Designation Z275.
- .3 Z Bars and Sub-framing Systems:
  - .1 Zinc coated steel minimum 1.22 mm base steel thickness.
  - .2 Notched Z bar subgirts at liner panels.
  - .3 Depth as indicated or required by engineering design.
- .4 Sub-framing Thermal Clips: as specified in Section 07 05 43.
- .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 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 Apply a continuous bead of caulking on faces of all supports and at top, bottom and ends of cladding to provide a complete seal.
- .8 On lapped joints, caulk continuously between laps to provide a complete water seal.
- .9 Bed all flashings, closures and corner pieces in sealant to provide a weather tight installation.
- .10 Caulk all openings, joints and around perimeter to provide a weathertight installation.
- .11 Complete all air seals between metal cladding and other systems or materials as detailed. Air barrier membranes are specified under Section 07 27 13.

- .12 Provide expansion joints required by shop drawings complete with metal closures, flashings, trim and caulking, to provide a weather tight installation.
- .13 Provide all matching trim, fasteners and accessories to make building weathertight.
- .14 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 07 21 13 Building Insulation
- .2 Section 07 26 00 Vapour Retarders
- .3 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .4 Section 07 46 13 Preformed Metal Siding
- .5 Section 07 62 00 Sheet Metal Flashing and Trim
- .6 Section 07 92 00 Joint Sealants

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM B221-21 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - .2 ASTM E330/E330M – 14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- .2 American Architectural Manufacturer's Association (AAMA)
  - .1 AAMA 2603-98 Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coating on Aluminum Extrusions and Panels
  - .2 AAMA 2604-98 Voluntary Specifications for High Performance Organic Coatings on Aluminum Extrusions and Panels
  - .3 AAMA 2605-98 Voluntary Specification for High performance Organic Coatings on Aluminum Extrusions and Panels

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- .3 Shop Drawings:
  - .1 Indicate dimensions, panel profile and layout, spans, joints, construction details, methods of anchorage, method and sequence of installation.
  - .2 Indicate compliance with design requirements including analysis data signed and sealed by a professional structural engineer licensed in the Province where the Project is located, and responsible for their preparation.
  - .3 Show plans, elevations, camber/bow/squareness tolerance, erection tolerance, drainage path from within the rainscreen cavity, wall membrane detailing and all interfaces to adjacent systems.
- .4 Samples: Submit two samples of siding, 300 x 300 mm in size illustrating finish, colour, sheen, and texture. Submit rail attachment system and cladding (soffit) support clip.
- .5 Qualification Data: For qualified fabricator and Installer.
- .6 Installation Data: Specified trade association and manufacturer's special installation



requirements.

- .7 Manufacturer's Certificate: Certify that system meets or exceeds performance requirements and that products have been manufactured to ISO 9000 series requirements.
- .8 Product Test Reports: Comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of metal soffit panel system.
- .9 Professional Structural Engineer's Letters of Assurance:
  - .1 Provide letters signed by the professional structural engineer used to perform inspections certifying that the formed metal wall panel system has been designed, fabricated and installed in accordance with the structural performance requirements of this section and of the applicable codes, including verification that:
  - .2 Specified products have been used.
  - .3 Designs and installations as tested, have been installed on the Project.
  - .4 Loads and movement requirements have been achieved.

#### 1.5 System Description

- .1 Metal soffit panels: horizontal preformed and prefinished metal soffit panels comprising of linear panels, supported by premanufactured system track designed to receive metal panels incorporating manufactures recommended attachment system supported by thermally broken clips, thermal insulation, and associated accessories applied over exterior sheathed and Engineered metal stud wall framing system and cast-in-place concrete; site assembled.

#### 1.6 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience by the manufacturer.

#### 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 panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- .4 Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- .5 Prevent contact with materials which may cause discolouration or staining.
- .6 Materials shall not be exposed to wetting or damage.
- .7 Remove and replace units that have become stained, watermarked, damaged or cracked.

#### 1.8 Administrative Requirements

- .1 Coordination:

- .1 Coordinate with other work having a direct bearing on work of this section.
- .2 Coordinate the Work for installation of vapour retarder, air barrier seals, insulation and cladding attachment clips.
- .3 Coordinate the Work with installation of windows, louvres, and components or materials.

#### 1.9 Performance Requirements

- .1 Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with NBC and measured in accordance with ASTM E330.
- .2 Panel anchorage system to be designed to provide removal of panels without disturbing adjacent panels and be totally concealed.
- .3 Maximum Allowable Deflection of Panel: 1/180 of span.
- .4 Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- .5 Design soffit system as secure yet "free floating" to accommodate expansion and contraction.
- .6 System to accommodate differential slab deflection, inter-storey drift, thermal movement and construction tolerances.
- .7 Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- .8 Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials.
- .9 Vapour Retarder: Provide continuity of vapour retarder at building enclosure elements in conjunction with vapour retarders and air barriers specified in Section 07 26 00 and 07 27 13.
- .10 Not permitted: Oil canning, warping, or buckling of panel faces under full design loads.

#### 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 fifteen 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 Include degradation of panel finish including colour fading caused by exposure to weather, water tightness, and integrity of seals.

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## PART 2 PRODUCTS

### 2.1 Metal Soffit Panels

- .1 Extruded Aluminum Soffits: fabricated to ASTM B221/B221M with bonded film finish is extruded aluminum with integrated venting system.
- .2 Basis of Design: 150 mm V Groove, Longboard Soffit panels fabricated by Longboard Architectural Products. <https://longboardproducts.com/contact-us>

### 2.2 Suspension System

- .1 Suspension System: Formed and fabricated into a one directional pattern with carriers placed at spacing indicated in engineered shop drawings. Suspended building structure and coordinated with work of Division 5 section engineered metal stud framing.
- .2 Soffit Carrier: Universal hat-shaped, 0.97 mm roll-formed aluminum section with hook-shaped tabs spaced to receive ceiling panels at 50 mm on-center and 21.4 mm apart. Support holes spaced 101 mm on-center.
- .3 Finish: Manufactures standard factory-applied black enamel.

### 2.3 Components

- .1 Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitred to required angles. Mitred internal corners to be back braced with pre-coated sheet stock to maintain continuity of profile.
- .2 Trim, Closure Pieces, Caps, Flashings, Fascia, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

### 2.4 Accessories

- .1 Panel End Caps: Formed, stamped, or milled end caps with matching finish.
- .2 Panel Splice: Formed aluminum insert designed to snap-fit between ends of two ceiling panels. Finish: To match panel.
- .3 Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; colour as selected.
- .4 Vent Strips: 38 mm perforated vent strip.
- .5 Sealants:
  - .1 Exposed: One part 100% silicone; non-staining, non-skinning and non-sagging; ultraviolet and ozone-resistant; colour as selected by Consultant.
  - .2 Concealed: Tape or compound, non-skinning, non-drying, butyl rubber; as recommended by Manufacturer.
- .6 Fasteners: Manufacturer's standard concealed type to suit application; with soft neoprene washers, stainless steel; fastener cap same colour as exposed panel. Exposed fasteners same finish as panel system.

- .7 Anchors: stainless steel.
- .8 Isolation Coating: Bituminous paint, asphalt base.
- .9 Provide manufactures recommended, j-track, inside Corner, outside Corner, Starter Strip.

## 2.5 Finishes

- .1 To AAMA 2603 AAMA 2604 and AAMA 2605 Performance Standard. Solid Colour finishes polyurethane powder coat w:
  - .1 Finish system: 'Decoral by Decoral Systems USA Corp.
- .2 Colour: "Onyx Black" textured matt solid.

## 2.6 Fabrication

- .1 Form sections true to shape, accurate in size, square, and free from distortion or defects.
- .2 All panels to be formed to specified dimensions with tolerances to accommodate expansion and contraction between panels and structure.
- .3 Form pieces in longest practicable lengths.
- .4 Fabricate corners in one continuous piece.
- .5 Fabricate flashings, trims and closures offsite to be ready for installation.

## PART 3 EXECUTION

### 3.1 Examination

- .1 Verify existing conditions before starting work.
- .2 Verify that building framing members are ready to receive panel system.
- .3 Allow the Consultant to review the air/vapour barrier membrane prior to covering with insulation and soffit panel.

### 3.2 Installation – Support System

- .1 Attach support system components at spacing's required to achieve performance requirements.
- .2 Install thermally isolated Supports clip over Air barrier membrane substrate in accordance with manufacture recommendations. Fasten through to building structure.
- .3 Miscellaneous Framing: Install subgirts, base angles, sills, and other miscellaneous wall panel support members and anchorages according to metal wall panel manufacturer's instructions.
- .4 Protect metal surfaces in contact with dissimilar metals, and cementitious materials with isolation coating.

### 3.3 Installation

- .1 Suspension system, suspend soffit from engineered sub-structure and as follows:
  - .1 Install supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications, and applicable codes and standards.
  - .2 Space suspension and carrier system as indicated on approved shop drawings.
  - .3 Adjust suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- .2 Install metal soffit panels in accordance with manufacturer's recommendations and reviewed engineered stamped shop drawings.
- .3 Install edge moldings and trim of type indicated at perimeter to conceal edges of metal pan. Method of edge trim attachment and design of edge trims to be as indicated in approved shop drawings.
- .4 Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval, or unless detailed otherwise.
- .5 Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated. Install directionally patterned or textured panels in directions indicated on approved shop drawings.

#### 3.4 Erection Tolerances

- .1 Maximum Offset from True Alignment between Adjacent Members Butting or In Line: 1.6 mm.
- .2 Maximum Variation from Plane: 3 mm in 3000 mm, but not more than 6mm in total plane.

#### 3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean installed work.
- .3 Remove site cuttings from finish surfaces.
- .4 Protect work from damage during construction. Make good damaged panels.
- .5 Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

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 10 Steel Deck
- .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 13 Modified Bituminous Sheet Air Barriers
- .6 Section 07 62 00 Sheet Metal Flashing and Trim
- .7 Section 07 71 00 Roof Specialties and Accessories
- .8 Section 07 92 00 Joint Sealants

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C1177/C1177M-17 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
  - .2 ASTM C1289-23 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
  - .3 ASTM C1396/C1396M-17 Standard Specification for Gypsum Board
  - .4 ASTM D312/D312M-16a(2023) Standard Specification for Asphalt Used in Roofing
  - .5 ASTM D5147/D5147M-18 Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
  - .6 ASTM D6162/D6162M-21 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
  - .7 ASTM D6163/D6163M-21 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
  - .8 ASTM E108-20a Standard Test Methods for Fire Tests of Roof Coverings
- .2 CSA Group (CSA)
  - .1 CSA A123.3-05 (R2015) Asphalt Saturated Organic Roofing Felt.
  - .2 CSA A123.4-04 (R2018) Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems
  - .3 CSA A123.21:20 Standard Test Method for The Dynamic Wind Uplift Resistance of Membrane-Roofing Systems.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102-18 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 ULC 107-10 Methods of Fire Tests of Roof Coverings
  - .3 ULC 704-11 Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced
- .4 Canadian General Services Board (CGSB)
  - .1 CAN/CGSB-37.5, Cutback Asphalt Plastic Cement.
  - .2 CGSB 37-GP-15M, Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
  - .3 CGSB 37-GP-19M, Cement, Plastic, Cutback Tar.
  - .4 CAN/CGSB-37.29, Rubber-Asphalt Sealing Compound.

- .5 CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- .6 CAN/CGSB 51.33-M, Vapour Barrier, Sheet, Excluding Polyethylene, for Use in Building Construction.
- .5 Canadian Roofing Contractors Association (CRCA) Metric Specification Manual.

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Provide manufacturer's specification data sheets for each product.
- .3 Shop Drawings
  - .1 Submit shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets and saddles.
  - .2 Submit engineered shop drawing showing layout of mechanical fasteners to achieve specified uplift ratings.
- .4 Certification
  - .1 Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
  - .2 Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.
  - .3 Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.

#### 1.5 Quality Assurance

- .1 The roofing and sheet metal 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 shall be acceptable to the roofing product manufacturer.
- .2 Roofing shall be executed under the full time supervision of a competent foreman and shall be carried out by applicators fully experienced in this type of work.
- .3 Hold a pre-installation meeting prior to start of roofing works, with the Consultant, the Owner, the General Contractor, the independent inspection and testing agency inspector and the manufacturers roofing inspector. The purpose of this meeting is to review particular installation conditions. Prepare and distribute a report for this meeting.
- .4 Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108 for external fire and meet local building codes.
- .5 Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM I-90.

**1.6 Manufacturer's Design Responsibility**

- .1 Provide total roofing assembly confirmation of conformity to "ULC Class A" design criteria. Confirmation to include project specific Uniform Wind Uplift Load Capacity (required for each roof section). Installed roof system shall withstand negative (uplift) design wind loading pressures complying with site specific conditions and all local buildings codes. It is the responsibility of the manufacturer to provide the contractor with a detailed report endorsing the attachment methods proposed.
- .2 The roofing contractor must receive written authorization from the roofing inspector to proceed.

**1.7 Manufacturer's Inspections**

- .1 Report progress and quality of the work as observed. Progress reports must be published and distributed to all project stakeholders weekly.
- .2 Provide periodic (minimum of 2 days per week) roofing installation inspections: Inspections must include; photographic documentation of work in-progress and written statements of compliance with details/shop drawings.
- .3 Report to the Owner and Consultant in writing any failure or refusal of the contractor to correct unacceptable practices called to the contractor's attention.
- .4 Prior to commencement of roof membrane application, the manufacturer's roofing inspector shall review the installation of the insulation substrate including all tapered insulation to confirm that the finished roof system will have no flat or negatively sloped areas which will affect the performance of the roof or will adversely impact or void the roofing warranty.
- .5 Confirm after project completion that the manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

**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 Provide and maintain adequate facilities or access to facilities to take receipt of and store roofing materials so that the materials are ready to be built in.
- .4 Deliver and store materials undamaged in original unopened containers with manufacturer's label and seals intact. Materials not identified shall be removed off the site. Containers shall be stored upright and roofing membrane shall be stored on end to prevent flattening. All materials shall be protected from moisture at all times. No material shall be placed in direct contact with the earth.
- .5 Store adhesives and emulsion-based waterproofing mastics at a minimum +5 °C. Store adhesives and solvent-based mastics at sufficiently high temperatures to ensure ease of application.
- .6 All materials must be stored in a dry area and protected from water and direct sunlight. Damaged materials shall be replaced at roofing Contractor's expense.



- .7 Storage of insulation and roofing materials, etc. on the roof is prohibited.

#### 1.9 Protection

- .1 Provide adequate protection of materials and work of this trade from damage by weather, traffic and other causes. Schedule roofing installations in such a manner that traffic over the completed portions of roofing will be avoided. 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.

#### 1.10 Environmental Requirements

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

#### 1.11 Waste Management and Disposal

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

#### 1.12 Warranty

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of 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 ten (10) 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 ten years from the date of Substantial Performance.

### PART 2 PRODUCTS

#### 2.1 Manufacturer

- .1 When a particular trade name or performance standard is specified it shall be indicative of a standard required.
- .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.

#### 2.2 Systems

- .1 Provide insulated Modified SBS/SIS Bituminous roof systems as indicated complete with all materials and accessories required for a complete installation.

- .2 All roof areas shall have a minimum slope of 2% to drains. Provide tapered insulation where indicated and where required to provide the necessary slope. Flat roof areas or negatively sloped areas which retain standing water are not permitted.
- .3 Where indicated, cutting and patching of existing roofs shall match new roof construction

### 2.3 Materials

- .1 Gypsum Board Substrate Board: To ASTM C1396/C1396M, Type M/R with water resistant core, 12.7 mm thick. Joint tape as recommended by manufacturer.
- .2 Vapour Retardant: Sheet air/vapour barrier membrane shall be an SBS modified bitumen, self-adhering sheet membrane complete with a blue engineered thermoplastic film. Membrane shall have the following physical properties:
  - .1 ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies,
  - .2 Air leakage: <0.0001 CFM/ft<sup>2</sup> @0.76 kPa to ASTM E2178 and ASTM E283 and have no increased air leakage when subjected to a sustained wind load of 0.5 kPa for 1 hour and gust wind load pressure of 3.0 kPa for 10 seconds when tested at 0.76 kPa to ASTM E331,
  - .3 Vapour permeance: 0.03 perms to ASTM E96 (Desiccant Method),
  - .4 Vapour permeance: 0.08 perms to ASTM E96 (Wet Cup Method),
  - .5 Membrane Thickness: 1 mm,
  - .6 Low temperature flexibility: -30 ° C to CGSB 37-GP-56M,
  - .7 Elongation: 200% to ASTM D412-modified,
  - .8 Meets CAN/CGSB-51-33 Type I Water Vapor Permeance requirements
  - .9 Product: Blueskin SA self-adhesive vapour barrier membrane by Henry Co. or equivalent.
  - .10 Primer: as recommended by the vapour retardant manufacturer and suitable for the specified substrates.
- .3 Insulation: to ASTM C1289 and ULC 704 Rigid, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
  - .1 Thickness 102 mm.
  - .2 LTTR-Value: Minimum RSI 24.
  - .3 1220 x 1220 boards.
  - .4 Compliances: UL, WH or FM listed under Roofing Systems Federal Specification HH-I-1972, Class 1.
- .4 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: 76 mm
    - .2 1219 x 1219 boards.
    - .3 Thermal resistance to ASTM C518 (25 mm):
      - .1 RSI 0.72 m2K/W at - 4 °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.

- .5 Tapered Insulation: Tapered Insulation: compatible with roofing system and as recommended by roof insulation manufacturer, slope as indicated on the drawings but not less than 2%, starting thickness of 0 mm, factory tapered.
- .6 Fasteners: Corrosion resistant screw and plate fastener as recommended by roof membrane manufacturer and tested with specified insulation.
  - .1 Factory Mutual Tested and Approved with 76 mm coated disc for I-90 rating, length required to penetrate metal deck 25 mm.
- .7 Protection board: 13 mm thick high density fibreboard. Board size 1220 mm x 1524 mm.
- .8 Asphalt: ASTM D312, Type III Steep Asphalt.
- .9 Fiber Cant and Tapered Edge Strips: torchable, performed rigid insulation units of sizes/shapes indicated. Matching insulation board or of perlite or organic fiberboard.
- .10 SBS Modified Bitumen Base Sheet and Base Sheet Flashing: 120 mil thickness modified bitumen membrane with fiberglass reinforcement sandwiched between SBS rubber in a high penetrating index asphalt mixture, minimum tensile strength 17.5 kN/m, minimum tear strength 480 N and low temperature flexibility -28 ° C.
- .11 SBS Modified Bitumen Granulated Cap Sheet and Cap Sheet Flashing: 145 mil minimum thickness modified bitumen membrane sheet consisting of two laminated layers of polyester and fiberglass scrim reinforcement sandwiched by SBS/SIS in a high penetration index asphalt mixture, minimum tensile strength 150 kN/m, minimum tear strength 7000 N, and minimum low temperature flexibility -40 ° C. Membrane performance requirements, CSA A123.15 Type C Grade 1, and ASTM D6162, Type III. Sanded bottom surface and white granulated top surface.
- .12 Mastics: Asphalt mastic conforming ASTM D312/D312M-15.
- .13 Bituminous Materials:
  - .1 Asphalt Primer: Unfilled asphalt conforming to CGSB 37-GP-9Ma.
  - .2 Cutback Asphalt Plastic Cement: Fibrated cut back type plastic asphalt compound.
  - .3 Rubberized Asphalt Sealing Compound.
  - .4 Bituminous Paint: To CGSB 1-GP-108M.
- .14 Walkways: SBS modified asphalt cap sheet membrane of a different colour from field membrane cap sheet.
- .15 Pitch Pockets: Lexsuco Spun Aluminum Mastic Pans.
- .16 Pourable Sealer: 2 part polyurethane sealer intended for use by the manufacturer to seal pitch pans and other penetrations.
- .17 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.
- .18 Roof Drains: As specified on mechanical drawings.
- .19 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 Manufacturer's Instructions**

- .1 Perform all work in accordance with membrane manufacturer's material installation printed instructions for specified system installation and as specified herein.

#### **3.2 Examination**

- .1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to installation.
- .2 Verify roof penetrations and drains are present in quantity required. Verify roof drains are securely clamped in place.
- .3 Verify wood blocking is securely anchored to deck and nailers match thickness of roof insulation.
- .4 Examine substrate for compliance of conditions that affect installation and performance of roof system.

#### **3.3 Workmanship**

- .1 Workmanship shall be of the highest quality. Use only competent mechanics and execute work in accordance with drawings and specifications.
- .2 Regard the manufacturer's printed recommendations and specifications as the minimum requirement for materials, methods and workmanship not otherwise specified.
- .3 Maintain roofing equipment in good working order.
- .4 Unsuitable or damaged materials shall immediately be removed from the site.
- .5 Materials shall not be applied during inclement weather. Do not apply roofing over wet decks, or where frost or snow is present.
- .6 Install roofing elements on clean, dry surfaces.
- .7 Use torch types recommended by roof membrane manufacturer.
- .8 Install temporary barrier around existing roofing to remain to prevent excess traffic.

#### **3.4 Substrate Board**

- .1 Install gypsum board substrate over metal deck using adhesive as recommended by manufacturer. Tape all joints.

#### **3.5 Vapour Retarder**

- .1 Install vapour retarder membrane over substrate and seal all laps, edges and penetrations in accordance with the manufacturer's installation instructions.

- .2 Apply in straight lines, free from wrinkles, tears or open laps. Minimum 150 mm end laps and 50 mm side laps tightly sealed with a continuous mopping of adhesive. At perimeters, vertical walls and curbs, etc. apply a 300 mm wide strip of vapour retardant and seal to air barrier membrane.
- .3 No more vapour retardant shall be applied in any one working day than can be covered with insulation and properly "dried in".
- .4 Vapour retardant shall not be installed to bridge across expansion joints or similar devices.

### 3.6 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 with all joints staggered. Insulation shall be laid with the longest side parallel to the flutes unless the manufacturer stipulates otherwise. Lay board in tight contact to prevent gaps and resulting loss of thermal insulation value. Cut boards to fit neatly around projections through roof.
- .2 Attachment of Base Layer with Mechanical Fasteners (Metal Deck):
  - .1 Base layer of insulation board shall be fully attached to the metal deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for ULC Class A classification.
  - .2 Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than 0.4 m<sup>2</sup>.
  - .3 Spacing pattern of fasteners shall be as per manufacturer's recommendations and reviewed shop drawings, to meet the specified requirements. Placement of any fastener from edge of insulation board shall be a minimum of 76 mm, and a maximum of 152 mm.
  - .4 Minimum penetration into deck shall be as recommended by the fastener manufacturer but not less than 25mm.
  - .5 Install secondary layer to primary layer in full mopping of hot asphalt in accordance with manufacturer's instructions
- .3 Attachment of Base Layer with Adhesive (Concrete Deck):
  - .1 Install insulation to vapour retarder in full mopping of asphalt in accordance with manufacturer's instructions.
  - .2 Install secondary layer to primary layer in full mopping of asphalt in accordance with manufacturer's instructions.
- .4 At roof drains and scupper drains, reduce the insulation thickness by 13 mm for a distance of 600 mm from the centre of the drain.
- .5 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 extend 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.
- .6 Install tapered insulation where indicated and in accordance with the reviewed shop drawings.
- .7 Insulation shall not be installed to bridge across control joints.

### 3.7 Cant Strip

- .1 Install cant strip at junction with vertical surfaces in accordance with manufacturer's instructions.

### 3.8 Protection Board

- .1 Stagger coverboard joints with insulation joints.
- .2 Apply adhesive in continuous ribbons of type III asphalt or insulation adhesive as recommended by the manufacturer, placed 13 mm wide and no more than 225 mm apart to top surface of insulation. Use a 34 kg roller to press the coverboard for full and continuous contact to insulation.
- .3 Lay coverboard with joints offset minimum 300 mm from underlying layer.
- .4 At drains ensure sump depth is kept to a minimum of 13 mm below finished roof surface.

### 3.9 Base Sheet

- .1 Unroll base sheet onto dry substrate and allow to relax before re-rolling. Base sheet is to be applied to properly prepared substrate at a rate of no less than 11.3 kg of type III asphalt per 9 m<sup>2</sup>. The roll is to push a puddle of asphalt ensuring that there is adequate "asphalt bleed-out" at all side and end laps.
- .2 Base sheet shall have side laps of 90 mm and end laps of 150 mm.
- .3 Ensure the membrane is properly adhered, without air pockets, wrinkles, fishmouths, or tears.
- .4 Base sheet is to extend to the top of the cant at all vertical to horizontal transitions.

### 3.10 Base Sheet Stripping (Flashing)

- .1 Primer coating must be dry before application of the base sheet stripping.
- .2 Base sheet stripping to be laid in strips one metre wide to the vertical surfaces, extending on to the flat surface of the roof a minimum of 155 mm. Side laps to be 90 mm and staggered a minimum of 200 mm with the laps of the base sheet.
- .3 Base sheet stripping to be torch-welded directly on its support from bottom to top. Torch-welding must soften the underside of the base sheet without overheating, resulting in a uniform adhesion over the entire surface. When allowed by the support, the base sheet top edge must be nailed on 300 mm centres.

### 3.11 Cap Sheet

- .1 Cap sheet membrane must be unrolled and allowed to relax. Start from the low point of the roof. Care must be taken to ensure alignment of the first roll (parallel with the edge of the roof).
- .2 Cap sheet shall be fully adhered using type III asphalt on to the base sheet membrane at a rate of no less than 25 lbs. of asphalt per 100 square feet. The roll is to push a puddle of asphalt ensuring that there is adequate "asphalt bleed-out" at all side and end laps.
- .3 Base sheet and cap sheet seams shall be offset a minimum of 300 mm.
- .4 Cap sheet must have side laps of 90 mm and end laps 150 mm.
- .5 After installation of the cap sheet, inspect all lap seams on the cap sheet for full adhesion and evidence of bleed out.

- .6 Cap sheet is to extend to the top of the cant at all vertical to horizontal transitions.

### 3.12 Cap Sheet Stripping (Flashing)

- .1 Cap sheet stripping to be laid in strips one metre wide. Side laps to be 90 mm and to be staggered a minimum of 200 mm from cap sheet laps.
- .2 Lay out a straight line on the cap sheet surface, parallel to roof edge, 150 mm inside the roof from the base of the cant strip.
- .3 Using a torch and round-nosed roofing trowel, embed the surface granules into the heated and soft bitumen, from the chalk line to the edge of the cap sheet.
- .4 Cap sheet stripping shall be torch-welded directly on its base sheet, proceeding from bottom to top. Torching shall soften the two membranes to ensure a uniform weld.
- .5 Cap sheet stripping shall be applied to extend down the outside face of exterior edge, across top of parapet, down interior vertical surface and on to flat roof a distance of 230 mm, to the extent of area of embedded granules. Cut roll into required lengths and use width of roll down length of roof, maintaining specified 90 mm side laps.

### 3.13 End Laps

- .1 Only pre-finished end laps will be accepted.

### 3.14 Metal Flashing

- .1 Metal flashings shall be completed in accordance with Section 07 62 00.

### 3.15 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.

### 3.16 Mechanical and Electrical Equipment

- .1 All electrical conduits and gas lines must be sufficiently supported as directed by the Consultant. Use treated wood blocking supported on concrete pavers resting on PVC pedestals.
- .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.

3.17 Testing and Inspection

- .1 Inspect completed membrane and flashings for punctures, tears and discontinuous seams. Apply additional layer of membrane over punctures and tears, extending minimum 50 mm beyond damaged area in all directions.
- .2 Independent Inspection and testing shall be performed as specified under Section 01 45 00 – Quality Control and shall be paid from the Cash Allowances. Provide necessary facilities and cooperate with designated inspection and testing agency.

3.18 Cleaning

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

End of Section



## **PART 1 GENERAL**

### **1.1 General**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Sections**

- .1 Section 04 27 00 Multiple Wythe Unit Masonry
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 31 13 Asphalt Shingles
- .4 Section 07 42 00 Perforated Metal Wall Panels
- .5 Section 07 42 30 Solid Phenolic Wall Panels
- .6 Section 07 46 13 Preformed Metal Siding
- .7 Section 07 46 16.16 Preformed Metal Soffits
- .8 Section 07 52 00 Modified Bituminous Roofing
- .9 Section 07 71 00 Roof Specialties and Accessories
- .10 Section 07 92 00 Joint Sealants

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM D523-14(2018) Standard Test Method for Specular Gloss
- .2 CSA Group (CSA)
  - .1 CSA B111 Wire Nails, Spikes and Staples
  - .2 CSA S136-16 North American Specification for the Design of Cold-Formed Steel Structural Members
- .3 Canadian General Services Board (CGSB)
  - .1 CAN/CGSB 1.108-M Bituminous Solvent Type Paint
  - .2 CAN/CGSB-37.5 Cutback Asphalt Plastic Cement
  - .3 CAN/CGSB-51.32 Sheathing, Membrane, Breather Type.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
  - .1 CSSBI Standard Practice for Sheet Steel Cladding.
  - .2 CSSBI 20M-91 Sheet Steel Cladding for Architectural and Industrial Applications.
  - .3 CSSBI B16-94 Prefinished Sheet Steel for Building Construction.
- .5 Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual.

### **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 ± 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 five 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 52 00 Modified Bituminous Roofing
- .5 Section 07 62 00 Sheet Metal Flashing and Trim
- .6 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 Mechanical Vent Flashings: As recommended by roof system manufacture and to suit mechanical installations. Prefabricated.

## 2.2 Roof Access Hatch

- .1 760 mm wide x 915 mm long, single leaf roof access hatch.
- .2 Acceptable Products:
  - .1 Lexsuco R-100/SS/SB/460 mm Ladder Access Roof Hatch.
  - .2 Bilco Type S-20 Roof Access Hatch.
- .3 Curb and door shall be 1.994 mm primer coated G-90 galvanized steel, neatly welded and ground at corners. Doors shall have 25 mm thick glass fibre insulation with a minimum density of 19 kg/m<sup>2</sup> and a door liner of 1.311 mm primer coated galvanized steel. Reinforce doors to support a minimum live load of 1.9 kPa. Curb shall be 460 mm high with 25 mm thick high density rigid fibre insulation secured to the curb exterior. Curb shall have 90 mm wide pre-punched flanges.
- .4 Roof hatch shall be completely assembled with heavy duty pintle hinges, torsion bar operated doors, latching mechanisms, interior padlock hasps and neoprene draft seals. Door shall have automatic hold open arm complete with rubber grip handle.
- .5 All hardware shall be stainless steel.
- .6 Hatches shall be factory finished with grey primer.
- .7 Provide roof hatch with 35 mm diameter safety bar coated with 20 mil. PVC colour coated roof safety green. Safety bar shall be mounted so as to not impede operation of door.
- .8 Fabrication:
  - .1 Fabricate components free of twists, bends, or visual distortion and insulated. Weld corners and joints.
  - .2 Ensure continuity of gasket seals.
  - .3 Design and fabricate hatch assemblies to collect and lead off accumulated condensation.
  - .4 Pre-drill flanges for anchoring to deck.
  - .5 Assemble hatch components in accordance with reviewed shop drawings and deliver pre-fabricated units to site complete with anchoring hardware, safety bar and accessories.
  - .6 Locate safety bar on side indicated or approved by the Consultant.

## PART 3 EXECUTION

### 3.1 Roof Hatch

- .1 Install in accordance with manufacturers printed instructions.
- .2 Secure all hatches to deck with bolts to meet the manufacturer's specifications.
- .3 Shim and level all curbs to suit roof slopes.
- .4 Erect hatch level and plumb and in proper alignment.
- .5 Ensure continuity of building envelope air barrier and vapour retarder systems.
- .6 Adjust and seal assembly with provision for expansion and contraction of components.
- .7 Install safety bar, securely anchored to curb with tamper proof screws or bolts.

**3.2     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.

**3.3     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 03 48 16 Precast Concrete Splash Blocks
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 31 13 Asphalt Shingles
- .4 Section 07 92 00 Joint Sealants

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM D2369-20 Standard Test Method for Volatile Content of Coatings
  - .2 ASTM D2832-92(2016) Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings
- .2 CSA Group (CSA)
  - .1 CSA B111-1974 (R2003) Wire Nails, Spikes and Staples
- .3 American Society of Mechanical Engineers (ASME)
  - .1 ASME B18.6.4-1998 (R2005) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws - Inch
- .4 Canadian General Services Board (CGSB):
  - .1 CAN/CGSB 93.2-M91 Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use.
  - .2 CAN/CGSB 93.5-92 Installation of Metal Residential Siding, Soffits and Fascia.

### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit duplicate copies of manufacturer's standard colour range for selection by the Consultant.
- .3 Submit duplicate 600 mm long samples of gutters and downspouts, in material, colour and profile specified.

### **1.5 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.

### **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.



- .2 Submit manufacturers standard 40 year limited warranty for all pre-finished aluminum materials.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- .1 Aluminum metal shall be AA3000 alloy or equivalent, minimum ultimate strength of 172 MPa and minimum yield strength of 151 MPa.
- .2 Finish to be thermoset polymer cured at 232° C to total thickness of 20-22 microns. Colour to be selected by the Consultant from full range of manufacturer's custom colours.
- .3 Gutter and Downspout: Manufacturer's standard profile with lock seam. Provide all elbows angles and fittings. Form gutters of continuous sheeting in maximum possible lengths. Minimum 0.68 mm base thickness.
- .4 Accessories: Exposed trim, closures, cap pieces, corners, etc. preformed, of same material and colour as adjoining materials.
- .5 Fasteners: Nails: to CSA B111, hot dipped galvanized coated steel. Screws: to ASME B18.6.4. All fasteners shall be concealed.
- .6 Sealants: as specified in Section 07 92 00. Colour matched to prefinished materials.

## **PART 3 EXECUTION**

### **3.1 Installation**

- .1 Maintain joints true to line, tight fitting.
- .2 Attach components in a manner not restricting thermal movement.
- .3 Install gutters and downspouts. Slope gutters to drain and fasten to fascia at maximum 1220 mm centres. Install downspouts plumb and true, tight to building with all elbows and fittings as necessary. Install end caps. Anchor downspouts to wall with colour matched clips at 1220 mm c/c maximum. Turn base of downspout diagonally away from wall minimum 400 mm.
- .4 Caulk junctions with adjoining work with colour matched sealant as specified in Section 07 92 00.

### **3.2 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 04 22 00 Concrete Unit Masonry
- .2 Section 05 31 00 Steel Deck
- .3 Section 07 92 00 Joint Sealants
- .4 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-23d Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM E119-20 Standard Test Methods for Fire Tests of Building Construction and Materials
  - .3 ASTM E136-19a Standard Test Method for Behavior of Material in a Vertical Tube Furnace at 750° C
  - .4 ASTM E814-13a (2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
  - .5 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems
  - .6 ASTM E2307-20 Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 ULC 101-2014 Standard Methods of Fire Endurance Tests of Building Construction and Materials
  - .2 ULC 102.2-2018 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
  - .3 ULC 115-2018 Standard Method of Fire Tests of Firestop Systems
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 252 Standard Methods of Fire Test and Door Assemblies
- .4 South Coast Air Quality Management District (SCAQMD) California State
  - .1 SCAQMD Rule 1168-03: Adhesives and Sealants.
- .5 Ontario Building Code

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings: Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.
- .4 Samples: Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports: in accordance with ULC 101 for fire endurance and ULC 102 for surface burning

characteristics.

- .2 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

#### 1.5 Definitions

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

#### 1.6 Quality Assurance

- .1 One installer shall install all firestopping on the project. Each trade shall not firestop their own service penetrations. Installer shall be certified by fire stopping manufacturer.
- .2 Qualifications:
  - .1 Qualified Installer: specializing in fire stopping installations with 5 years documented experience approved and trained by manufacturer.
- .3 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Consultant to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.
- .4 Site Meetings:
  - .1 As part of Manufacturer's Services described in 3.5- Field Quality Control, schedule site visits, to review Work, at stages listed.
  - .2 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
  - .3 Twice during progress of Work at 25% and 60% complete.
  - .4 Upon completion of Work, after cleaning is carried out.
  - .5 Single Source Responsibility: Obtain through-penetration fire-stop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- .5 Field-Constructed Mockup: Prior to installing fire-stopping, erect mockups for each different through-penetration fire-stop system indicated to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.
  - .1 Locate mockups on site in locations indicated or, if not indicated, as directed by Consultant.

- .2 Notify Consultant one week in advance of the dates and times when mockups will be erected.
- .3 Obtain Consultant's acceptance of mockups before start of final unit of Work.
- .4 Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.
- .5 Accepted mockups in an undisturbed condition at time of Substantial Performance may become part of completed unit of Work.

1.7 Sustainable Requirements

- .1 Materials shall be Low VOC type conforming to SCAQMD Rule 1168-03. Maximum VOC level of firestopping materials shall be 250 g/l.

1.8 Project Conditions

- .1 Environmental Conditions: Do not install fire-stopping when ambient or substrate temperatures are outside limits permitted by fire-stopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- .2 Ventilation: Ventilate fire-stopping per fire-stopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.9 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .4 Storage and Protection:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

1.10 Waste Management and Disposal

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

**PART 2 PRODUCTS**

2.1 Materials

- .1 All fire stopping shall consist of ULC listed firestop system.
- .2 Applications: Provide fire-stopping systems composed of materials specified in this Section that comply with system performance and other requirements.
- .3 General: Provide fire-stopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
- .4 All firestopping material shall be:
  - .1 From one manufacturer;
  - .2 Intumescent where an appropriate system exists.

- .5 Fire stopping and smoke seal systems: ULC listed in accordance with ULC 115.
  - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of ULC 115 and not to exceed opening sizes for which they are intended.
- .6 Service penetration assemblies: ULC listed systems tested to ULC 115.
- .7 Service penetration fire stop components: ULC listed and certified by test laboratory to ULC 115.
- .8 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .9 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .10 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .11 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .12 Water: potable, clean and free from injurious amounts of deleterious substances.
- .13 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .14 F-Rated Through-Penetration Fire-stop Systems: Provide through-penetration fire-stop systems with F ratings indicated, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
- .15 T-Rated Through-Penetration Fire-stop Systems: Provide through-penetration fire-stop systems with T ratings, in addition to F ratings, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupy-able floor areas. T-rated assemblies are required where the following conditions exist:
  - .1 Where fire-stop systems protect penetrations located outside of wall cavities.
  - .2 Where fire-stop systems protect penetrations located outside fire-resistive shaft enclosures.
  - .3 Where fire-stop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
  - .4 Where fire-stop systems protect penetrating items larger than a 100 mm diameter nominal pipe or 10,000 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 22 00 Concrete Unit Masonry
- .3 Section 04 27 00 Multiple Wythe Unit Masonry
- .4 Section 06 10 00 Rough Carpentry
- .5 Section 06 20 00 Finish Carpentry
- .6 Section 06 40 00 Architectural Woodwork
- .7 Section 07 21 13 Building Insulation
- .8 Section 07 42 00 Perforated Metal Wall Panels
- .9 Section 07 42 30 Solid Phenolic Wall Panels
- .10 Section 07 46 13 Preformed Metal Siding
- .11 Section 07 46 16.16 Preformed Metal Soffits
- .12 Section 07 52 00 Modified Bituminous Roofing
- .13 Section 07 62 00 Sheet Metal Flashing and Trim
- .14 Section 07 84 00 Firestopping
- .15 Section 08 11 00 Metal Doors and Frames
- .16 Section 08 50 00 Aluminum Doors, Windows and Screens
- .17 Section 08 80 05 Glazing

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C510-16(2022) Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
  - .2 ASTM C661-15(2022) Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
  - .3 ASTM C679-15(2022) Standard Test Method for Tack-Free Time of Elastomeric Sealants
  - .4 ASTM C719-22 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
  - .5 ASTM C793-05(2017) Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
  - .6 ASTM C794-18(2022) Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
  - .7 ASTM C834-17 Standard Specification for Latex Sealants
  - .8 ASTM C919-22 Standard Practice for Use of Sealants in Acoustical Applications
  - .9 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants
  - .10 ASTM C1087-23 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
  - .11 ASTM C1183/C1183M-13(2018) Standard Test Method for Extrusion Rate of Elastomeric Sealants
  - .12 ASTM C1193-16 Standard Guide for Use of Joint Sealants
  - .13 ASTM C1246-17(2022) Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants After Cure
  - .14 ASTM C1247-20 Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids
  - .15 ASTM C1248-22 Standard Test Method for Staining of Porous Substrate by Joint Sealants

- .16 ASTM C1311-22 Standard Specification for Solvent Release Sealants
- .17 ASTM C1330-23 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
- .18 ASTM D412-16(2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- .19 ASTM D2203-01(2023) Standard Test Method for Staining from Sealants
- .20 ASTM E84-23d Standard Test Method for Surface Burning Characteristics of Building Materials
- .21 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- .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 Compatibility: Use ASTM C1087 to determine materials forming joints and adjacent materials do not adversely affect sealant materials and do not affect sealant colour.
- .5 Stain Testing: Use ASTM C510, ASTM C1248, or ASTM D2203 to verify non-staining characteristics of proposed sealants on specified substrates.

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 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](http://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.

## 2.4 Urethane Joint Sealants

- .1 UJS#1: Single-Component, Nonsag, Moisture-Cure, Polyurethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, Use NT; Greenguard certified.
  - .1 Basis of Design Product: Tremco Dymonic 100.
  - .2 Volatile Organic Compound (VOC) Content: 40 g/L maximum.
  - .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
  - .4 Tensile Strength ASTM D412: 350 to 450 psi
  - .5 Percent Elongation ASTM D412: 800 to 900%
  - .6 Modulus at 100% ASTM D412: 75 to 85 psi
  - .7 Tear Strength ASTM D412: 65 to 75 psi
  - .8 Smoke Development ASTM E84: 5
  - .9 Colour: As selected by Consultant from manufacturer's standard line.
- .2 UJS#2: Single-Component, Nonsag, Moisture-Cure, Polyurethane Hybrid Joint Sealant: ASTM C920, Type S, Grade NS, Class 35, Use NT; Greenguard certified.
  - .1 Basis of Design Product: Tremco Dymonic FC.
  - .2 Extrusion Rate ASTM C1183: 93.1 mL/min
  - .3 Weight Loss ASTM C1246: Pass
  - .4 Tack Free Time ASTM C679: 3 to 4 hours.
  - .5 Volatile Organic Compound (VOC) Content: 10 g/L maximum.
  - .6 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
  - .7 Colour: As selected by Consultant from manufacturer's standard line.
- .3 UJS#3: Immersible, Single-Component, Pourable, Traffic Grade Polyurethane Joint Sealant: ASTM C920, Type S, Grade P, Class 50, Use T and I.
  - .1 Basis of Design Product: Tremco Vulkem 45 SSL.
  - .2 Volatile Organic Compound (VOC) Content: 110 g/L maximum.
  - .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
  - .4 Colour: As selected by Consultant from manufacturer's standard line.

## 2.5 Latex Joint Sealants

- .1 LJS#1: Latex Joint Sealant: Siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
  - .1 Basis of Design Product: Tremco Tremflex 834.
  - .2 Volatile Organic Compound (VOC) Content: 35 g/L maximum.
  - .3 Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
  - .4 Colour: White, paintable.

## 2.6 Solvent-Release-Curing 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 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 Exterior construction joints in cast-in-place concrete.
  - .1 UJS#1: Single-component non-sag urethane sealant.
- .3 Exterior movement joints in brick masonry.
  - .1 SJS#1: Single-component neutral-curing non-staining silicone sealant.
- .4 Exterior concealed watertight joints in cladding systems.
  - .1 SJS#1: Single-component neutral-curing silicone sealant.
- .5 Exterior joints between different materials listed above.
  - .1 SJS#1: Single-component neutral-curing non-staining silicone sealant.
- .6 Exterior perimeter joints at frames of doors, windows, storefront frames and louvers.
  - .1 SJS#1: Single-component neutral-curing non-staining silicone sealant.
- .7 Exterior joints within aluminum storefront framing and window systems: Refer to Section 08 50 00
- .8 All other exterior non-traffic joints.
  - .1 SJS#1, SJS# 2: Single-component neutral-curing non-staining silicone sealant.
  - .2 UJS#1, UJS#2: Single-component non-sag urethane sealant.
- .9 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: Single-component non-sag urethane sealant.
- .2 Interior movement joints in interior unit masonry.
  - .1 UJS#1: Single-component non-sag urethane sealant.

- .3 Interior perimeter joints of exterior aluminum frames.
  - .1 UJS#1: Single-component non-sag urethane sealant.
- .4 Interior perimeter joints of interior frames.
  - .1 LJS#1: Siliconized acrylic latex
- .5 Interior sanitary joints between plumbing 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# 3: Single-component pourable urethane sealant.
- .7 Interior non-moving joints between interior painted surfaces and adjacent materials.
  - .1 LJS#1: Siliconized acrylic latex
  - .2 Joint-Sealant Colour: Paintable.
- .8 Interior concealed sealants at thresholds and sills.
  - .1 BJS#1: Butyl-rubber-based joint sealant.
- .9 Interior exposed and non-exposed acoustical applications.
  - .1 AJS#1: Acoustical joint sealant.

### 3.7 Cleaning

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

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 22 00 Concrete Unit Masonry
- .2 Section 04 27 00 Multiple Wythe Unit Masonry
- .3 Section 06 10 00 Rough Carpentry
- .4 Section 07 92 00 Joint Sealants
- .5 Section 08 14 16 Flush Wood Doors
- .6 Section 08 71 10 Door Hardware
- .7 Section 08 80 05 Glazing
- .8 Section 09 21 16 Gypsum Board
- .9 Section 09 22 16 Non-Structural Metal Framing
- .10 Section 09 91 13 Exterior Painting
- .11 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM C177-19e1 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
  - .3 ASTM C518-21 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .4 ASTM C553-13(2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  - .5 ASTM C591-22 Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
  - .6 ASTM C1289-22a Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
  - .7 ASTM D6386-22 Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
  - .8 ASTM D7396-14(2020) Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting
  - .9 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .10 ASTM E330/E330M-14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99 Ready-Mixed Organic Zinc-Rich Coating.
- .3 CSA Group (CSA)
  - .1 CSA-G40.20-13/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-18 Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000

- .2 CSDMA Recommended Specifications for Commercial Steel Doors and Frames, 2006.
- .3 CSDMA Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.
- .5 Underwriters Laboratories Canada (ULC)
  - .1 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 80-22 Standard for Fire Doors and Other Opening Protectives.
  - .2 NFPA 252-2017 Fire Tests of Door Assemblies.
- .8 American National Standards Institute (ANSI)
  - .1 ANSI 250.4-2018 Test Procedure and Acceptance Criteria for — Physical Endurance for Steel Doors, Frames and Frame Anchors
  - .2 ANSI 250.10-2011 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Provide shop drawings
  - .1 Indicate each type of door, frame, steel, construction and core.
  - .2 Indicate fire ratings.
  - .3 Indicate material thicknesses, mortises, reinforcements, anchorages, location of exposed fasteners, openings, arrangement of hardware, and finishes.
  - .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

#### 1.5 System Description

- .1 Design exterior frame assembly to accommodate expansion and contraction when subjected to minimum and maximum surface temperature of -35° C to 35° C.

#### 1.6 Defining Opening Sizes

- .1 Width - Widths of openings shall be measured from inside to inside of frame jamb rabbets. (Referred to as "frame rabbet width" or "nominal door width")
- .2 Height - Heights of openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame. (Referred to as "frame rabbet height" or "nominal door height")
- .3 Door Sizes - Doors shall be sized so as to fit the above openings and allow a 3 mm nominal clearance at jambs and head of frame. A clearance of 13 mm maximum shall be allowed between the bottom of the door and the finished floor (exclusive of floor coverings).
- .4 Tolerances - Doors and frame product shall be manufactured and installed in accordance with

CSDMA's, "Recommended Dimensional Standards for Commercial Steel Doors and Frames".

#### 1.7 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

#### 1.8 Requirements of Regulatory Agencies

- .1 Steel fire rated doors and frames: labeled and installed by an organization accredited by Standards Council of Canada in conformance with ULC 104 or NFPA 252 for ratings specified or indicated.
- .2 Provide fire labeled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with ULC 104 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

#### 1.9 Testing and Performance

- .1 Fire labeled products shall be provided for those openings requiring fire protection ratings as scheduled on the drawings. Products shall be tested in strict conformance with ULC 104 and listed by Underwriters Laboratory of Canada Ltd. or Warnock Hersey under an active Factory Inspection Program.
- .2 Product quality shall meet the standards established by the Canadian Steel Door Manufacturer's Association.
- .3 Door construction shall meet acceptance criteria of ANSI A250.10 and shall be certified as meeting Level A (1,000,000 cycles) and Twist Test Acceptance Criteria deflection not to exceed 6.4 mm/13.6 kg force, total deflection at 136.1 kg force not to exceed 64 mm and permanent deflection not to exceed 3.0 mm when tested in strict conformance with ANSI A250.4. Test shall be conducted by an independent nationally recognized accredited laboratory.
- .4 Core materials for insulated doors shall attain a thermal resistance rating of RSI 2.17 when tested in accordance with ASTM C177 or ASTM C518.

#### 1.10 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 Acceptable Materials
  - .1 Steel doors and frame product manufactured in accordance with this Specification by CSDMA members, are eligible for use on this project.
- .2 Steel: Commercial grade steel to ASTM A653, CS, Type B, Coating Designation ZF75 (A25) minimum. Minimum steel thicknesses shall be in accordance with Appendix 1 of the CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products unless noted otherwise.

- .3 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653, ZF75.
- .4 Door Core Materials
  - .1 Interior Doors: Structural small cell, 24.5mm maximum kraft paper 'honeycomb'. Weight 36.3 kg per ream minimum, density: 16.5 kg/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).
- .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.

## 2.3 Accessories

- .1 Glazing Stops: Minimum 0.9 mm base thickness sheet steel with wipe zinc finish to ASTM A525. Fasteners to be #6 x 32 mm cadmium plated oval head scrulox self-drilling type screws. Tamper proof screws.
- .2 Exterior top caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Door silencers: single stud rubber/neoprene type.
- .4 Fiberglass: to ULC 702, loose batt type, minimum density of 24 kg/m<sup>3</sup>.
- .5 Metallic paste filler: to manufacturer's standard.
- .6 Sealant: As specified in Section 07 92 00.

## 2.4 Fabrication - Frame Products

- .1 General
  - .1 Fabricate frames in accordance with CSDMA specifications.
  - .2 Fabricate frames to profiles and maximum face sizes as indicated.
  - .3 Exterior frame product shall be 1.60 mm welded type construction.
  - .4 Interior frame product shall be 1.60 mm. Interior frames, 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.
- .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 as indicated. Such products shall be listed for conformance with ULC 104. All fire-rated doors shall bear the label of and be listed by a nationally recognized testing agency having a factory inspection service. Labeling shall be in accordance with NFPA 80, the listing authority's policies and label materials, and shall identify the manufacturer. Fire-rated doors shall be constructed as listed for labeling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.
- .10 Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.
- .11 Manufacturer's nameplates on doors are not permitted.

2.6 Glazing Stops

- .1 Glazing stops shall be accurately fitted, butted at corners with removable stops located on push side of door.
- .2 Provide tamper proof screws on all doors and screens.

2.7 Finishes

- .1 Doors and frames shall wipe coat zinc, ready for painting.

**PART 3 EXECUTION**

3.1 Manufacturer's Instructions

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 Installation

- .1 Install doors and frames to CSDMA Installation Guide, NAAMM-HMMA 840, Installation Guide for Commercial Steel Doors and Frames.
- .2 Fire-rated door and frame product shall be installed in accordance with NFPA-80.
- .3 Coordinate with Section 08 71 10 for preparation and installation of automatic door operators.
- .4 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.
- .5 Caulk perimeter of frames. Refer to Section 07 92 00 – Joint Sealants.

3.3 Finish Repairs

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.4 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 06 20 00 Finish Carpentry
- .2 Section 08 11 00 Metal Doors and Frames
- .3 Section 08 71 10 Door Hardware
- .4 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D1761-20 Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials
  - .2 ASTM D5456-21e1 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 E413-22 Classification for Rating Sound Insulation
  - .5 ASTM E1332-22 Standard Classification for Rating Outdoor-Indoor Sound Attenuation
  - .6 ASTM E2235-04(2020) Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods
- .2 CSA Group (CSA)
  - .1 CSA O115-M1982 (R2001) Hardwood and Decorative Plywood.
  - .2 CSA O132.2 Series-90 (R1998) Wood Flush Doors
- .3 Canadian General Services Board (CGSB)
  - .1 CAN/CGSB-71.19 Adhesive, Contact, Sprayable
  - .2 CAN/CGSB-71.20 Adhesive, Contact, Brushable
- .4 American National Standards Institute (ANSI)
  - .1 ANSI A208.1 Standard for Particleboard.
- .5 Underwriters Laboratories Canada (ULC)
  - .1 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-21 Interior Architectural Wood Flush Doors
- .9 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1113-06 Architectural Coatings.
  - .2 SCAQMD Rule 1168-03 Adhesives and Sealants Applications.
- .10 Green Seal Environmental Standards
  - .1 Standard GS-11-97 Architectural Paints.

### 1.4 Submittals

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



- .2 Submit manufacturer's printed product literature, specifications and data sheets for door materials and adhesives.
- .3 Submit shop drawings and door schedules.
  - .1 Indicate door types and cutouts for [lights] [and] [louvres], sizes, core construction, transom panel construction and cutouts.
- .4 Submit samples.
  - .1 Submit one 300 x 300 mm corner sample of each type wood door.
  - .2 Show door construction, core, glazing detail and faces.
- .5 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

1.5 Quality Assurance

- .1 The "Quality Standards" of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), 1991 Edition, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification.
- .2 Where modifications to the AWMAC Quality Standards contained within the Manual are included in this project specification, then such modifications shall govern in case of conflict.
- .3 Any reference to Custom or Premium grade in this specification shall be as defined in the AWMAC Quality Standards.
- .4 Any item not given a specific quality grade shall be Custom grade as defined in the AWMAC Quality Standards.
- .5 References in this specification to part and item numbers mean those parts and items contained within the AWMAC Quality Standards Manual.
- .6 Regulatory Requirements: Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.

1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 16 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .3 Wood door delivery, storage and handling shall be in accordance with Part 6, Item 3, of the AWMAC Quality Standards.
- .4 Do not deliver wood doors until the building and storage areas are sufficiently dry so that the wood doors will not be damaged by excessive changes in moisture content.
- .5 Delivered materials which are damaged in any way or do not comply with these specifications will be rejected by the Consultant and shall be removed from the job site and replaced with acceptable materials.

1.7 Waste Management and Disposal

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

1.8 Warranty

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of two years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

PART 2 PRODUCTS

2.1 Manufacturers

- .1 Acceptable Manufacturers: Member in good standing of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) with minimum 5 years of production experience similar to this project, whose qualifications indicate ability to comply with requirements of this Section.

2.2 Materials

- .1 All door materials to conform to CSA O132.2.
- .2 Doors shall be constructed of solid laminated wood core with 3.0 mm thick Grade A face, book matched, flat cut maple, 50 mm stiles and 76 mm top and bottom rails. Stiles to be No. 3 maple edge.
- .3 Core shall consist of low density wood blocks, random lengths with staggered joints. All cores shall be drum sanded both sides. Particleboard cores are not acceptable.
- .4 Door thickness: as indicated.
- .5 Adhesive: To CSA 0132.2, Type II, water resistant, for interior use.

2.3 Fire Rated Wood Doors

- .1 Wood doors: tested in accordance with ULC 104 and NFPA 252 to achieve rating as scheduled.

PART 3 EXECUTION

3.1 Fabrication

- .1 Fabricate doors in accordance with CSA 0132.2.
- .2 Provide No. 3 vertical edge strips to match face veneer.
- .3 Bevel vertical edges of single acting doors 3.0 mm on lock side and 1.6 mm on hinge side.
- .4 Prepare doors for hardware.
- .5 Fabricate doors with reinforced openings for louvres, door grilles and glazed lites. Provide manufacturer's standard trim and stops.

- .6 Sand and prepare doors to receive clear urethane finish as indicated on the Room Finish and Door Schedules.

### 3.2 Installation

- .1 Unwrap and protect doors in accordance with CSA-O132.2 Series, Appendix A.
- .2 Install doors and hardware in accordance with manufacturer's printed instructions and CSA-O132.2 Series, Appendix A.
- .3 Install labelled fire rated doors to NFPA 80.
- .4 Install glazing in accordance with Section 08 80 05.
- .5 Adjust hardware for correct function.
- .6 Doors to receive clear urethane finish as specified in Section 09 91 23.

### 3.3 Final Adjustment

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly

### 3.4 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 50 00 Metal Fabrications
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 08 71 10 Finishing Hardware

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM B221-21 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- .3 Product Data: Provide information on grille construction, components, materials, and finishes.
- .4 Operation and Maintenance Data: Provide operation and maintenance data for coiling doors and grilles regarding adjustment, operator maintenance, and troubleshooting for incorporation into operation and maintenance manual specified under Section 01 78 00.

### 1.5 Quality Assurance

- .1 Manufacturer Qualifications: Minimum of three years experience in the fabrication and installation of Coiling Doors and Grilles.
- .2 Installer Qualifications: Authorized representative of the manufacturer.

### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials in labeled protective packages. Store and handle in compliance with manufacturer's 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 Manufacturers

- .1 Contract Documents are based on products by Dynamic Closures Corporation.  
(www.dynamicclosures.com) Telephone: 1-800-663-4599; Fax: 800-205-6665 E-mail:  
CustomerService@DynamicClosures.com
- .2 Equivalent products by the following manufacturers are acceptable subject to compliance with specifications and performance requirements.
  - .1 Amstel Manufacturing Inc.
  - .2 Kinnear
  - .3 Richards Wilcox of Canada Ltd.

2.2 Materials

- .1 Aluminum Extrusions: ASTM B221, 6063-T5 or T6 alloy and temper.

2.3 Components

- .1 Lift Ready Portcullis Curtain:
  - .1 8mm diameter extruded aluminum rods spaced 45mm on center vertically by 3 x 16 x 108mm aluminum links horizontally spaced 229mm on center and covered by 13mm aluminum spacer tubes on every other rod.
  - .2 Pattern: Straight.
- .2 Bottom Bar: Tubular aluminum extrusion with bottom astragal
- .3 Hood: Minimum 26 gage aluminum.
- .4 Guides: Extruded aluminum, 76mm x 38mm with shoulders for curtain retention, fitted with vinyl stripping both sides of curtain.
- .5 Counterbalance: Aluminum barrel with enclosed helical torsion spring with grease sealed ball bearings or self-lubricating graphite bearings for rotating members, sized to grille weight with maximum deflection of 0.8mm per 305mm of width.
- .6 Bracket Plates: 10mm thick by 381mm front-loading off-set steel plate. Finish: grey metallic powder-coat paint.
- .7 Operation:
  - .1 Hand crank from coil side of curtain.
- .8 Lock:
  - .1 Interior: keyed cylinder.
  - .2 Locking for more than one Grille/Closure keyed alike.

- .3 Key type: manufacturers standard cylinder acceptable.
- .9 Steel tube: 76 x 76 x 3mm x 7315mm unpainted.
- .10 Aluminum double/single wall angle 76 x 64mm x required length clear anodized.
- .11 Aluminum telescoping tube 76 x 64mm mill finish w/integral steel U channel.
- .12 Finishes: Clear anodized is standard finish on curtain, bottom bar and guides.
- .1 Curtain/BB/Guides: Anodized, colour selected by Consultant.

### **PART 3 EXECUTION**

#### **3.1 Examination**

- .1 Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- .2 Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- .3 Commencement of work by installer is acceptance of substrate

#### **3.2 Installation**

- .1 Install grille assembly in accordance with manufacturer's instructions.
- .2 Follow reviewed shop drawings.
- .3 Fit and align grille assembly including hardware, level and plumb, to provide smooth operation.

#### **3.3 Field Quality Control**

- .1 Site Test: Test grilles for normal operation and automatic closing.

#### **3.4 Adjusting**

- .1 Test Operation of door and adjust to provide smooth and proper operation.

#### **3.5 Demonstration**

- .1 Demonstrate proper operation to Owner's Representative.
- .2 Instruct Owner's Representative in maintenance procedures.

#### **3.6 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean exposed surfaces using manufacturers recommended cleaners.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 04 27 00 Multiple Wythe Unit Masonry
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 06 20 00 Finish Carpentry
- .4 Section 07 21 13 Building Insulation
- .5 Section 07 26 00 Vapour Retarders
- .6 Section 07 27 15 Modified Bituminous Sheet Air Barriers.
- .7 Section 07 92 00 Joint Sealants.
- .8 Section 08 71 10 Finishing Hardware
- .9 Section 08 80 05 Glazing
- .10 Section 08 87 13 Solar Control Films
- .11 Section 08 87 20 Decorative Window Films
- .12 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM B221-21 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - .2 ASTM B456-17(2022) Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
  - .3 ASTM B633-23 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
  - .4 ASTM E330/E330M-14(2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - .5 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
  - .6 ASTM E1105-15(2023) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
  - .7 ASTM E1186-22 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.
- .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/I.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)
  - .1 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 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 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.
  - .3 Submit point to point wiring diagrams for electric strikes.
  - .4 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

### 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 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 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 Clear anodized finish.
  - .5 Rails and stiles to be 90 mm ± wide, bottom rail 165 mm ± high. Frame 45 mm thick.
  - .6 Door members to be 3.0 mm nominal thickness. Glazing mouldings to be lock in type with glazing gaskets.
  - .7 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 Provide the following hardware for aluminum doors, as appropriate to location and configuration:
  - .1 Exterior Doors:
    - .1 Continuous heavy duty hinge with stainless steel ball bearings and clear epoxy finish.

- .2 Adams Rite 1850A deadlock with interior thumbturn.
  - .1 Cylinder provided under Section 08 71 10.
- .3 Style CO-12 Architects Classic Pull with clear anodized finish.
- .4 Kawneer 1786 Rim Exit Device.
  - .1 Cylinder provided under Section 08 71 10.
- .5 Concealed heavy duty closer 2030 LCN.
- .6 Kawneer controller locking system for paired doors.
- .7 Extruded aluminum threshold for barrier free access, 102 mm wide x 12 mm high.  
Thermally broken.
- .8 Weather-seal to head and jambs. Aluminum with sponge neoprene a minimum of 6.0 mm thick, width to suit frame. Type TW2000.
- .9 Meeting stiles: adjustable astragal utilizing wool pile with polymeric fin.
- .10 Door sweeps to be Sealeze EB 395 EPDM blade gasket x door width.
- .11 Automatic Door Operator: as specified in Section 08 71 00
- .12 Electric Strike.
- .13 Card Readers (by security Contractor)

.2 Interior Doors:

- .1 Continuous heavy duty hinge with stainless steel ball bearings and clear epoxy finish
- .2 Style CO-12 Architects Classic Pull with finish to match door.
- .3 Style CP-II Architects Classic Single Acting Push Bar
- .4 Kawneer 1786 Rim Exit Device.
  - .1 Cylinder provided under Section 08 71 10
- .5 Concealed heavy duty closer 2030 LCN.
- .6 Door Holder: Glynn Johnson. Door hold open device shall be fully compatible with door closer and shall be as recommended by manufacturer, for installation without requiring modification to doors or frames.
- .7 Automatic Door Operator: as specified in Section 08 71 00
- .8 Electric Strike.
- .9 Card Readers (by security Contractor)

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 Factory Finishing:
  - .1 Permanodic Finish: AA-M10C21A44 Architectural Class I (0.7 mils minimum) Colour Anodic Coating Colour # 29 Black.
  - .2 Clear Anodic Finish: AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating not less than 18 micrometre thick.
  - .3 Interior and exterior window frames will be different colours.

## PART 3 - EXECUTION

### 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.
- .9 Coordinate installation of Automatic Door Operators with Section 08 71 10.

### 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: 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.

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## PART 2 PRODUCTS

### 2.1 Materials

- .1 All hardware shall be supplied as specified in the Finishing Hardware Schedule.
- .2 All finishes shall be as indicated in the Finishing Hardware Schedule by international codes.
- .3 All door handles shall be lever type meeting requirements of the referenced accessibility standards and the Ontario Building Code.
- .4 Power Door Operators and controls shall be CSA approved and shall meet the requirements of the Ontario Building Code and the Accessibility for Ontarians with Disabilities Act (AODA).

### 2.2 Fastenings

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

### 2.3 Electrified Devices

- .1 Electrified exit devices shall conform to all traditional exit device standards as specified above. All power requirements for exit devices used must utilize a continuous circuit electric hinge for clean design and no visible means of interrupting power to device.
- .2 All exit devices with electric latch retraction shall provide for a remote means of unlocking for momentary or maintained periods of time.
- .3 Exit devices with electrified trim shall be fail-secure unless otherwise specified.

### 2.4 Keying

- .1 Keying: All permanent cylinders to be grandmaster-keyed as directed by the Owner. The factory shall key all locks and cylinders and maintain keying records. The factory shall establish a System Information Document (SID) to designate primary system administrators and require a separate letter of authorization for all future shipments of keyed products.
- .2 Remove all construction cores and install all permanent cores. Unless otherwise directed by the Owner.
- .3 Construction master/change keys are to be delivered by the contractor directly to The Owner.

- .4 Ship all permanent cylinders and keys separately. Identify door number and keyset symbol on each envelope for direct factory delivery to the owner.

### **PART 3 EXECUTION**

#### **3.1 Manufacturer's Instructions**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

#### **3.2 Examination**

- .1 Before installing any hardware, carefully check all architectural drawings of the work requiring hardware, verify door swings, door and frame materials and operating conditions, and assure that all hardware will fit the work to which it is to be attached.
- .2 Check all shop drawings and frame and door lists affecting hardware type and installation, and certify to the correctness thereof, or advise the hardware supplier and Consultant in writing of required revisions.

#### **3.3 Templates**

- .1 Check the hardware schedule, drawings and specifications, and furnish promptly to the applicable trades any patterns, templates, template information and manufacturer's literature required for the proper preparation for and application of hardware, in ample time to facilitate the progress of the work.

#### **3.4 Installation**

- .1 Installation of hardware shall be in accordance with ANSI A115.1G, manufacturer's templates and instructions.
- .2 Install each item of mechanical and electromechanical hardware and access control equipment to comply with the manufacturer's written instructions and according to specifications. All items to be installed with fasteners identified by manufacturer's installation instructions unless otherwise noted.
- .3 Mounting Heights: Install door hardware at heights indicated in the following applicable publications unless; specifically indicated or required by local governing regulations, requirements to match for special templates, necessary coordination with door elevations, and or to ensure consistency with pairs of doors.
  - .1 DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames"
  - .2 DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors"
  - .3 ANSI/ICC A117.1 Accessibility Guidelines for Buildings and Facilities
  - .4 NWWDA
  - .5 AODA

- .4 Power door operator products and accessories are required to be installed by an AAADM certified technician as approved by the manufacturer. Adjust for proper opening and closing operation after final balancing of HVAC system.
- .5 Coordinate installation of electric door strikes, keypad locks, card readers, washroom duress systems, and other electronic door control and security devices with Electrical contractor including supply and installation of wiring and all terminations.
- .6 All hardware shall be installed by carpenters, skilled in the application of architectural hardware and satisfactory to the hardware supplier. Refer to Section 06 20 00 - Finish Carpentry. Instruction sheets, details and templates shall be read and understood before installation.
- .7 Install all materials as listed in the Finishing Hardware Schedule on the doors and frames listed. Interchanging of hardware will not be allowed.
- .8 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .9 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .10 Remove construction cores when directed by Owner's Representative.
- .11 After installation, templates, installation instructions and details shall be put in a file and turned over to the Owner, when building is Substantially Performed.

### 3.5 Field Quality Control

- .1 Conduct periodic inspections to ensure that door frames are installed plumb, level and square with verification by installer prior to installation of doors and door hardware.
- .2 Hardware supplier to attend site meetings as required to ensure proper execution of the guidelines set forth herein.
- .3 Hardware supplier will perform final field inspection of installed door hardware after final adjustment of all products and will document and report any deficiencies or omissions for correction and written acceptance by the Contractor.

### 3.6 Adjusting

- .1 Adjust door hardware, operators, closers and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to provide tight fit at contact points with frames.

### 3.7 Demonstration

- .1 Instruct Owner's maintenance personnel in the proper adjustment, operation and maintenance of mechanical and electromechanical door hardware, electronic devices and maintenance of finishes.

3.8 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
- .4 Remove protective material from hardware items where present.

End of Section



**Knell's**  
DOOR & HARDWARE

2090 Shirley Drive Kitchener Ontario N2B 0A3

Phone: (519) 578.1000 Toll Free: (800) 265.8959 Fax: (519) 578.3262

## Schedule of Finish Hardware

ARCHITECT/DESIGNER: BARRY BRYAN ASSOCIATES  
250 WATER ST.  
WHITBY ON L1N 0G5  
PHONE - 905-666-5252  
FAX - 905-666-5256

CONTRACTOR:

PHONE -  
FAX -

PROJECT: MILL-COURTLAND COMMUNITY CENTRE  
216 MILL ST.  
KITCHENER ON  
7013

PROJECT CONSULTANT: MIKE WICKENS

PREPARED: February 24, 2025

REVISED: February 24, 2025  
January 22, 2025  
December 20, 2024

REV#02  
REV# 01  
ORIGINAL



Scan to check  
out our website

# DOOR INDEX

Mark	Heading #	Mark	Heading #	Mark	Heading #
101	01	117A	28		
101A	02	117B	27		
103A	03.1	119	16		
103B	03	120	17		
104	30	122	16		
105	04	123	18		
105A	05	123A	18.1		
106	06	123B	19		
107A	07	124	20		
107B	07.1	125	20		
108	07	126	21		
108A	08	126A	29		
109	09	127	10		
110	10	128	22		
111	11	129	22		
112	12	130	23		
113	13	130A	24		
114	14	131	25		
115	13.1	131A	26		
116	15	133	22		
117	27	134	22		



KNELLS DOOR & HARDWARE

2090 SHIRLEY DRIVE

KITCHENER

Tel: 519-578-1000

ON

N2B 0A3

Fax: 519-578-3262

MILL-COURTLAND COMMUNITY CENTRE

Control No.7013

7013

Submitted By: MIKE WICKENS

## Hardware Finishes

Finish	Description
26D	SATIN CHROMIUM
626	SATIN CHROMIUM PLATED
630	SATIN STAINLESS STEEL
652	CHROME-LIKE COATING ON STEEL
689	POWDER COAT, ALUMINUM
A92	ALUMINUM CLEAR COAT
ALUMINUM	ALUMINUM
C.A.	CLEAR ANODIZED
C26D	SATIN CHROMIUM
C32D	STAINLESS STEEL, SATIN
CL	CLEAR
CLEAR	CLEAR ANODIZED
M.A.	MILL FINISH
PC	PRIME COAT
SP28	LACQUER SPRAYED ALUMINUM
US26D	SATIN CHROME
US26D/US28	ANODIZED ALUMINUM
US26D/US32D	STAINLESS STEEL - SATIN
US28	ANODIZED ALUMINUM
US32D	SATIN STAINLESS STEEL



KNELLS DOOR & HARDWARE

MILL-COURTLAND COMMUNITY CENTRE

2090 SHIRLEY DRIVE

KITCHENER

ON

N2B 0A3

Tel: 519-578-1000

Fax: 519-578-3262

Control No.7013

7013

Submitted By: MIKE WICKENS

February 24, 2025



MILL-COURTLAND COMMUNITY CENTRE  
216 MILL ST.

Heading # 01

1 PR DOORS 101 EXTERIOR FROM ENTRY VESTIBULE 101

90° RHRA

965/965 x 2130 x 45 ALD Door/ ALF Frame

NON-RTD Door/NON-RTD Frame

2	CONTINUOUS HINGE	SL11 CL HD300 X 2108MM X SDTF	CL	SEL
1	MULLION	L980S X 86MM	PC	SAR
1	RIM EXIT DEVICE NIGHT LATCH CYLINDER ASSEMBLY	CD-35A-NL-OP X 388NL X 1439(US19) X 4-0 X SNB	US26D/US28	VON
1	RIM EXIT DEVICE EXIT ONLY	CD-35A-EO X 1439(US19) X 4-0 X SNB	US28	VON
3	MORTISE CYLINDER - DOGGING & MULLION	20-061 X 112 X KA	626	SCH
1	RIM CYLINDER - TRIM	20-057 X KA	626	SCH
1	ELECTRIC STRIKE	9500-12/24D-630	630	IES-CDI
2	PULL	GSH 1180-2 X #2	C32D	GAL
2	OVERHEAD STOP	104S	US32D	GLY
1	CLOSER, TOP JAMB	4040XP.RWPA.689.SRT	689	LCN
	INSTALL CLOSER INSIDE OPERATOR CASE			
1	AUTO OPERATOR	8100 DOUBLE CASE AUTOMATIC OPERATOR	CLR ANOD.	REC
1	DOOR POSITION SWITCH	CM-190/31		CAM
2	DOOR SWEEP	W-13S X 38	CLEAR	KNC
1	THRESHOLD	CT-10 X 76	ALUMINUM	KNC
2	ACTUATOR	CM-7536SS/4-SS; CM-75SB		CAM
1	RELAY	CX-12PLUS		CAM
1	MISCELLANEOUS	MISC - WIRE & SUPPLIES	NA	G&A
1	MISCELLANEOUS	INSTALLATION		DLR
1	CLOSER, ACCESSORY	4640 CLOSER SHAFT EXTENSION	AL	LCN

INTEGRAL WEATHER STRIPPING BY ALUMINUM DOOR SUPPLIER.  
 CONFIRM DOOR THICKNESS WITH AL DOOR SUPPLIER PRIOR TO ORDERING HARDWARE.  
 120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.  
 CARD READER BY OTHERS.

MILL-COURTLAND COMMUNITY CENTRE  
216 MILL ST.

## Heading # 02

1 PR DOORS 101A ENTRY VESTIBULE 101 FROM CORRIDOR 102

90° RHRA

965/965 x 2130 x 45 ALD Door/ ALF Frame

NON-RTD Door/NON-RTD Frame

2	CONTINUOUS HINGE	SL11 CL HD300 X 2108MM X SDTF	CL	SEL
2	PULL	GSH 1180-2 X #2	C32D	GAL
2	DUMMY EXIT DEVICE	350 X 36MM X SNB	US32D	VON
2	OVERHEAD STOP/HOLDER, CONCEALED	104S	US32D	GLY
1	CLOSER, TOP JAMB	4040XP.RWPA.689.SRT INSTALL CLOSER INSIDE OPERATOR CASE	689	LCN
1	AUTO OPERATOR	8100 DOUBLE CASE AUTOMATIC OPERATOR	CLR ANOD.	REC
1	THRESHOLD	CT-10 X 76	ALUMINUM	KNC
2	ACTUATOR	CM-7536SS/4-SS; CM-75SB		CAM
1	MISCELLANEOUS INSTALLATION			DLR
1	MISCELLANEOUS MISC - WIRE & SUPPLIES		NA	G&A
1	CLOSER, ACCESSORY	4640 CLOSER SHAFT EXTENSION	AL	LCN

CONFIRM DOOR THICKNESS WITH AL DOOR SUPPLIER PRIOR TO ORDERING HARDWARE.  
120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.

## Heading # 03

1 SGL DOOR 103B CORRIDOR 102 FROM MULTI-PURPOSE ROOM 103

90° LHR

900 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, STD WT	TA2895 114MM	26D	MCK
1	CLASSROOM LOCK	ALX70R X SPA X 47267042 X 47267101 X KA	626	SCH
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM	C32D	GAL
1	WALL STOP	GSH 240	C26D	GAL

MILL-COURTLAND COMMUNITY CENTRE  
216 MILL ST.

## Heading # 03.1

1 SGL DOOR 103A CORRIDOR 102 FROM MULTI-PURPOSE ROOM 103

90° RHR

900 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, STD WT	TA2895 114MM	26D	MCK
1	CLASSROOM LOCK	ALX70R X SPA X 47267042 X 47267101 X KA	626	SCH
1	ELECTRIC STRIKE	5000C-12/24D-630	630	IES-CDI
1	AUTO OPERATOR	8100 SINGLE CASE AUTOMATIC OPERATOR	CLR. ANOD.	REC
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM	C32D	GAL
1	WALL STOP	GSH 240	C26D	GAL
1	DOOR POSITION SWITCH	CM-190/31		CAM
INSTALL ON THE CORRIDOR SIDE OF THE OPENING				
2	ACTUATOR	CM-7536SS/4-SS; CM-75SB		CAM
1	MISCELLANEOUS	INSTALLATION		DLR
1	MISCELLANEOUS	MISC - WIRE & SUPPLIES	NA	G&A

120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.

## Heading # 04

1 SGL DOOR 105 CORRIDOR 102 TO RECEPTION 105

90° RH

965 x 2130 x 45 WD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA	626	SCH
1	ELECTRIC STRIKE	5000C-12/24D-630	630	IES-CDI
1	OVERHEAD STOP/HOLDER, SURFACE	904S	US32D	GLY
1	CLOSER, REGULAR ARM	4040XP.RWPA.689.SRT	689	LCN
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL

CARD READER BY OTHERS.

## Heading # 05

1 SGL DOOR 105A LOUNGE 104 TO RECEPTION 105

90° RH

900 x 2130 x 45 WD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, STD WT	TA2895 114MM	26D	MCK
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA	626	SCH
1	ELECTRIC STRIKE	5000C-12/24D-630	630	IES-CDI
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM	C32D	GAL
1	WALL STOP	GSH 240	C26D	GAL

CARD READER BY OTHERS.

MILL-COURTLAND COMMUNITY CENTRE  
216 MILL ST.

## Heading # 06

1 SGL DOOR 106 LOUNGE 104 TO CRAFT ROOM 106

90° RH

965 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM
1	CLASSROOM LOCK	ALX70R X SPA X 47267042 X 47267101 X KA
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM
1	WALL STOP	GSH 240

US26D	LAW
626	SCH
C32D	GAL
C26D	GAL

## Heading # 07

1 SGL DOOR 107A LOUNGE 104 TO DONATION ROOM 107A

90° RH

1 SGL DOOR 108 LOUNGE 104 TO KINDER ROOM 108

90° LH

965 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM
2	CLASSROOM LOCK	ALX70R X SPA X 47267042 X 47267101 X KA
2	OVERHEAD STOP/HOLDER, SURFACE	904S
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM

US26D	LAW
626	SCH
US32D	GLY
C32D	GAL

## Heading # 07.1

1 SGL DOOR 107B LOUNGE 104 TO OFFICE 107B

90° LH

900 x 2130 x 45 HMD Door/ EXST Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM
1	CYLINDRICAL LOCK WITH THRU BOLTS ENTRANCE	ALX53R X SPA X 47267042 X 47267101 X KA
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM
1	WALL STOP	GSH 240

US26D	LAW
626	SCH
C32D	GAL
C26D	GAL

HARDWARE SCHEDULE - CODE # 7013

MILL-COURTLAND COMMUNITY CENTRE  
216 MILL ST.

Heading # 08

1 SGL DOOR 108A EXTERIOR FROM KINDER ROOM 108

90° RHR

965 x 2130 x 45 ALD Door/ ALF Frame

NON-RTD Door/NON-RTD Frame

1	CONTINUOUS HINGE	SL11 CL HD300 X 2108MM X SDTF
1	RIM EXIT DEVICE	CD-35A-NL-OP X 388NL X 1439(US19) X 4-0 X SNB
1	RIM CYLINDER - TRIM	20-057 X KA
1	MORTISE CYLINDER - DOGGING & MULLION	20-061 X 112 X KA
1	OVERHEAD STOP	104S
1	CLOSER, TOP JAMB	4040XP.RWPA.689.SRT
	INSTALL CLOSER INSIDE OPERATOR CASE	
1	DOOR SWEEP	W-13S X 38
1	THRESHOLD	CT-10 X 38
1	MISCELLANEOUS	4040XP-18G.689

CL	SEL
US26D/US28	VON
626	SCH
626	SCH
US32D	GLY
689	LCN
CLEAR	KNC
ALUMINUM	KNC
689	LCN

INTEGRAL WEATHER STRIPPING BY ALUMINUM DOOR SUPPLIER.

Heading # 09

1 SGL DOOR 109 KINDER ROOM 108 FROM WR 109

90° LHR

800 x 2130 x 45 HMD Door/ EXST Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, STD WT	TA2895 114MM
1	PRIVACY SET, WITH THRU BOLTS	ALX40 X SPA X 47267038 X 47267101
1	OVERHEAD STOP/HOLDER, SURFACE	904S
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM

26D	MCK
626	SCH
US32D	GLY
C32D	GAL

Heading # 10

1 SGL DOOR 110 CORRIDOR 111 TO JANITOR 110

90° RH

1 SGL DOOR 127 CORRIDOR 112 TO STORAGE 127

90° RH

965 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM
2	CLASSROOM LOCK	ALX70R X SPA X 47267042 X 47267101 X KA
2	OVERHEAD STOP/HOLDER, SURFACE	904S
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM

US26D	LAW
626	SCH
US32D	GLY
C32D	GAL

MILL-COURTLAND COMMUNITY CENTRE  
216 MILL ST.

## Heading # 11

1 PR DOORS 111 CORRIDOR 111 FROM CORRIDOR 112

90° LHRA

965/965 x 2130 x 45 HMD Door/ HMF Frame

45 MIN Door/45 MIN Frame

6	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
2	SVR EXIT DEVICE	9827L-F X 996L(#17) X 499F X 4-0 X 2134MMH X LBR	US26D/US32 D	VON
1	RIM CYLINDER - TRIM	20-057 X KA	626	SCH
2	CLOSER, PARALLEL ARM	4040XP.RWPA.689.SRT	689	LCN
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 940MM	C32D	GAL
2	ELECTROMAGNETIC HOLDER	EM 508-24120	689	DKB
1	ASTRAGAL	W-25 X 7	C.A.	KNC

## Heading # 12

1 SGL DOOR 112 EXTERIOR FROM CORRIDOR 112

90° RHR

965 x 2130 x 45 ALD Door/ ALF Frame

NON-RTD Door/NON-RTD Frame

1	CONTINUOUS HINGE	SL11 CL HD300 X 2108MM X SDTF	CL	SEL
1	RIM EXIT DEVICE	CD-35A-NL-OP X 388NL X 1439(US19) X 4-0 X SNB	US26D/US28	VON
1	RIM CYLINDER - TRIM	20-057 X KA	626	SCH
1	MORTISE CYLINDER - DOGGING & MULLION	20-061 X 112 X KA	626	SCH
1	ELECTRIC STRIKE	9400-12/24D-630	630	IES-CDI
1	OVERHEAD STOP	104S	US32D	GLY
1	AUTO OPERATOR	8100 SINGLE CASE AUTOMATIC OPERATOR	CLR. ANOD.	REC
1	DOOR POSITION SWITCH	CM-190/31		CAM
1	DOOR SWEEP	W-13S X 38	CLEAR	KNC
1	THRESHOLD	CT-10 X 38	ALUMINUM	KNC
2	ACTUATOR	CM-7536SS/4-SS; CM-75SB		CAM
1	RELAY	CX-12PLUS		CAM
1	MISCELLANEOUS	INSTALLATION		DLR
1	MISCELLANEOUS	MISC - WIRE & SUPPLIES	NA	G&A

INTEGRAL WEATHER STRIPPING BY ALUMINUM DOOR SUPPLIER.  
120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.  
CARD READER BY OTHERS.

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216 MILL ST.

## Heading # 13

1 SGL DOOR 113 CORRIDOR 112 TO OFFICE 113

90° RH

965 x 2130 x 45 WD Door/ HMF Frame

45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM
1	CYLINDRICAL LOCK WITH THRU BOLTS	ALX53R X SPA X 47267042 X 47267101 X KA
1	CLOSER, REGULAR ARM	4040XP.RWPA.689.SRT
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM
1	WALL STOP	GSH 240

US26D	LAW
626	SCH
689	LCN
C32D	GAL
C26D	GAL

## Heading # 13.1

1 SGL DOOR 115 CORRIDOR 112 TO PANTRY 115

90° LH

965 x 2130 x 45 HMD Door/ HMF Frame

45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA
1	CLOSER, REGULAR ARM	4040XP.RWPA.689.SRT
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM
1	WALL STOP	GSH 240

US26D	LAW
626	SCH
689	LCN
C32D	GAL
C26D	GAL

## Heading # 14

1 SGL DOOR 114 CORRIDOR 112 TO ELECTRICAL 114

90° LH

900 x 2130 x 45 HMD Door/ EXST Frame

45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA
1	ELECTRIC STRIKE	1500C-12/24D-630
1	CLOSER, REGULAR ARM	4040XP.RWPA.689.SRT
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM
1	WALL STOP	GSH 240

US26D	LAW
626	SCH
630	IES-CDI
689	LCN
C32D	GAL
C26D	GAL

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## Heading # 15

1 SGL DOOR 116 CORRIDOR 112 TO UNIVERSAL WASHROOM 116

90° LH

965 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA	626	SCH
1	EXIT CONTROL LOCK	CX-WC13AXSM		CAM
1	EXIT CONTROL LOCK	CX-WEC10		CAM
1	ELECTRIC STRIKE	5000C-12/24D-630	630	IES-CDI
1	AUTO OPERATOR	8100 SINGLE CASE AUTOMATIC OPERATOR	CLR. ANOD.	REC
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	WALL STOP	GSH 240	C26D	GAL
1	ACTUATOR	CM-7536SS/4-SS; CM-75SB		CAM
1	MISCELLANEOUS	MISC - WIRE & SUPPLIES	NA	G&A
1	MISCELLANEOUS	INSTALLATION		DLR
1	MOUNTING HARDWARE	CM-43CBL		CAM

120V TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.

## Heading # 16

1 SGL DOOR 119 CORRIDOR 112 TO FEMALE WASHROOM 119

90° LH

1 SGL DOOR 122 CORRIDOR 112 TO MALE WASHROOM 122

90° RH

965 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
2	PUSH PLATE	GSH 81A X 2-SIDED TAPE X 152MM X 508MM	C32D	GAL
2	PULL	4709-2 X #2	C32D	GAL
2	CLOSER, REGULAR ARM	4040XP.RWPA.689.SRT	689	LCN
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
2	WALL STOP	GSH 240	C26D	GAL

## Heading # 17

1 SGL DOOR 120 CORRIDOR 112 TO W/C 120

90° RH

965 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

3	HINGE, 4 1/2, STD WT	TA2895 114MM	26D	MCK
1	PRIVACY SET, WITH THRU BOLTS	ALX40 X SPA X 47267038 X 47267101	626	SCH
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM	C32D	GAL
1	WALL STOP	GSH 240	C26D	GAL



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## Heading # 18

1 PR DOORS 123 CORRIDOR 112 FROM ACTIVITY/ BANQUET ROOM 123

90° LHRA

900/900 x 2130 x 45 HMD Door/ EXST Frame

NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, STD WT	TA2895 114MM	26D	MCK
1	ELECTRIC POWER TRANSFER	EPT 10	SP28	VON
2	FLUSH BOLT, AUTOMATIC, EXTENSION	FB31P-12-MD	US32D	IVE
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA	626	SCH
1	ELECTRIC STRIKE	1500C-12/24D-630	630	IES-CDI
2	CLOSER, PARALLEL ARM	4040XP.SHCUSH.689.SRT	689	LCN
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 875MM	C32D	GAL

Z-ASTRAGAL BY HM DOOR SUPPLIER.

## Heading # 18.1

1 PR DOORS 123A CORRIDOR 112 FROM ACTIVITY/ BANQUET ROOM 123

90° LHRA

900/900 x 2130 x 45 HMD Door/ EXST Frame

NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, STD WT	TA2895 114MM	26D	MCK
1	ELECTRIC POWER TRANSFER	EPT 10	SP28	VON
2	FLUSH BOLT, AUTOMATIC, EXTENSION	FB31P-12-MD	US32D	IVE
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA	626	SCH
1	ELECTRIC STRIKE	1500C-12/24D-630	630	IES-CDI
2	CLOSER, PARALLEL ARM	4040XP.SHCUSH.689.SRT	689	LCN
1	AUTO OPERATOR	8100 DOUBLE CASE AUTOMATIC OPERATOR	CLR ANOD.	REC
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 875MM	C32D	GAL
1	DOOR POSITION SWITCH	CM-190/31		CAM
	INSTALL ON THE CORRIDOR SIDE OF THE OPENING			
1	ACTUATOR	CM-7536SS/4-SS; CM-75SB		CAM
1	MISCELLANEOUS	MISC - WIRE & SUPPLIES	NA	G&A
1	MISCELLANEOUS	INSTALLATION		DLR

Z-ASTRAGAL BY HM DOOR SUPPLIER.

120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.

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## Heading # 19

1 SGL DOOR 123B EXTERIOR FROM ACTIVITY/ BANQUET ROOM 123

90° LHR

900 x 2130 x 45 HMD Door/ EXST Frame

NON-RTD Door/NON-RTD Frame

1	CONTINUOUS HINGE	SL41 CL HD600 X 2108MM X SDTF	CL	SEL
1	RIM EXIT DEVICE NIGHT LATCH CYLINDER ASSEMBLY	CD-35A-NL-OP X 388NL X 1439(US19) X 3-0 X SNB	US26D/US28	VON
1	RIM CYLINDER - TRIM	20-057 X KA	626	SCH
1	MORTISE CYLINDER - DOGGING & MULLION	20-061 X 112 X KA	626	SCH
1	OVERHEAD STOP	104S	US32D	GLY
1	CLOSER, TOP JAMB	4040XP.RWPA.689.SRT	689	LCN
	INSTALL CLOSER INSIDE OPERATOR CASE			
1	DOOR SWEEP	W-13S X 900MMW	C.A.	KNC
1	THRESHOLD	CT-10 X 900MM	M.A.	KNC
1	MISCELLANEOUS	4040XP-18G.689	689	LCN

INTEGRAL WEATHER STRIPPING BY ALUMINUM DOOR SUPPLIER.

## Heading # 20

1 PR DOORS 124 ACTIVITY/ BANQUET ROOM 123 FROM STORAGE 124

90° RHRA

1 PR DOORS 125 ACTIVITY/ BANQUET ROOM 123 FROM STORAGE 125

90° LHRA

900/900 x 2130 x 45 HMD Door/ EXST Frame

NON-RTD Door/NON-RTD Frame

12	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
4	FLUSH BOLT, MANUAL, EXTENSION	FB458-12	US26D	IVE
2	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA	626	SCH
4	OVERHEAD STOP/HOLDER, SURFACE	904H	US32D	GLY
4	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 875MM	C32D	GAL

Z-ASTRAGAL BY HM SUPPLIER.

## Heading # 21

1 SGL DOOR 126 CORRIDOR 112 TO MECH. ROOM 126

90° LH

900 x 2130 x 45 HMD Door/ EXST Frame

45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
1	STOREROOM LOCK	ALX80R X SPA X 47267042 X 47267101 X KA	626	SCH
1	CLOSER, REGULAR ARM	4040XP.RWPA.689.SRT	689	LCN
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 927MM	C32D	GAL
1	WALL STOP	GSH 240	C26D	GAL

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## Heading # 22

1 SGL DOOR 128 CORRIDOR 112 TO OFFICE 128	90°	RH
1 SGL DOOR 129 CORRIDOR 112 TO MEETING ROOM 129	90°	LH
1 SGL DOOR 133 MULTI-PURPOSE PROGRAM ROOM 131 TO RECORDING STUDIO 133	90°	RH
1 SGL DOOR 134 MULTI-PURPOSE PROGRAM ROOM 131 TO STORAGE 134	90°	LH
965 x 2130 x 45 HMD Door/ HMF Frame	NON-RTD Door/NON-RTD Frame	
12 HINGE, 4 1/2, HVY WT LH168BB 114MM X 114MM	US26D	LAW
4 CYLINDRICAL LOCK WITH ALX53R X SPA X 47267042 X 47267101 X KA THRU BOLTS	626	SCH
4 KICK PLATE GSH 80A X 2-SIDED TAPE X 203MM X 862MM	C32D	GAL
4 WALL STOP GSH 240	C26D	GAL

## Heading # 23

1 PR DOORS 130 EXTERIOR FROM ENTRY VESTIBULE 130	90°	LHRA
965/965 x 2350 x 45 ALD Door/ ALF Frame	NON-RTD Door/NON-RTD Frame	
2 CONTINUOUS HINGE SL11 CL HD300 X 2413MM X SDTF	CL	SEL
1 MULLION 12-980 X 120MM	PC	SAR
1 RIM EXIT DEVICE NIGHT LATCH CYLINDER ASSEMBLY CD-35A-NL-OP X 388NL X 1439(US19) X 4-0 X SNB	US26D/US28	VON
1 RIM EXIT DEVICE EXIT ONLY CD-35A-EO X 1439(US19) X 4-0 X SNB	US28	VON
2 MORTISE CYLINDER - DOGGING & MULLION 20-061 X 112 X KA	626	SCH
1 RIM CYLINDER - TRIM 20-057 X KA	626	SCH
1 ELECTRIC STRIKE 9500-12/24D-630	630	IES-CDI
2 PULL GSH 1180-2 X #2	C32D	GAL
2 OVERHEAD STOP 104S	US32D	GLY
1 CLOSER, TOP JAMB 4040XP.RWPA.689.SRT	689	LCN
INSTALL CLOSER INSIDE OPERATOR CASE		
1 AUTO OPERATOR 8100 DOUBLE CASE AUTOMATIC OPERATOR	CLR ANOD.	REC
2 DOOR SWEEP W-13S X 38	CLEAR	KNC
1 THRESHOLD CT-10 X 76	ALUMINUM	KNC
2 ACTUATOR CM-7536SS/4-SS; CM-75SB		CAM
1 MISCELLANEOUS INSTALLATION		DLR
1 MISCELLANEOUS MISC - WIRE & SUPPLIES	NA	G&A
1 CLOSER, ACCESSORY 4640 CLOSER SHAFT EXTENSION	AL	LCN

INTEGRAL WEATHER STRIPPING BY ALUMINUM DOOR SUPPLIER.  
 CONFIRM DOOR THICKNESS WITH AL DOOR SUPPLIER PRIOR TO ORDERING HARDWARE.  
 120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.

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## Heading # 24

1 PR DOORS 130A ENTRY VESTIBULE 130 FROM CORRIDOR 112

90° LHRA

965/965 x 2350 x 45 ALD Door/ ALF Frame

NON-RTD Door/NON-RTD Frame

2	CONTINUOUS HINGE	SL11 CL HD300 X 2413MM X SDTF	CL	SEL
2	PULL	GSH 1180-2 X #2	C32D	GAL
2	DUMMY EXIT DEVICE	350 X 36MM X SNB	US32D	VON
2	OVERHEAD STOP/HOLDER, CONCEALED	104S	US32D	GLY
1	CLOSER, TOP JAMB	4040XP.RWPA.689.SRT INSTALL CLOSER INSIDE OPERATOR CASE	689	LCN
1	AUTO OPERATOR	8100 DOUBLE CASE AUTOMATIC OPERATOR	CLR ANOD.	REC
1	DOOR POSITION SWITCH	CM-190/31		CAM
1	THRESHOLD	CT-10 X 76	ALUMINUM	KNC
2	ACTUATOR	CM-7536SS/4-SS; CM-75SB		CAM
1	RELAY	CX-12PLUS		CAM
1	MISCELLANEOUS	MISC - WIRE & SUPPLIES	NA	G&A
1	MISCELLANEOUS	INSTALLATION		DLR
1	CLOSER, ACCESSORY	4640 CLOSER SHAFT EXTENSION	AL	LCN

CONFIRM DOOR THICKNESS WITH AL DOOR SUPPLIER PRIOR TO ORDERING HARDWARE.  
120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.

## Heading # 25

1 PR DOORS 131 CORRIDOR 112 TO MULTI-PURPOSE PROGRAM ROOM 131

90° RHA

965/965 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
2	FLUSH BOLT, AUTOMATIC, EXTENSION	FB31P-12-MD	US32D	IVE
1	CYLINDRICAL DEAD LOCK	B562R X 12-288 X 10-094 X KA	626	SCH
2	PUSH PLATE	GSH 81A X 2-SIDED TAPE X 152MM X 508MM	C32D	GAL
2	PULL	4709-2 X #2	C32D	GAL
2	CLOSER, PARALLEL ARM	4040XP.SHCUSH.689.SRT	689	LCN
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 940MM	C32D	GAL
1	WALL STOP	GSH 240	C26D	GAL

Z-ASTRAGAL BY HM SUPPLIER.

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## Heading # 26

1 PR DOORS 131A EXTERIOR FROM MULTI-PURPOSE PROGRAM ROOM 131

90° RHRA

965/965 x 2130 x 45 ALD Door/ ALF Frame

NON-RTD Door/NON-RTD Frame

2	CONTINUOUS HINGE	SL11 CL HD300 X 2108MM X SDTF	CL	SEL
1	MULLION	L980S X 86MM	PC	SAR
1	RIM EXIT DEVICE NIGHT LATCH CYLINDER ASSEMBLY	CD-35A-NL-OP X 388NL X 1439(US19) X 4-0 X SNB	US26D/US28	VON
1	RIM EXIT DEVICE EXIT ONLY	CD-35A-EO X 1439(US19) X 4-0 X SNB	US28	VON
3	MORTISE CYLINDER - DOGGING & MULLION	20-061 X 112 X KA	626	SCH
1	RIM CYLINDER - TRIM	20-057 X KA	626	SCH
2	PULL	GSH 1180-2 X #2	C32D	GAL
2	OVERHEAD STOP	104S	US32D	GLY
2	CLOSER, TOP JAMB	4040XP.RWPA.689.SRT	689	LCN
	INSTALL CLOSER INSIDE OPERATOR CASE			
2	DOOR SWEEP	W-13S X 38	CLEAR	KNC
1	THRESHOLD	CT-10 X 76	ALUMINUM	KNC
2	MISCELLANEOUS	4040XP-18G.689	689	LCN

INTEGRAL WEATHER STRIPPING BY ALUMINUM DOOR SUPPLIER.  
 CONFIRM DOOR THICKNESS WITH AL DOOR SUPPLIER PRIOR TO ORDERING HARDWARE.  
 120V AC TO HEAD, CONDUIT, WIRING AND BACK BOXES BY OTHERS.

## Heading # 27

1 SGL DOOR 117 CORRIDOR 112 TO SERVERY 117

90° RH

1 SGL DOOR 117B ACTIVITY/ BANQUET ROOM 123 TO SERVERY 117

90° RH

900 x 2130 x 45 HMD Door/ HMF Frame

NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
2	CLASSROOM LOCK	ALX70R X SPA X 47267042 X 47267101 X KA	626	SCH
2	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM	C32D	GAL

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## Heading # 28

1 SGL DOOR 117A KINDER ROOM 108 TO SERVERY 117

90° LH

900 x 2130 x 45 HMD Door/ HMF Frame

45 MIN Door/45 MIN Frame

3	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
1	CLASSROOM LOCK	ALX70R X SPA X 47267042 X 47267101 X KA	626	SCH
1	OVERHEAD	904S	US32D	GLY
	STOP/HOLDER, SURFACE			
1	CLOSER, REGULAR ARM	4040XP.RWPA.689.SRT	689	LCN
1	KICK PLATE	GSH 80A X 2-SIDED TAPE X 203MM X 862MM	C32D	GAL

## Heading # 29

1 SGL DOOR 126A MECH. ROOM 126 TO MECH. ROOM 126A

90°

ext x ext x 45 EXST Door/ EXST Frame

NON-RTD Door/NON-RTD Frame

EXISTING DOOR HARDWARE TO REMAIN.

## Heading # 30

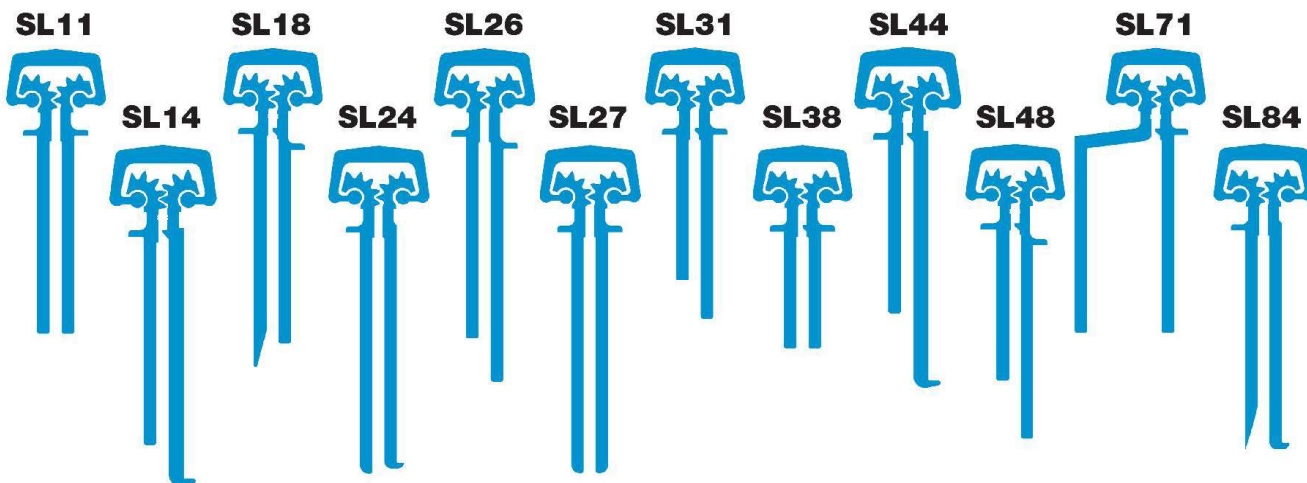
1 PR DOORS 104 LOUNGE 104 FROM CLOSET

90° LHR,RHR

600/600 x 2130 x 45 WD Door/ WDF Frame

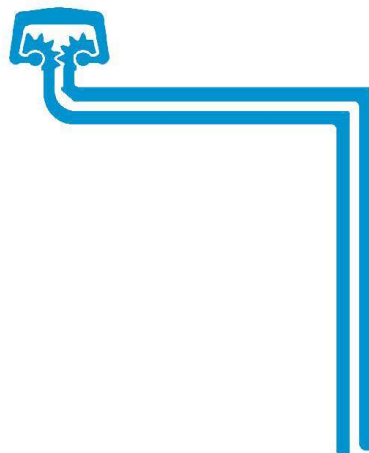
NON-RTD Door/NON-RTD Frame

6	HINGE, 4 1/2, HVY WT	LH168BB 114MM X 114MM	US26D	LAW
2	DUMMY TRIM, SINGLE	ALX170 X SPA	626	SCH
2	OVERHEAD	452S	652	GLY
	STOP/HOLDER, SURFACE			
2	CATCH, MAGETIC	327	A92	IVE

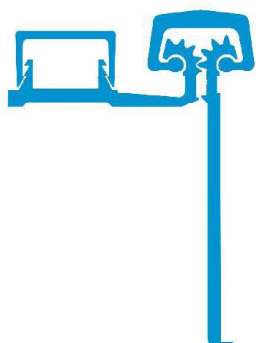
*Concealed*


*Wide Throw*  
**SL40**

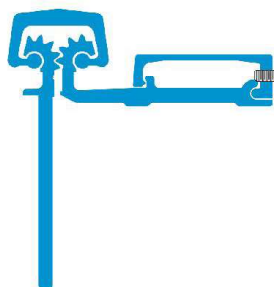
*Swing Clear*  
**SL41**


*Half Mortise*

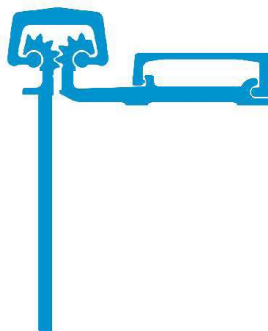
**SL52**


*Half Surface*

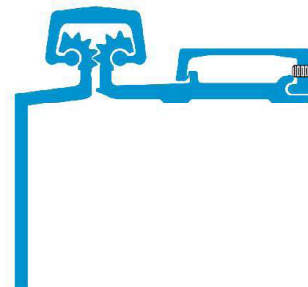
**SL53**



**SL54**



**SL77**

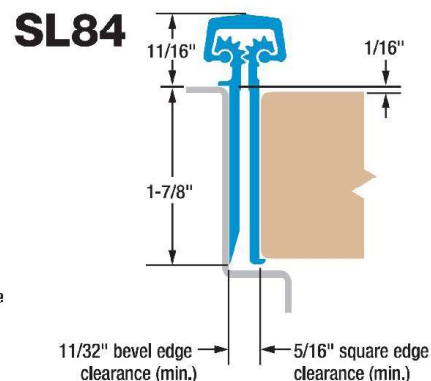
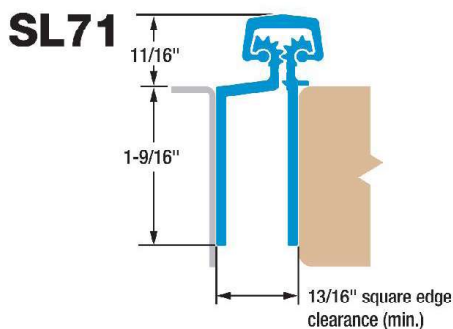
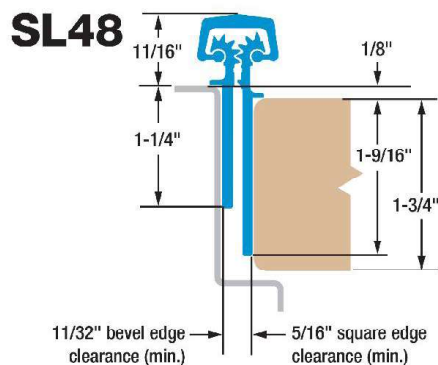
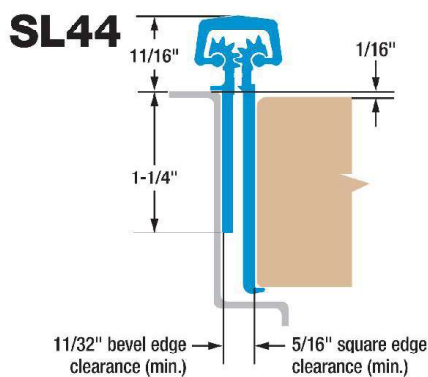
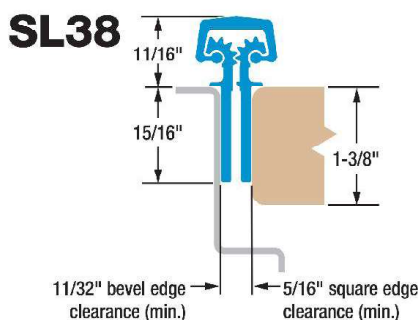
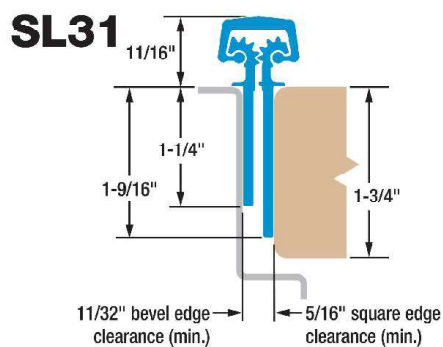
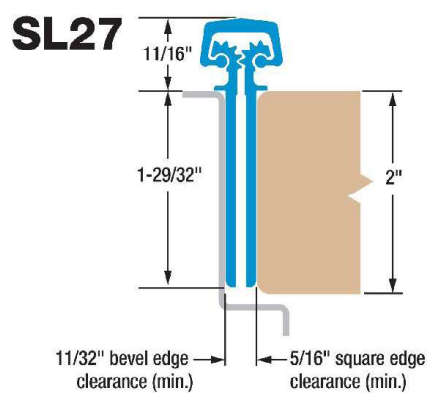
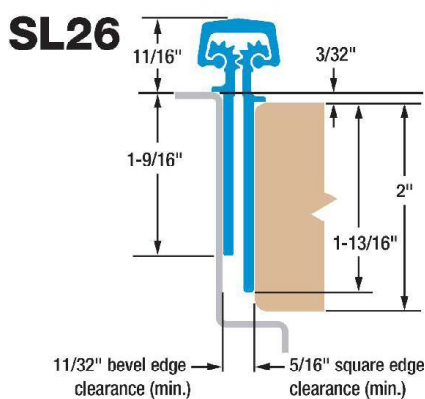
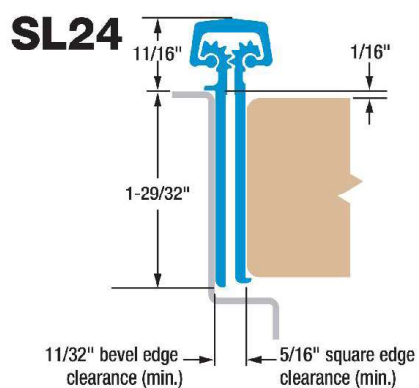
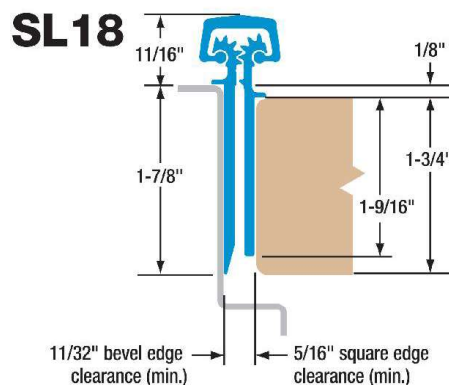
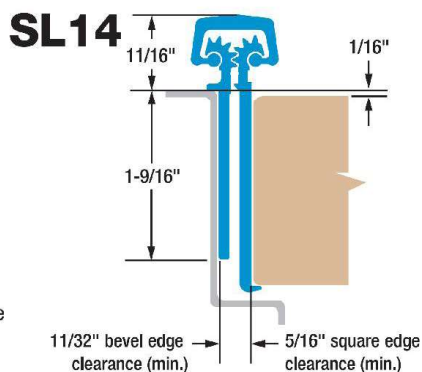
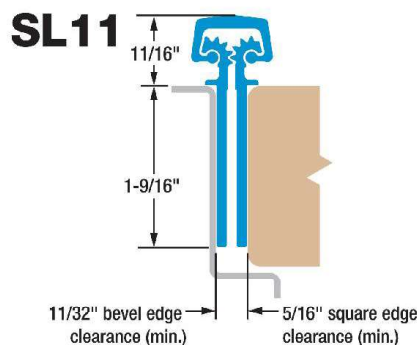

*Full Surface*

**SL21**



**SL57**

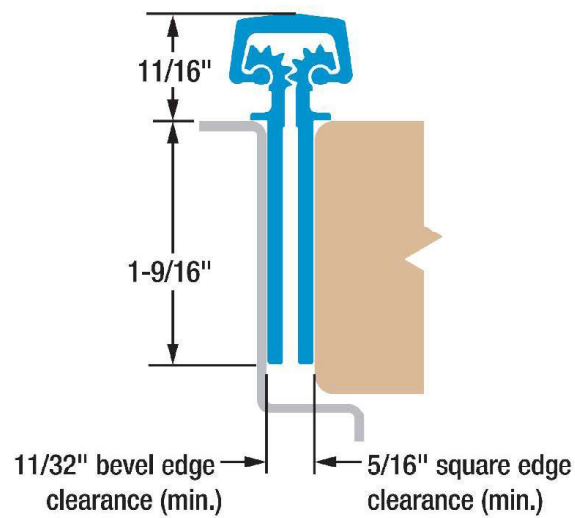




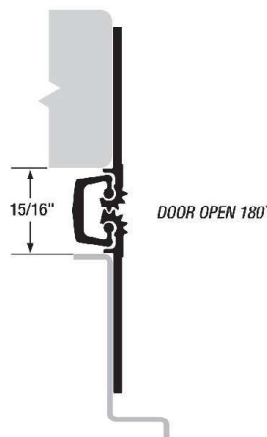
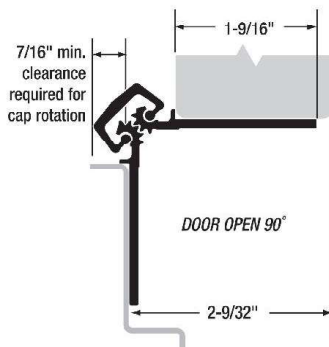
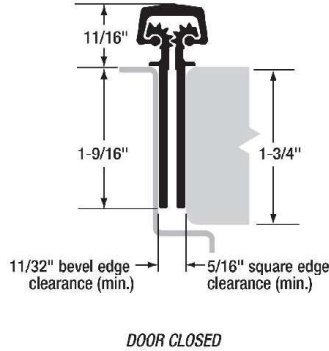




- Flush mounted (no door inset)
- For 1-3/4" doors



# SL11 Concealed Geared Continuous Hinge



**MATERIAL:** Extruded 6063 T6 aluminum alloy with self-lubricating polyester thrust bearings.

**LENGTHS:** 83", 85", 95" and 120" lengths standard for nominal door heights. Custom lengths are available.

**LOAD/FREQUENCY RATINGS:** For 1-3/4" doors. 48" max. door width in 16 gauge hollow metal (min.) or 1/8" aluminum (min.).

**Standard Duty** — Tested per BHMA standards for medium-frequency doors up to 200 lb. without frame or door reinforcement.

**Heavy Duty** — Tested per BHMA standards. Up to 200 lb. doors (high-frequency) and up to 400 lb. doors (medium-frequency) without frame or door reinforcement; up to 600 lb. doors (low-frequency) with the use of Rivnuts in the frame and door.

**Heavy Duty (LL)** — Our HD hinge with additional fastener holes for low-frequency doors up to 1,000 lb., including most lead-lined doors. Rivnuts are recommended in the frame and door on extremely tall, extremely heavy or wide doors.

**FINISHES:** All SL11 hinges are stocked in Clear, Dark Bronze and Black anodized aluminum. Custom anodized or painted finishes are available. Product painted or anodized in the field voids the SELECT hinge warranty.

**CLOSERS:** Conventional overhead surface, concealed sliding arm overhead or floor closers may be used with SELECT hinges. Pivot-type floor closers (with a fixed, conflicting center pivot) must be replaced.

**ORDER:** Specify length, finish and standard duty (SD), heavy duty (HD) or heavy duty with additional fastener holes (LL). Also, specify door and frame screw applications. 12-24 x 3/4" self-drilling, thread-forming 410SS Phillips undercut flathead screws are provided as a standard pack unless otherwise specified. Wood and thread-forming screws also available. Security screws optional at extra cost.

**AVAILABLE ELECTRIC PREPS:** EPT, ATW, EMS, CTW4, CTW5, CTW8, CTW10, CTW12, CMG, AP and RP. For CTW12 prep, please consult factory for engineering approval.

**BHMA CERTIFICATION:** SL11SD, SL11HD and SL11LL geared continuous hinges conform to BHMA Standard ANSI/BHMA A156.26-2006 Grade 1.

SL11 HINGE SCREW COUNT		
HINGE LENGTH & DUTY RATING	DOOR SCREWS	FRAME SCREWS
79" HD	19	19
83" SD/HD	19	19
85" SD/HD	19	19
95" SD/HD	21	21
120" SD/HD	23	23
83" LL	26	26
85" LL	26	26
95" LL	30	30
120" LL	34	34

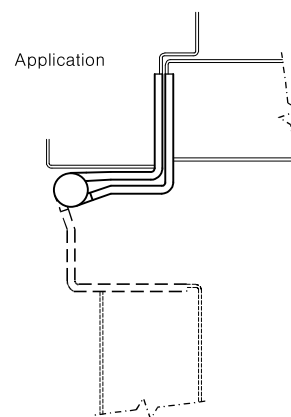
# Five Knuckle Standard Weight Swing Clear Series (Reversible)

**Swing Clear Hinges create barrier free openings by moving the hinge barrel and door edge out of the way.**

- Recommended for use on standard weight, medium frequency doors in schools, hospitals or other public buildings
- Hinge allows for maximum clearance for passage of beds, tables or other equipment through the doorway
- Meets ADA Requirements and ANSI A117.1-1986
- Pressed steel jambs require no special reinforcing
- Pin is held in place by an NRP set screw, which allows the hinge to be reversible
- For Beveled Edge, where doors are beveled on hinge side, specify TA4895 or TA4395
- For available finishes see page 28

TA2395

TA2895



No.	ANSI Cross Reference	Base Material	Weight
TA2395	N/A	Stainless	STD
TA2895	A8122	Steel	STD

## Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
4 1/2"	114.3	.134	8	1/2 x 12-24	1 1/4 x 12
5"	127	.146	8	1/2 x 12-24	1 1/2 x 12

\*Not Available with electric options

**Approved for NFPA 80 fire rated openings**

## Options:

Code	Description
<b>TB</b>	Ball Bearing
<b>HT</b>	Hospital Tip
<b>QC</b>	ElectroLynx® Hinge – 4, 8 or 12 wire available in 4-1/2" US26D and US32D only
<b>CC</b>	Concealed Circuit – 4, 8 or 12 wire available in 4-1/2" US26D and US32D only

Full Mortise Hinges - Heavy Weight

Full mortise hinge for use on heavy weight doors that have high frequency service. They are suitable for hollow metal or wood doors.



LH168BB

Certification:	ANSI/BHMA A156.1 and A156.7			
Description:	Heavy Weight 5 Knuckle 4 ball bearing hinges Steel			
Sizes:	Inches	mm	Inches	mm
	4-1/2" x 4"	(114X102)	.180	(4.6)
	4-1/2" x 4-1/2"	(114X114)	.180	(4.6)
	5" x 4"	(127X102)	.190	(4.8)
	5" x 4-1/2"	(127X114)	.190	(4.8)
	5" x 5"	(127X127)	.190	(4.8)
Finishes:	US26, US26D, US10B, C19 (Black)			
Options	NRP/ETW/PIC/RC cUL Listing stamp for fire			

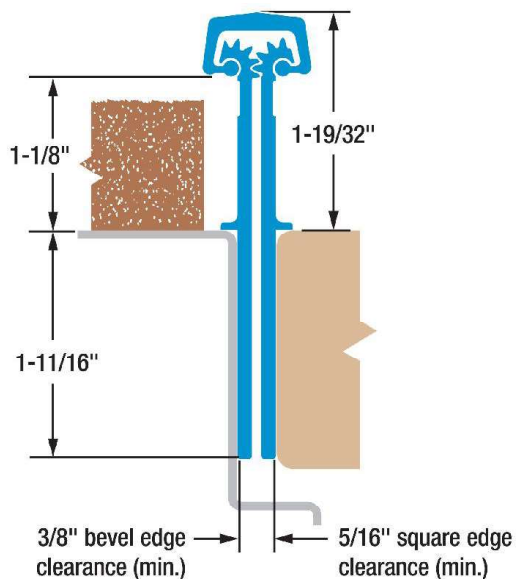


LH199BB

Certification:	ANSI/BHMA A156.1 and A156.7			
Description:	Heavy Weight 5 Knuckle 4 ball bearing hinges Stainless Steel			
Sizes:	Inches	mm	Inches	mm
	4-1/2" x 4"	(114X102)	.180	(4.6)
	4-1/2" x 4-1/2"	(114X114)	.180	(4.6)
	5" x 4"	(127X102)	.190	(4.8)
	5" x 4-1/2"	(127X114)	.190	(4.8)
	5" x 5"	(127X127)	.190	(4.8)
Finishes:	US32D			
Options	NRP/ETW/PIC/RC/HT cUL Listing stamp for fire			

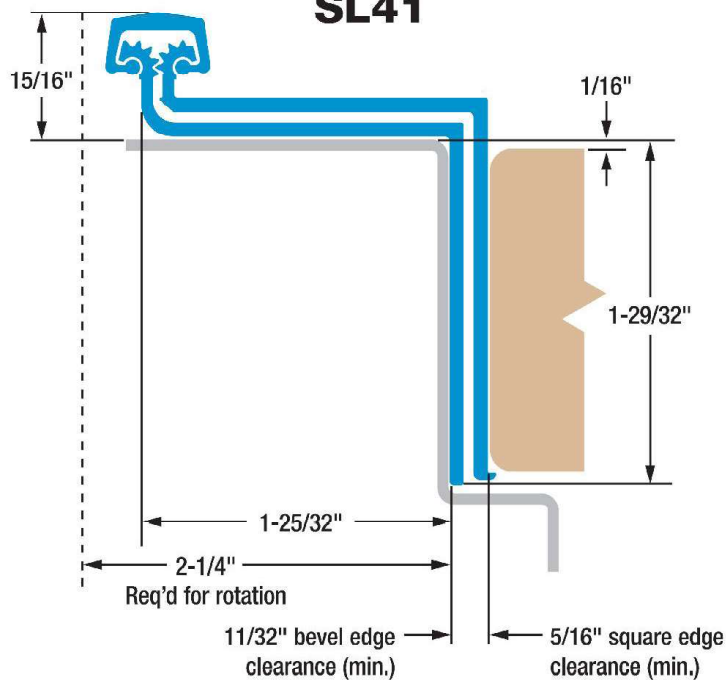
### Wide Throw

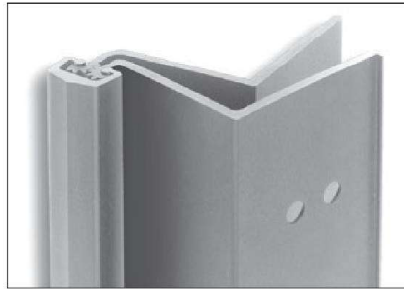
#### SL40



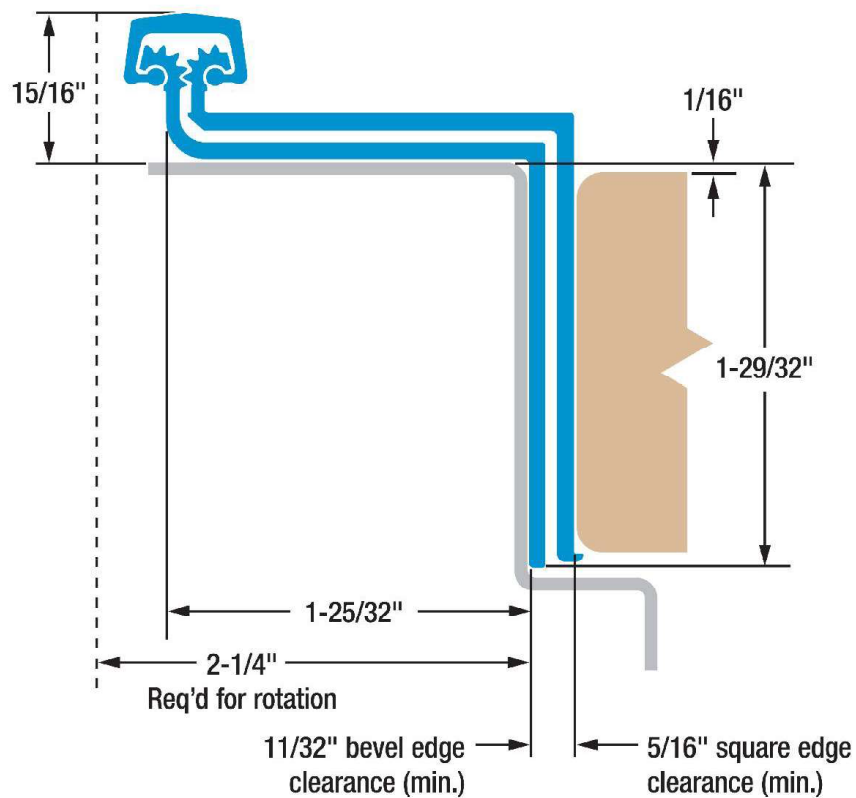
### Swing Clear

#### SL41

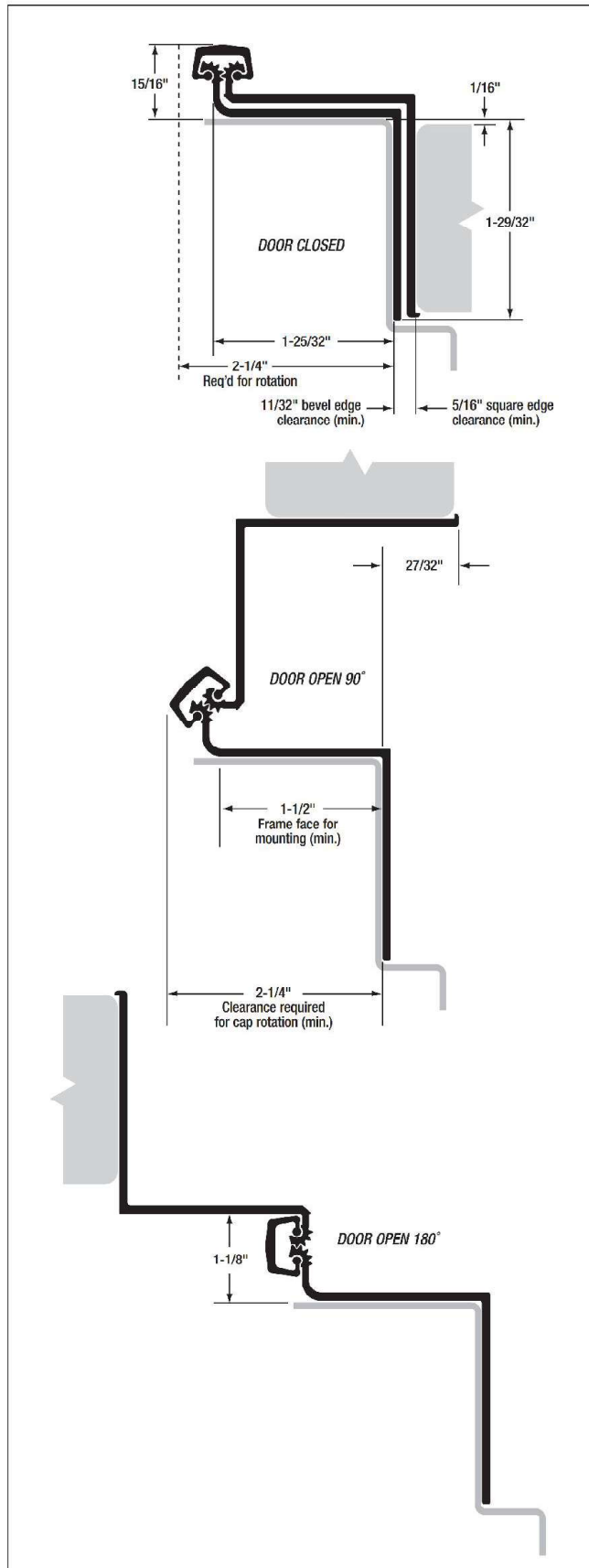




- Swing-clear action
- Door edge protector
- Requires 2-1/4" frame face for full rotation clearance
- 1/16" door inset
- For 1-3/4" doors







**MATERIAL:** Extruded 6063 T6 aluminum alloy with self-lubricating polyester thrust bearings.

**LENGTHS:** 83", 85", 95" and 120" lengths standard for nominal door heights. Custom lengths are available.

**LOAD/FREQUENCY RATINGS:** For 1-3/4" doors. 48" max. door width in 16 gauge hollow metal (min.) or 1/8" aluminum (min.).

**Heavy Duty** — Tested per BHMA standards. Up to 200 lb. doors (high-frequency) and up to 400 lb. doors (medium-frequency) without frame or door reinforcement; up to 600 lb. doors (low-frequency) with the use of Rivnuts in the frame and door.

**Heavy Duty (LL)** — Our HD hinge with additional fastener holes for low-frequency doors up to 1,000 lb., including most lead-lined doors. Rivnuts are recommended in the frame and door on extremely tall, extremely heavy or wide doors.

**FINISHES:** All SL41 hinges are stocked in Clear and Dark Bronze anodized aluminum. Custom anodized or painted finishes are available. Product painted or anodized in the field voids the SELECT hinge warranty.

**CLOSERS:** Conventional overhead surface, concealed sliding arm overhead or floor closers may be used with SELECT hinges. Pivot-type floor closers (with a fixed, conflicting center pivot) must be replaced.

**ORDER:** Specify length, finish and heavy duty (HD) or heavy duty with additional fastener holes (LL). Also, specify door and frame screw applications. 12-24 x 3/4" self-drilling, thread-forming 410SS Phillips undercut flathead screws are provided as a standard pack unless otherwise specified. Wood and thread-forming screws also available. Security screws optional at extra cost.

**AVAILABLE ELECTRIC PREPS:** EPT, EMS and CMG. For EPT prep on this hinge model, please consult factory for engineering approval.

**BHMA CERTIFICATION:** SL41HD and SL41LL geared continuous hinges conform to BHMA Standard ANSI/BHMA A156.26-2006 Grade 1.



SL41 HINGE SCREW COUNT		
HINGE LENGTH & DUTY RATING	DOOR SCREWS	FRAME SCREWS
83" HD	19	25
85" HD	19	25
95" HD	21	27
120" HD	23	29
83" LL	26	32
85" LL	26	32
95" LL	30	36
120" LL	34	40

## Flush bolts, strikes and coordinators

### Automatic flush bolts

# FB31P / FB31T / FB31B

### Top and bottom flush bolts - metal doors

- FB31P top and bottom bolts pair
- FB31T top bolt only
- FB31B bottom bolt only
- Only for use with metal doors
- Fully automatic—inactive door is latched, bolts are extended when active door closes, door is unlatched, bolts retract when active door is opened
- Low actuation forces—top bolt has no spring tension
- Non-handed
- Bolt throw is  $\frac{3}{4}$ " with a  $\frac{7}{8}$ " vertical adjustment
- Bolt backset is  $\frac{3}{4}$ "
- Standard rod length is 12", which is measured from the center of the flush bolt body to the bolt tip

### Specifications

Mounting hardware	▪ 8-32 X $\frac{3}{8}$ " UFPHMS
	▪ 10-12 X $1\frac{1}{4}$ " Plastic anchor
	▪ 6-32 X $\frac{3}{8}$ " FPHMS
	▪ 6 X $\frac{3}{4}$ " FPHSMS
	▪ 8 X 1" FPHSMS
	▪ 10 X 1" FPHSMS

Certifications	▪ Fits standard ANSI/BHMA A115.4 door frame preparations.
	▪ UL10C Listed (3 hour) fire doors 8'0" x 10'0" when both top and bottom bolt used

### Options

Optional rod lengths available for top bolt only on non-fire rated openings—18", 24", 36" and 48"

### Dimensions

Body size (Width x Length x Depth)	Guide size (Width x Length x Height x Thickness)	Strike size (Width x Length x Thickness)	Rub plate size (Width x Length x Thickness)
1" x 6 $\frac{3}{4}$ " x 2"	1" x $1\frac{27}{32}$ " x $\frac{27}{32}$ " x $\frac{3}{32}$ "	$\frac{15}{16}$ " x $2\frac{1}{4}$ " x $\frac{1}{16}$ "	$1\frac{1}{4}$ " x $1\frac{11}{16}$ " x $\frac{3}{64}$ "

### Finishes

BHMA	Description	Substrate	Finish
605	Bright brass	Brass	US3
606	Satin brass	Brass	US4
612	Satin bronze	Brass	US10
613	Oil rubbed bronze	Brass	US10B
BLK	Matte black	Stainless steel	—
629	Bright stainless steel	Stainless steel	US32
630	Satin stainless steel	Stainless steel	US32D

Custom finishes are available as engineering special, consult customer service.

### Additional accessories

- Security pin screws
- DP1 and DP2 dust proof strike, see page 167

Bottom  
bolt



Top  
bolt



# FB458

## Top or bottom bolts - metal doors

- When the active door is opened, the lever can be moved to the 'up' position, retracting the bolt and allowing the inactive leaf to be opened
  - When the inactive leaf is closed, the lever can be moved to the 'down' position, projecting the bolt into the strike and securely locking the inactive leaf
- Simplified installation in metal frames
  - Round bolt head requires only a punched hole
  - Use of strike optional
  - Special design of guide and flat sided bolt tip to prevent bolt rotation
- Non-handed
- Bolt tip  $\frac{1}{2}$ " diameter
- Bolt throw is  $\frac{3}{4}$ " with a  $\frac{7}{8}$ " vertical adjustment
- Bolt backset is  $\frac{3}{4}$ "
- Standard rod length is 12", which is measured from the center of the flush bolt body to the bolt tip

## Specifications

Mounting hardware	8-32 X 1" FPHMS
Certifications	UL10C Listed (3 hour) fire doors 8'0" X 10'0" (fire rated openings require top and bottom bolt)

## Options

Optional rod lengths available for top bolt only on non-fire rated openings—18", 24" for fire rated doors with AHJ approval, 36" and 48" for non-fire rated doors

## Dimensions

Body size (Width x Length x Depth)	Guide size (Width x Length x Height x Thickness)	Strike size (Width x Length x Thickness)
1" x 6 $\frac{3}{4}$ " x 1 $\frac{1}{8}$ "	1" x 2" x $\frac{5}{64}$ "	$\frac{15}{16}$ " x 2 $\frac{1}{4}$ " x $\frac{5}{64}$ "

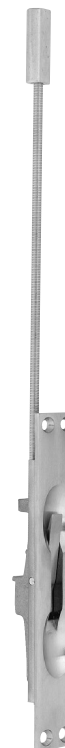
## Finishes

BHMA	Description	Substrate	Finish
605	Bright Brass	Brass	US3
606	Satin Brass	Brass	US4
609	Satin Brass, Blackened	Brass	US5
612	Satin Bronze	Brass	US10
613	Oil Rubbed Bronze	Brass	US10B
619	Satin Nickel	Brass	US15
622	Matte Black	Brass	BLK
625	Bright Chrome	Brass	US26
626	Satin Chrome	Brass	US26D
643e/716	Aged Bronze	Brass	—

Custom finishes are available as engineering special, consult customer service.

## Additional accessories

- DP1 and DP2 dust proof strike, see page 167

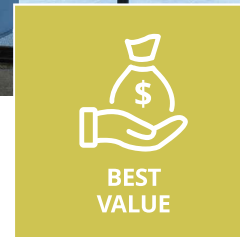


## CM-190 / 195 Series Automatic Door Toggle Switches



Camden's CM-190 and CM-195 Series maintained toggle switches are specifically designed for control of automatic door operators and are designed to be mounted on the door operator cabinet or wall.

The switches are rated for 50,000 cycles and are rated 6 amps @ 30 VDC.



### Features

- 2 Sizes, Mini and Single Gang
- Two or Three Position Switches
- Heavy Duty 6A Contacts
- Compatible with all Automatic Door Operators
- 3 Year Warranty

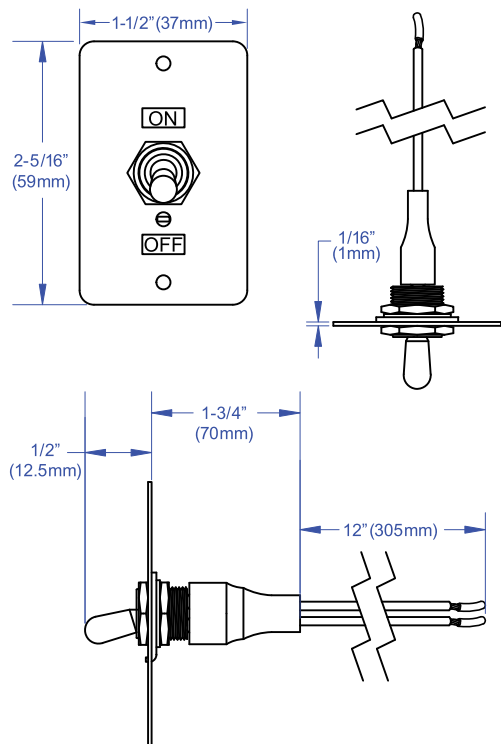


## SPECIFICATIONS

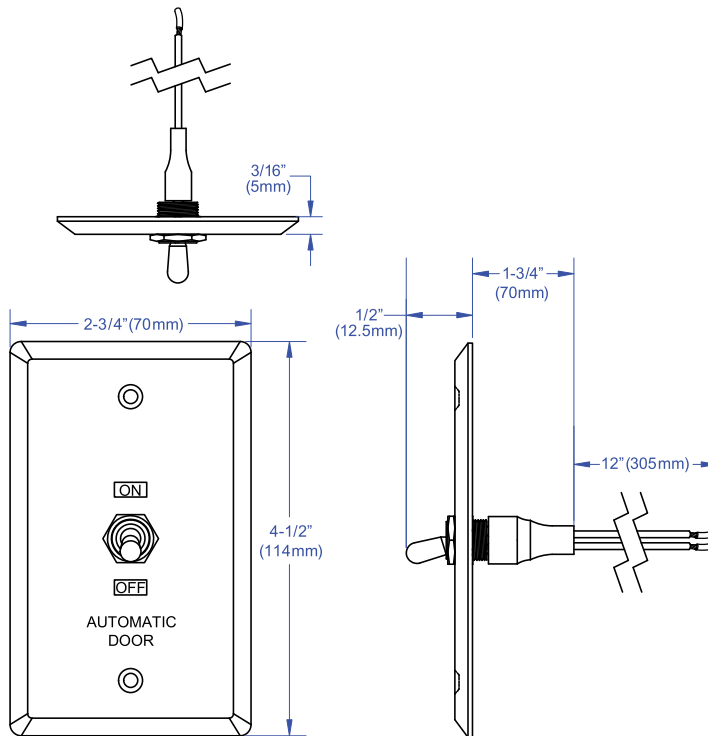
INPUT VOLTAGE: 12/24 VDC  
 CONTACT RATING: 6 A @ 30 VDC  
 SWITCH LIFE: 50,000 Cycles  
 TEMPERATURE RANGE: 4°F to 185°F (-20°C to 85°C)

DIMENSIONS: **CM-190**  
 1-1/2" W x 2-5/16" H x 1-3/4" D  
 (38mm x 59mm x 44mm)  
**CM-195**  
 2-3/4" W x 4-1/2" H x 1-3/4" D  
 (51mm x 114mm x 44mm)

## DIMENSIONS



CM-190



CM-195

## ORDERING INFORMATION



**CM-190**  
 Mini Aluminum Faceplate

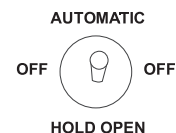


**CM-195**  
 Single Gang Stainless Steel Faceplate

## GRAPHIC OPTIONS (add suffix to model)



**CM-xx/30**



**CM-xx/31**

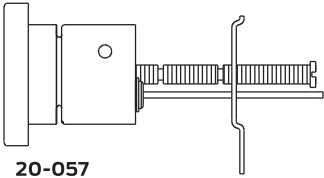
# FSIC cylinders to use with rim and mortise exit devices

Security	Key mechanism	Pins	Patent protected keyway families	Rim cylinders for exit devices	Mortise cylinders for Von Duprin and other straight cam applications	
				Core and housing	Cylinder with compression ring, spring and blocking ring	Cylinder with compression ring and spring
Basic security	Standard pin and tumbler	6	— <sup>1</sup>	20-057	20-061	26-091
	Open keyways	Check pin	S (Everest 29)			
Enhanced security	Check pin	6	T (Everest 29)	20-057	20-061	26-091
	Restricted use	SL	R (Everest 29)	91-170	91-173	91-171
Upgraded security	Legacy Primus	6	S, T (Everest 29)	20-757	20-771	20-763
	Primus level restricted use, geographic exclusivity, and independent sidebar	Primus RP	Obverse <sup>1</sup> (Classic)	20-757-RP	20-771-RP	20-763-RP
		Primus XP	S, T (Everest 29)	20-757-XP	20-771-XP	20-763-XP
		Primus XP SL	R (Everest 29)	91-870-XP	91-873-XP	91-871-XP
Housing less core				20-079	26-094	26-064

1. Out-of-patent keyways like Classic Obverse are available. Obverse, however, can gain patent protection in a Primus RP or XP cylinder. RP is recommended because patent coverage carries to 2029 versus 2024 for Primus XP.

Security	Key mechanism	Pins	Patent protected keyway families	Adams Rite MS, 4500 and 4700 Series, Lori 4500 Series, and Corbin Russwin DL3000 Series deadlocks/ deadlatches		Adams Rite 4070 deadbolt
				Cylinder with compression ring, spring and $\frac{3}{16}$ " plus $\frac{3}{8}$ " blocking rings	Cylinder with compression ring and spring	Cylinder with compression ring, spring and $\frac{3}{16}$ " plus $\frac{3}{8}$ " blocking rings
Basic security	Standard pin and tumbler	6	— <sup>1</sup>	20-062	26-098	20-091
	Open keyways	Check pin	S (Everest 29)			
Enhanced security	Check pin	6	T (Everest 29)	20-062	26-098	20-091
	Restricted use	SL	R (Everest 29)	91-174	91-172	91-175
Upgraded security	Legacy Primus	6	S, T (Everest 29)	20-766	--	20-722
	Primus level restricted use, geographic exclusivity, and independent sidebar	Primus RP	Obverse <sup>1</sup> (Classic)	20-766-RP	--	20-722-RP
		Primus XP	S, T (Everest 29)	20-766-XP	--	20-722-XP
		Primus XP SL	R (Everest 29)	91-874-XP	--	91-875-XP
Housing less core				20-060 <sup>2</sup>	--	20-090 <sup>2</sup>

1. Out-of-patent keyways like Classic Obverse are available. Obverse, however, can gain patent protection in a Primus RP or XP cylinder. RP is recommended because patent coverage carries to 2029 versus 2024 for Primus XP.  
2. Housing only - does not come with compression ring, spring, or blocking ring.



# The X Factor

Qualities defining a lock designed to exceed expectations

The Schlage ALX Series is a grade 2 lock unlike any other. As a modular lock, it features a single, patent pending chassis design that supports most functions and all cylinder applications. The lock's ability to be configured on site to meet the functional need let's you avoid problems. You can do more with less, giving you an unprecedented level of flexibility to every aspect of how you use it in your business.

## Extreme installation simplicity

- Accommodates 1 <sup>3</sup>/<sub>8</sub>" to 1 <sup>3</sup>/<sub>4</sub>" door thickness with minimal chassis adjustment
- Captured screws in latch, strike and inside spring cage eliminate small, loose parts

## Expansive lever offering

Perfectly suites with ND Series levers to offer 10 total lever designs



## Extra functionality

Field reversible Vandlgard® to non-Vandlgard locked lever engagement

## Exceptional durability

- Deep-drawn spindle with 5 points of lever engagement minimizes droop and wobble
- Grade 1 compression springs



## Next level parts management

The ALX Series gives you the advantage both on the job site and in the warehouse with flexible buying options. In its kitted form, the chassis is purchased separately from function and lever kits which are sold in convenient packs of five. Fewer unique parts means more space in your warehouse. There is also a special locksmith mix pack covering 10, 40, 50, 53 and 80 functions to help optimize truck stock.

Schlage ALX Series can be purchased as a configured lock...





## A detailed look...

### Maximum utility

One chassis fits all functions and cores to minimize inventory

### Expanded cylinder support

Accepts all Schlage plus five competitive cylinder formats

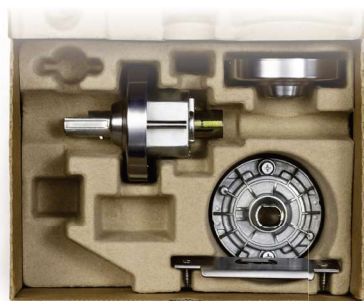
### Function flexibility

Patent pending chassis design allows quick, in-field function set up

### Exceeds Grade 2 strength expectations

Stainless steel latchbolt

or as configurable kits for warehouse and jobsite flexibility.



Chassis kits are chosen solely by desired finish. They are shipped non-Vandgard but can be field-configured for Vandgard functionality.



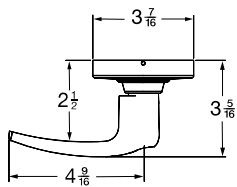
Function kits are sold in packs of five defined by function, finish, and latch backset. Locksmith assortment kits are available.



Levers are sold in five packs of same design with inside levers defined by function, finish and design, and outside levers by function/cylinder, finish and design.

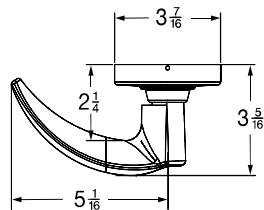
# Lever designs and finishes

Athens (ATH)



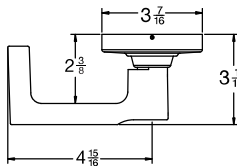
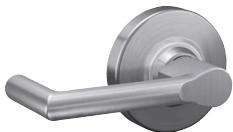
**Cores** KIL, FSIC, SFIC, L-SAR, L-CO6, J-SAR, J-CO6

Omega (OME)<sup>1,2</sup>



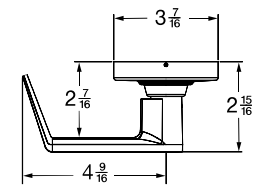
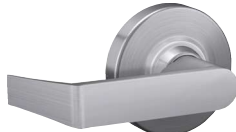
**Cores** KIL, FSIC, SFIC

Boardwalk (BRK)<sup>1</sup>



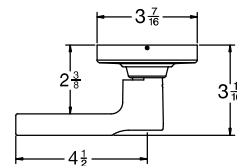
**Cores** KIL, FSIC, SFIC

Rhodes (RHO)<sup>1</sup>



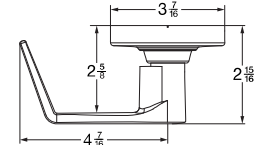
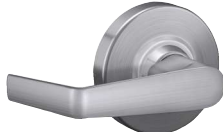
**Cores** KIL, FSIC, SFIC, L-SAR, L-CO6, J-SAR, J-CO6, J-CO7

Broadway (BRW)



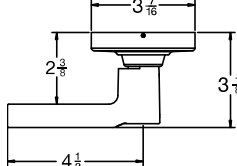
**Cores** KIL, FSIC, SFIC

Saturn (SAT)<sup>1</sup>



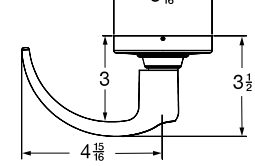
**Cores** KIL

Latitude (LAT)



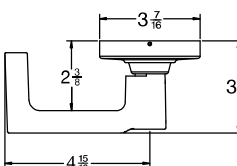
**Cores** KIL, FSIC, SFIC

Sparta (SPA)<sup>1</sup>



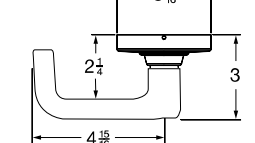
**Cores** KIL, FSIC, SFIC, L-SAR, L-CO6, J-SAR, J-CO6

Longitude (LON)<sup>1</sup>



**Cores** KIL, FSIC, SFIC

Tubular (TLR)<sup>1</sup>



**Cores** KIL, FSIC, SFIC, L-SAR, L-CO6, J-SAR, J-CO6

## Finish options





### Color

ANSI/BHMA number

Bright brass	Satin brass	Satin bronze	Oil rubbed bronze	Satin nickel	Matte black	Bright chrome	Satin chrome	Aged bronze
605	606	612	613	619	622	625	626/626AM <sup>3</sup>	643e

1. Boardwalk, Longitude, Omega, Rhodes, Saturn, Sparta and Tubular levers comply with California State code for return within 1/2" of door face.  
2. Omega levers not available for kit system orders.  
3. Antimicrobial finish option is not available for kit system orders.

Product information and specifications contained in this catalog are subject to change without notice. Please consult the factory.

<div>Schlage ALX Series functions can be created or changed in-field simply and quickly.</div>	Non-keyed functions				Keyed functions			
	Schlage		ANSI		Schlage		ANSI	
	10		F75		40		F76	
	Passage latch				Bath/bedroom privacy lock		Entrance/office lock	
	<ul style="list-style-type: none"><li>• No key; plain lever both sides; spring latch</li><li>• Both levers always unlocked</li></ul>				<ul style="list-style-type: none"><li>• No key; emergency access coin turn outside; push button inside; spring latch</li><li>• Inside push button locks outside lever</li><li>• Turn inside lever or close door to release button and prevent lock-out; outside coin turn provides emergency access</li><li>• Field selectable Vandlgard® feature</li><li>• Inside lever is always free for immediate egress</li></ul>		<ul style="list-style-type: none"><li>• Key cylinder outside; push button inside; deadlatch</li><li>• Inside push button locks outside lever</li><li>• Unlock with key outside or by rotating inside lever</li><li>• Field selectable Vandlgard® feature</li><li>• Inside lever always free for immediate egress</li></ul>	
	Outside		Inside		Outside		Inside	
								



# How to order

For correct ordering and to help ensure no delays in the shipment of your product, follow the information sequence below.

## Example: SCH-ALXV53P-RHO-613-47267051-10-013-T123

Brand	Product number			Trim				Door detail				Keyway	Handing	Other requirements
1	2	3	4	5	6	5	6	7	8	9	10	11	12	13
	Series	Func	Cylinder suffix	Outside Des	Inside <sup>1</sup> Fin	Outside Des	Inside <sup>1</sup> Fin	Latch part #	Strike part #	Door thickness	Extension	Keyway	Handing	Examples <sup>2</sup>
SCH	- ALXV	53	P6	- RHO	- 613	-	-	47267051	- 10-013	- N/A	- N/A	- T123	- N/A	-
SCH	- ALX	50	M	- RHO	- 626	- LON	- 622	-	-	- N/A	- N/A	- R123	- N/A	-

1. Inside design defaults to outside design unless specified.  
 2. Examples include: Competitive keyway cylinder part number and master keying requirements.

### Detail

- Brand:** Schlage=SCH
- Series:** ALX (for any lock function when Vandlgard lever engagement is not desired)  
ALXV (for functions 40, 44, 50, 53, 70 and 80 preset to Vandlgard lever engagement)
- Function:** Choose from function list on pages 8 and 9.
- Cylinder suffix:** Choose cylinder type
 

<b>P</b> 6-pin Conventional (keyed 5)	<b>R</b> 6-pin FSIC (full size)	<b>J-SAR</b> Less FSIC, made to fit Sargent 6300
<b>P6</b> 6-pin Conventional (standard)	<b>M</b> SL 7-pin FSIC (A2 pinning)	<b>G7</b> 7-pin SFIC (slide capping)
<b>Z</b> SL 7-pin Conventional (A2 pinning)	<b>T</b> Refundable construction FSIC	<b>BDC</b> Disposable construction SFIC
<b>L</b> Less Conventional cylinder	<b>J</b> Less FSIC	<b>H</b> Refundable construction SFIC
<b>L-CO6</b> Less cylinder, made to fit Corbin 2000-033	<b>J-CO6</b> Less FSIC, made to fit Corbin 8000	<b>B</b> Less SFIC
<b>L-SAR</b> Less cylinder, made to fit Sargent 10L, 11L	<b>J-CO7</b> Less FSIC, made to fit Corbin 8000-7	
- Outside/inside trim:** Indicate abbreviation of lever design. Fill in inside design if different. If knurled/milled tactile warning is desired preface code with the number 8. (8AT, 8BK, 8BW, 8LT, 8LN, 8RO, 8SP, or 8TR)
 

ATH Athens	LON Longitude	SAT Saturn
BRK Boardwalk	OME Omega	SPA Sparta
BRW Broadway	RHO Rhodes	TLR Tubular
LAT Latitude		
- Outside/inside finish:** Choose outside finish from available options. Fill in inside finish if different.
 

605 Bright Brass	619 Satin Nickel	626 Satin Chrome
606 Satin Brass	622 Matte Black	626AM Satin Chrome Antimicrobial
612 Satin Bronze	625 Bright Chrome	643e Aged Bronze
613 Oil Rubbed Bronze		
- Backset/latch part number:** Leave blank for standard latch or specify part number if non-standard latch is required.
- Strike part number:** Leave blank for standard strike or specify part number if non-standard strike is required.
- Door thickness:** Accommodates 1 3/8" through 1 3/4" doors without needing to be specified.
- Extension:** Not available.
- Keyway:** Everest 29 S123 is standard when ordering Conventional or FSIC cylinders; Everest 29 R123 is standard when ordering SFIC cylinders. Other keyways available.
- Handing:** Leave blank - ALX lever options are non-handed.
- Other requirements:**
  - Keying detail may include additional keys (with quantity) requests, large bow keys, master keying (example: Grand Master keyed, Master keyed, change key, etc.)
  - Orders specifying use of restricted keyways must be accompanied by appropriate authorizations

## Options for configured locks

## Latches

Schlage ALX Series latches accommodate flat or beveled edge doors, and are finished to match the lock trim. All ALX Series latches have 1/2" throw and 1" housings except the anti-friction fire door latch, which has a 3/4" throw. Please see the Schlage pricebook for more options including extended backset strikes (up to 5") and rabbited latch and strike kits.

### Grade 2, UL 10C listed for 3-hour fire door

	Specify	Backset	Description
Springlatch (Restoring unless noted otherwise)	47267038	2 3/4"	Square corner, 1 1/8" x 2 1/4", standard
	47267039	2 3/4"	Square corner, 1" x 2 1/4"
	47267041	2 3/4"	Radius corner, 1" x 2 1/4"
	47267046	2 3/8"	Square corner, 1 1/8" x 2 1/4"
	47267048	2 3/8"	Square corner, 1" x 2 1/4"
	47267050	2 3/8"	Radius corner, 1" x 2 1/4"
	47272024	2 3/4"	Square corner, 1 1/8" x 2 1/4", grade 1 fire and windstorm performance <sup>1</sup>
	14-010	3 3/4"	Square corner, 1 1/8" x 2 1/4", non-restoring <sup>1</sup>
Deadlatch (Non-restoring)	47267042	2 3/4"	Square corner, 1 1/8" x 2 1/4", standard
	47267043	2 3/4"	Square corner, 1" x 2 1/4"
	47267045	2 3/4"	Radius corner, 1" x 2 1/4"
	47267051	2 3/8"	Square corner, 1 1/8" x 2 1/4"
	47267052	2 3/8"	Square corner, 1" x 2 1/4"
	47267054	2 3/8"	Radius corner, 1" x 2 1/4"
	14-028	3 3/4"	Square corner, 1 1/8" x 2 1/4"
	13-247	2 3/4"	Square corner, 1 1/8" x 2 1/4", grade 1 fire and windstorm performance <sup>1</sup>
	14-042	2 3/4"	Square corner, 1 1/8" x 2 1/4", anti-friction fire latch <sup>1</sup>

1. 1" housing diameter only.

Note: Specify finish. All latches for ALX Series, with the exception of the 3/4" anti-friction fire latch, locks have a 1/2" latch projection.

## Strikes

Locks are furnished with a 1 1/4" x 4 7/8" ANSI strike unless otherwise specified. Many additional strike options are available, see price book for details.

	Specify	Lip length	Description
T-strikes	10-013	1 1/8"	Square corner with dust box, 1 1/8" x 2 3/4"
	10-016	1 1/8"	Square corner with deep dust box for 3/4" fire latch, 1 1/8" x 2 3/4"
ANSI strike	47267101	1 3/16"	No dust box, 1 1/4" x 4 7/8", standard
Less strike	LLL		
Dust box	K510-066	N/A	Box for ANSI strike, must be specified

## Cylinder options

### Conventional cylinders (Schlage keyways)

When ordering as part of a configured lock, specify cylinder suffix in the product number as directed on page 12. The "L" less cylinder option also requires that you note the desired cylinder part number under the "other requirements" section of the order string. For kitted product orders simply order desired part number(s) as individual line items.

Configured lock specification	Sold separate part number	Tailpiece only	Functions	Pins	Cylinder mechanism
P, P6	21-020	A700-031	50, 53, 80	5, 6	Pin and tumbler (standard)
	23-195	47270197	70		
Z	91-018	N523-022	50, 53, 80	7	SL cylinder (restricted Everest 29R or Everest B only)
	91-118	47270197	70		
L	20-765	N523-022	50, 53, 80	6	Primus
	20-685	47270197	70		
L	20-565	N523-022	50, 53, 80	6	Primus UL 437 (UL listed high security)
	20-566	47270197	70		
L	91-718-XP	N523-022	50, 53, 80	7	SL cylinder PrimusXP (restricted Everest 29R or Everest B only)
	91-118-XP	47270197	70		
L	20-765-XP	N523-022	50, 53, 80	6	Primus XP
	20-685-XP	47270197	70		
L	20-565-XP	N523-022	50, 53, 80	6	Primus XP UL 437 (UL listed high security)
	20-566-XP	47270197	70		

Note: Specify keyway and plug face finish when ordering as parts (606, 622, 626, or 643e).

### Interchangeable cores (Schlage keyways)

When ordering as part of a configured lock, specify cylinder suffix in the product number as directed on page 10. The "J" less cylinder option also requires that you note the desired cylinder part number under the "other requirements" section of the order string. For kitted product orders simply order desired part number(s) as individual line items.

Configured lock specification	Sold separate part number	Tailpiece only	Functions	Pins	Cylinder mechanism
R	23-030	N523-127	50, 53, 80	6	FSIC pin and tumbler (standard FSIC)
		47269168	70		
M	91-161	N523-127	50, 53, 80	7	FSIC Everest SL (restricted Everest 29R and Everest B only)
		47269168	70		
J	20-740	N523-127	50, 53, 80	6	Primus FSIC
		47269168	70		
J	91-861	N523-127	50, 53, 80	7	FSIC SL Primus (restricted Everest 29R and Everest B only)
		47269168	70		
T	23-030-ICX	N523-127	50, 53, 80	6	FSIC refundable construction core - color coded
		47269168	70		
G	80-037	N523-091	50, 53, 80	7	SFIC combined Everest 29 R family keyway (standard SFIC)
		47269620	70		
H	80-035	N523-091	50, 53, 80	7	SFIC refundable construction core - color coded
		47269620	70		

Note: Specify plug face finish when ordering as parts: 606, 622, 626 or 643e.

## ALX Series mechanical lock function list

Schlage ANSI

**53 F109**

### Entrance lock

- Key cylinder outside; push/turn button inside; deadlatch
- Inside button locks outside lever by pushing button or pushing and turning button
- Pushed button: unlock with key outside or by rotating inside lever
- Pushed/turned button: key outside retracts latch only; unlock by returning inside button to home position then using key or rotating inside lever
- Field selectable Vandlgard® feature
- Inside lever always free for immediate egress

Outside

Inside



Schlage ANSI

**80 F86**

### Storeroom lock

- Key cylinder outside; plain lever inside; deadlatch
- Outside lever always fixed
- Key can retract the latch
- Field selectable Vandlgard® feature
- Inside lever always free for immediate egress

Outside

Inside



As a grade 2 lock perfectly suited to the ND Series, ALX allows you to seamlessly suite between the two to gain grade 1 strength, security and functionality when needed.

### Non-keyed functions

Schlage	ANSI	ALX	ND	Function description
10	F75	■	■	Passage latch
12	F89		■	Exit lock
12EL			■	Exit lock - electrically locked (fail safe)
12EU			■	Exit lock - electrically unlocked (fail secure)
25			■	Exit lock (no exterior lever)
40	F76	■	■	Bath/bedroom privacy lock
44		■	■	Hospital privacy lock
170		■	■	Single dummy trim
172		■	■	Double dummy trim

### Keyed functions

Schlage	ANSI	ALX	ND	Function description
50	F82	■	■	Entrance/office lock
53	F109	■	■	Entrance lock
60	F88		■	Vestibule lock
66	F91		■	Store lock
70	F84	■	■	Classroom lock
73	F90		■	Corridor lock
75	F110		■	Classroom security lock
80	F86	■	■	Storeroom lock
80EL			■	Storeroom lock - electrically locked (fail safe)
80EU			■	Storeroom lock - electrically unlocked (fail secure)
82	F87		■	Institution lock
85	F93		■	Faculty restroom lock

### Special functions

Schlage	ANSI	ALX	ND	Function description
25 x 70			■	Classroom exit lock
25 x 80			■	Storeroom exit lock
30	F77		■	Patio lock
45			■	Time out lock (Vandlgard standard)
60			■	Vestibule with closed outside lever
70 x 80			■	Classroom by storeroom lock
72	F80		■	Communicating lock

■ Note: Functions denoted with black dots are also available with Vandlgard. ND Vandlgard functions may have a different order code.

Vandlgard® trim is specifically designed for highly abusive environments. The outside lever rotates freely up and down when locked, limiting the ability of vandals to apply excessive force to the chassis.



## CX-WC Series Barrier Free Restroom Control



**Camden Door Controls leads the industry with a range of packages designed specifically for the control of automatic doors in restroom applications.**

CX-WC Series barrier free restroom control kits include everything needed for a complete installation, including control relays, activation switches, annunciation, electric strikes and power supplies.

Camden kits also feature exclusive products not available elsewhere, including single gang LED annunciators with white-out text, Aura™ illuminated push plate switch enclosures, the option for touchless switches and a pre-wired power supply cabinet.



ADVANCED  
TECHNOLOGY



EXCLUSIVE  
PRODUCTS

### Features

- System kits updated to include all components; power supply, controller, activation switches, annunciation, door contact and electric strike.
- Exclusive products and features not available elsewhere.
- The widest range of design options for one or two door restrooms, including the option for touchless switch activation.
- Compatible with Camden 'CX-WEC' emergency call systems for universal restrooms.
- Specifically designed to meet the latest requirements of Ontario Reg. 368/13 Amendment to 2012 OBC for barrier free restrooms.
- 3 year warranty





# CX-WEC Series Emergency Call Systems For Universal & Barrier Free Restroom Control



Listed  
Components



Compliant

IN THE EVENT OF AN EMERGENCY  
PUSH EMERGENCY BUTTON  
AND AUDIBLE AND VISUAL SIGNAL  
WILL ACTIVATE



**Camden CX-WEC Series equipment kits include everything you need to meet the latest building code requirements for emergency call systems in Universal restrooms.**

CX-WEC Series Emergency Call System kits include 'PRESS FOR EMERGENCY ASSISTANCE' push button, audible and visual annunciators inside and outside the restroom, and instructional signage.

Next generation CX-WEC10BK2 Universal Emergency Call System kits include a double gang push button/annunciator and a CM-AF142SO multi-color dome light with sounder and flashing LED.



RESTROOMS



EXCLUSIVE  
PRODUCT



BEST QUALITY

## Features

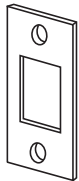
- Ideal for universal restrooms with or without low energy door operators.
- Annunciation inside and outside restroom with audible sound adjustment.
- Push/pull 'Press for Emergency Assistance' maintained mushroom push button, or with latching relay for use with momentary switches, including tape (ribbon) switches.
- New single gang multi-color LED dome light with sounder (Red, Green, Blue or White) is offered as an individual component or in the CX-WEC10BK2 emergency control kit.
- CX-WEC Series emergency call systems are available in English, French and Bilingual.
- Compatible with all Camden 'CX-WC' barrier free restroom control kits.
- 3 year warranty



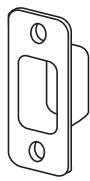
# Strikes

All B Series strikes are fully reversible for right handed and left handed doors, and are furnished complete with screws. Strike boxes are also included with all standard strikes. B Series deadbolt strikes are also packed with our exclusive wood frame reinforcer or a metal dust box reinforcer for added protection against “kick-in” attack.

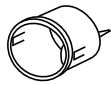
Standard strike



Strike box



Drive-in strike



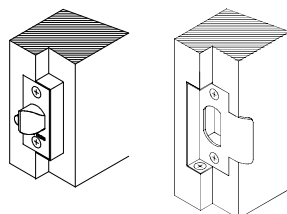
## Strikes for deadbolts

B500	B600	Number	Lip length	Description
	x	10-055	-	1 1/8" x 2 3/4" square corner, B600/700/800
x	x	10-064	-	1 3/16" circular drive-in
x	x	10-087	1 3/16"	1 1/4" x 4 7/8" ANSI
x	x	10-092	1 1/8"	1 5/8" x 2 1/4" radius round corner, no box
x	x	10-094	-	1 1/8" x 2 3/4" square corner, no box
x	x	10-095	1 1/8"	1 5/8" x 2 1/4" full lip, no box
x	x	B250-283	-	Box for 10-055, 10-094 and 10-108
x		10-104	-	1/4" round corner 1 1/4" x 3 5/8". 4 hole no reinforcement strike provided. 605, 609, 620, 650 only
x		10-108	-	1 1/8" x 2 3/4" round corner
x	x	10-103		1/4" round corner 1" x 2 1/4", no reinforcement strike provided. 605, 609, 630 only

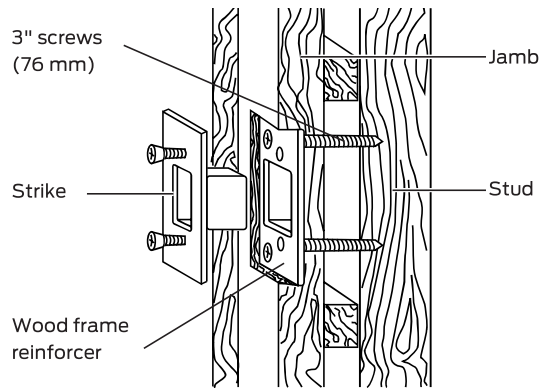
## Strikes for deadlatches

Number	Lip length	Description
10-001	1", 1 1/8", 1 1/4", 1 1/2", 1 3/16", 1 3/4"	1 1/8" x 2 3/4" square corner
10-004	1 1/8"	1 1/8" x 2 3/4" radius round corner
10-025	1 3/16", 1 3/8"	1 1/4" x 2 7/8" ANSI
C603-623	-	Box for T-strike
K510-066	-	Box for 10-025

Rabbeted latch and strike kit  
39-030



Wood frame reinforcer  
37-016



Furnished with standard and round corner deadbolt strikes, this reinforcer significantly strengthens a jamb against “kick-in” attack and greatly increases the security of the lock. The reinforcer is concealed under the strike and is anchored to the jamb with two 3" long screws. B500 Series metal dust box reinforcer anchors (B520-622) to jamb with three 3" screws.

## Thumbturn assemblies and inside plates



**B302-041**  
B560, B580, B581  
**B302-045**  
B563



**B202-672**  
B250 with  
holdback  
(standard)



**B202-671**  
B250 without  
holdback



**12-617**  
B660/760/860  
**12-618**  
B663/763/863



**12-626**  
B561/B661/  
761/861



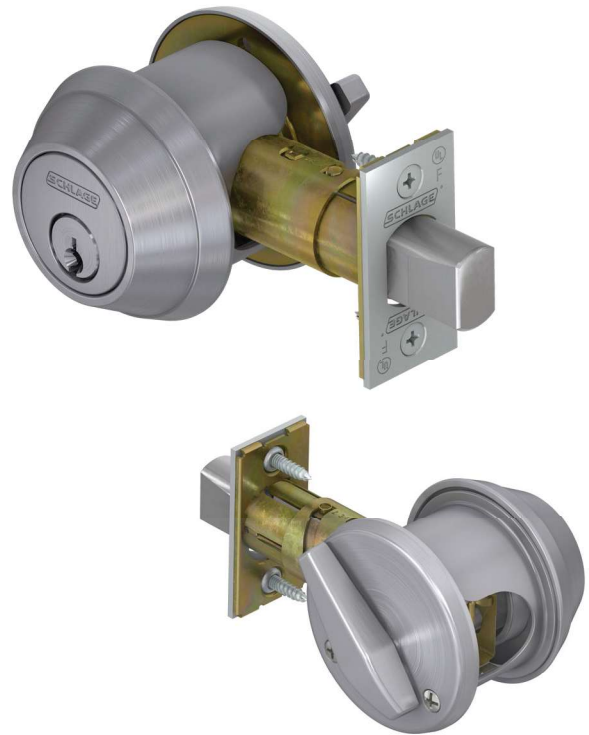
**38-034**  
Blank mounting  
plate kit for B581,  
B661, B761, B861

# B500 Series

## Grade 2 Deadbolt

### OVERVIEW

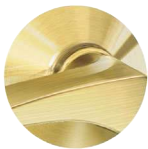
The B500 Series deadbolt from Schlage offers some of the toughest, most versatile Grade 2 deadbolts in the business. Designed by locksmiths for locksmiths, B500 Series can accept every Schlage cylinder format and fit virtually every door you service. It features enhanced lock strength on the jamb side of the door and is offered in most functions with optional single- or dual-sided lock status indicator trim options. Large window size and Schlage's patented 180-degree visibility will change forever the way you look at deadbolts.



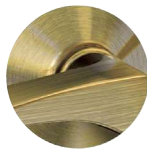
### FINISHES



605  
Bright Brass



606  
Satin Brass



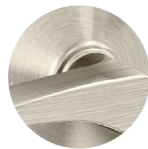
609  
Antique Bronze



612  
Satin Bronze



613  
Oil Rubbed  
Bronze



619  
Satin Nickel



622  
Matte Black



625  
Bright Chrome



626  
Satin Chrome



626AM  
Satin Chrome  
Antimicrobial



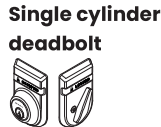
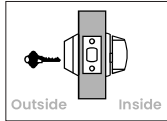
643e  
Aged Bronze

e = an equivalent finish to the BHMA standard.



## LOCK FUNCTIONS

**Schlage**  
**B560/B560F**

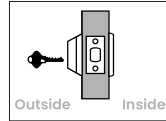


- Key cylinder outside; thumbturn inside
- Deadbolt thrown or retracted by key outside or thumbturn inside
- When installed with optional lock status indicator trim, in unlocked state message displays on white background; in locked state on red background

To order configured with indicator specify function and note indicator code as a special option

**ANSI**  
**E0152**

**Schlage**  
**B561/B561F**

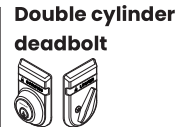
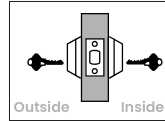


- Key cylinder outside; blank plate inside
- Deadbolt thrown or retracted by key outside
- When installed with optional lock status indicator trim, in unlocked state message displays on white background; in locked state on red background

To order configured with indicator specify function and note indicator code as a special option.

**ANSI**  
**E0162**

**Schlage**  
**B562**



- Key cylinder both sides
- Deadbolt thrown or retracted by key from either side
- When installed with optional lock status indicator trim, in unlocked state message displays on white background; in locked state on red background

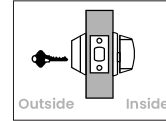
Caution: Double cylinder locks on any door, in any structure which is used for egress are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

Note: This function cannot be ordered UL 10C fire rated.

To order configured with indicator specify function and note indicator code as a special option.

**ANSI**  
**E0142**

**Schlage**  
**B563/B563F**

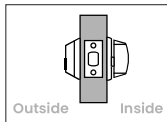


- Key cylinder outside; thumbturn inside
- Deadbolt thrown or retracted by key outside
- Thumbturn inside can only retract deadbolt
- When installed with optional lock status indicator trim, in unlocked state message displays on white background; in locked state on red background

To order configured with indicator specify function and note indicator code as a special option.

**ANSI**  
**E0172**

**Schlage**  
**B572/B572F**

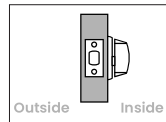


- Coin turn outside; thumbturn inside
- Deadbolt thrown or retracted by thumbturn inside
- A flat screwdriver inserted in the coin turn outside can also retract deadbolt
- When installed with optional lock status indicator trim, in unlocked state message displays on white background; in locked state on red background

To order configured with indicator specify function and note indicator code as a special option.

**ANSI**  
**-**

**Schlage**  
**B580/B580F**

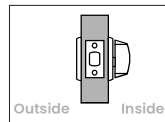


- No outside trim; thumbturn inside
- Deadbolt thrown or retracted by thumbturn inside

Note: 1-1/2" bore only.

**ANSI**  
**E0192**

**Schlage**  
**B581/B581F**



- Blank plate outside; thumbturn inside
- Deadbolt thrown or retracted by thumbturn inside
- When installed with optional lock status indicator trim, in unlocked state message displays on white background; in locked state on red background

To order configured with indicator specify function and note indicator code as a special option.

**ANSI**  
**E01112**

## CYLINDERS

### Conventional cylinder

P6	6-pin cylinder (default) with Schlage logo
P	6-pin cylinder, keyed 5
Z	Everest SL cylinder, 7-pin (A2 pinning) with Schlage logo
L	Less conventional cylinder

### Full size interchangeable core (FSIC)

R	6-pin FSIC with Schlage logo
M	Everest SL FSIC, 7-pin (A2 pinning) with Schlage logo
J	Less FSIC
T	Refundable FSIC construction core

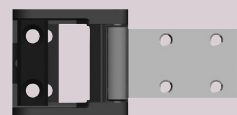
### Small format interchangeable core (SFIC)

G	7-pin SFIC (A2 pinning) with Schlage logo
B	Less SFIC
BDC	Disposable SFIC construction core
H	Refundable SFIC construction core

## Nomenclature – how to order

		EL	33	27A	-L	-16	-F	LBR	3'	US3	RHR
<b>CD</b>	Cylinder dogging - panic only										
<b>CX</b>	Chexit delayed egress										
<b>EL</b>	Electric latch retraction										
<b>HD-EL</b>	Electric latch retraction with hex dogging										
<b>QEL</b>	Quiet electric latch										
<b>HH</b>	Hurricane										
<b>LD</b>	Less dogging										
<b>LX</b>	Latchbolt monitoring										
<b>LX-LC</b>	Latch bolt monitor low current										
<b>LX-RX</b>	Latchbolt monitor / request to exit										
<b>LX-RX-LC</b>	Latchbolt monitor / request to exit low current										
<b>PL</b>	Pullman latch										
<b>PN</b>	Pneumatic										
<b>RX</b>	Request to exit										
<b>RX-LC</b>	Request to exit low current										
<b>RX2</b>	Request to exit double switch										
<b>SS</b>	Signal switch										
<b>AX</b>	Accessible device										
<b>WP-RX</b>	Waterproof request to exit										
<b>35A</b>	Series 35A-smooth										
<b>33A</b>	Series 33A-grooved										
<b>A</b>	Rim device										
<b>27A</b>	Surface mounted vertical rod device										
<b>47A</b>	Concealed vertical rod device										
<b>48A</b>	Concealed vertical rod device										
<b>49A</b>	Concealed vertical cable device										
<b>DT</b>	Dummy trim										
<b>EO</b>	Exit only										
<b>L</b>	Lever (classroom)										
<b>L-BE</b>	Lever-blank escutcheon (passage)										
<b>L-DT</b>	Lever-dummy trim										
<b>NL</b>	Night latch (key retracts latchbolt)										
<b>NL-OP</b>	Night latch cylinder assembly – optional pull										
<b>T</b>	Thumbturn										
<b>TL</b>	Turn Lever										
<b>T-BE</b>	Thumbturn-blank escutcheon										
<b>TL-BE</b>	Turn Lever-blank escutcheon (Passage)										
<b>XX</b>	Lever Style 06 standard Optional 01, 02, 02KN, 03, 03KN, 05, 06KN, 07, 12 (handed), 16, 17, 17KN, 18, ACC, AST, MER, STA										
<b>F</b>	Fire Exit Device - Rim, 27A, 47A, 48A, 49A Only										
<b>LBR</b>	Less Bottom Rod										
<b>LBL</b>	Less Bottom Latch										
<b>ALK</b>	Standard Alarm Kit										
<b>CON</b>	Allegion Connect										
<b>2'</b>	2' Device (2' Door Size) 27A, 47A or 49A only										
<b>3'</b>	3' Device (2' 4"– 3' Door Size)										
<b>4'</b>	4' Device (2' 10"– 4' Door size)										
<b>Finishes</b>	US3, US4, US10, US15 (35A only), US26, US26D, US26D-AM, US28, 313, 315										
<b>HR</b>	Handing – RHR or LHR										

## 33A/35A Rim device



**1439 Roller** ships standard, optional strikes available



**299 Strike** needs to be specified for Hollow Metal Frames

**33A and 35A** for all types of single and double doors with mullion, UL listed for panic exit hardware. Devices are ANSI A156.3 – 2014 Grade 1. The 35A has a smooth mechanism case and the 33A has grooved case. The rim device is non-handed except when the SS (signal switch) option is used. See opposite page for available outside trim and device functions.

33A/35A fits door stiles as narrow as 1 3/4" (44mm). Newly designed device has a one piece center case cover.

**Finishes** – US3, US4, US10, US15 (35A Only) US26, US26D, US26D-AM, US28, 313 and 315.

### Specifications

Device lengths	3' 2' 4" to 3' (711mm to 914 mm) Door size 4' 2' 10" to 4' (864 mm to 1219 mm) Door size
Device centerline from finished floor	39 13/16" (1011 mm) 39 11/16" (1008 mm) with Mullion
Center case dimensions	8 3/16" x 1 9/16" x 2 13/32" (208mm x 40mm x 62mm)
Mechanism case dimensions	2 1/4" x 2 1/4" (57mm x 57mm)
Projection	Pushbar Neutral – 3 13/16" (97 mm) Pushbar Depressed – 3 1/16" (78 mm)
Latch bolt	Deadlocking, 3/4" (19mm) throw
Fasteners & sex bolts (SNB)	Includes 1 3/4" (44mm) – 2 1/4" (57mm) wood & metal doors #425 SNB furnished standard for end case #325 SNB furnished standard for EO (exit only device)
Electric options	<b>ALK</b> Alarm kit <b>CX</b> Chexit delayed exit <b>EL</b> Electric latch retraction <b>HD-EL</b> Electric latch retraction with hex dogging <b>QEL</b> Quiet electric latch retraction <b>RX</b> Request to exit, WP-RX waterproof option <b>LX</b> Latchbolt monitoring <b>LX-RX</b> Request to exit / latchbolt monitoring <b>RX-LC, LX-LC, LX-RX-LC</b> Low current option for RX, LX, LX-RX <b>SS</b> Signal switch <b>CON</b> Allegion Connect
Mechanical options	<b>AX</b> Accessible device
Miscellaneous options	<b>GBK</b> Glass bead kit <b>PN</b> Pneumatic <b>SG</b> Safety glow <b>SEC</b> Security screws <b>SNB</b> Sex bolts
Dogging feature	<b>Hex Dogging standard</b> <b>CD</b> Cylinder dogging <b>LD</b> Less dogging
Strikes	<b>1439</b> – Dull black <b>Optional strikes</b>

**QEL**  
**Quiet electric latch retraction**

- Bolt retraction via switch
- Converts exit door to push-pull operation

**AX**  
**Accessible device**

- UL certified to meet new 5 lb. maximum operating force requirement
- Exceeds ANSI/BHMA requirements

**CX**  
**Chexit delayed exit**

- Meets NFPA 101 requirements
- Self-contained controls, locking, alarm

**ALK**  
**Alarm exit kit**

- Unauthorized opening triggers 85-decibel horn
- Set in armed or disarmed mode by key

**EL**  
**Electric latch retraction**

- Enables remote unlatching
- Alternative to manual dogging

**RX**  
**Pushpad monitor switch**

- Signals use of an opening
- SPDT switch to monitor pushpad

**E (E360L)**  
**Electric lever trim**

- Electrified remote locking/unlocking
- Fail safe & fail secure options available
- No key override

**CON**  
**Allegion Connectors**

- Common connectors to connect various door hardware all the way to the power supply

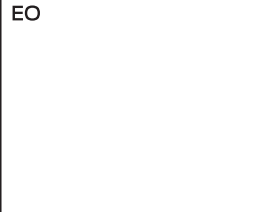



**PN**  
**Pneumatic latch retraction**





- For areas where electrical devices banned
- Special linkage for mechanical or pneumatic dogging

**CD**  
**Cylinder dogging**

- Replaces hex key dogging
- Requires standard 1 1/4" mortise cylinder

## Standard trim

	EO  <b>No outside trim</b> Exit only	DT  <b>Dummy trim</b> Pull when dogged	NL  <b>Night latch</b> Key retracts latchbolt	NL-OP  <b>Night latch</b> Key retracts latchbolt optional pull required
Product description	33A-EO 35A-EO	33A-DT 35A-DT	33A-NL 35A-NL	33A-NL-OP 35A-NL-OP
Trim description	—	386DT	386NL	388
Base size	—	7 <sup>15</sup> / <sub>32</sub> " x 1 <sup>5</sup> / <sub>8</sub> " (190x41mm)	7 <sup>15</sup> / <sub>32</sub> " x 1 <sup>5</sup> / <sub>8</sub> " (190x41mm)	7 <sup>1</sup> / <sub>2</sub> " x 1 <sup>11</sup> / <sub>16</sub> " (190x43mm)
Grip size	—	8 <sup>1</sup> / <sub>2</sub> " x 4 <sup>5</sup> / <sub>16</sub> " (216x110mm)	8 <sup>1</sup> / <sub>2</sub> " x 4 <sup>5</sup> / <sub>16</sub> " (216x110mm)	—
Projection	—	2 <sup>7</sup> / <sub>16</sub> " (62mm)	2 <sup>7</sup> / <sub>16</sub> " (62mm)	1" (25mm)
ANSI function	01	02	03	03
Cylinder type	—	—	Rim	Rim
Handing	—	—	Handed	—
Optional trim	—	x360L-DT x550DT x IVES 8190	—	x550DT x IVES 8190 10"

	L  <b>Lever</b> Key Locks and Unlocks	L-BE  <b>Lever Blank Escutcheon</b> Always Operable (No Cylinder)	T  <b>Thumbturn</b> Key Locks and Unlocks	T-BE  <b>Thumbturn</b> Always Operable (No Cylinder)
Product description	33A-L 35A-L	33A-L-BE 35A-L-BE	33A-T 35A-T	33A-T-BE 35A-T-BE
Trim description	360L	360L-BE	360T	360T-BE
Base size	7 <sup>1</sup> / <sub>2</sub> " x 1 <sup>11</sup> / <sub>16</sub> " x 7 <sup>7</sup> / <sub>8</sub> " (190x43x22mm)	7 <sup>1</sup> / <sub>2</sub> " x 1 <sup>11</sup> / <sub>16</sub> " x 7 <sup>7</sup> / <sub>8</sub> " (190x43x22mm)	7 <sup>1</sup> / <sub>2</sub> " x 1 <sup>11</sup> / <sub>16</sub> " x 7 <sup>7</sup> / <sub>8</sub> " (190x43x22mm)	7 <sup>1</sup> / <sub>2</sub> " x 1 <sup>11</sup> / <sub>16</sub> " x 7 <sup>7</sup> / <sub>8</sub> " (190x43x22mm)
Grip size	—	—	—	—
Projection	3" (76mm)	3" (76mm)	1 <sup>13</sup> / <sub>16</sub> " (46mm)	1 <sup>13</sup> / <sub>16</sub> " (46mm)
ANSI function	08 or 09 field selectable	—	11 or 12 field selectable	—
Cylinder type	1 <sup>1</sup> / <sub>4</sub> " Mortise	—	1 <sup>1</sup> / <sub>4</sub> " Mortise	—
Handing	Handed/Reversible	Handed/Reversible	—	—
Optional trim	—	E360L-BE	—	E360T-BE

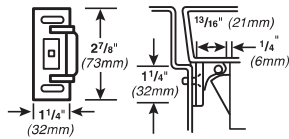
**Note:** 360L & 360T used on wood door require the 33A-WDA cover plate

## Notes

# 33A/35A Strike/Stile information

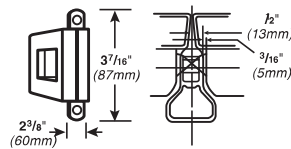
## Strikes for rim devices

299



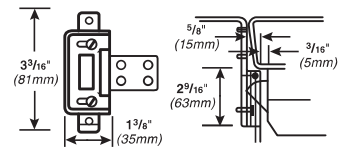
Projection  $\frac{13}{16}$ " (21mm)

1408



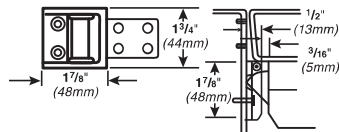
One per pair of doors - use with 5754 Mullion only

1410 — Integral stop



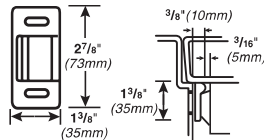
Projection  $\frac{1}{2}$ " (13mm)

1439



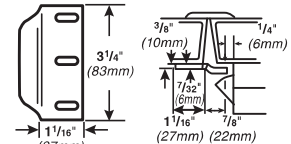
Projection  $\frac{1}{2}$ " (13mm)

1606



Projection  $\frac{3}{8}$ " (10mm)

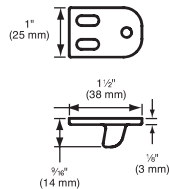
1609



For rim/vertical rod combination -not fire rated

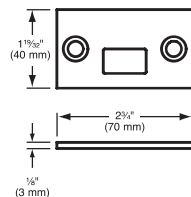
## Strikes for vertical cable devices

249 - Top strike



Projection  $\frac{9}{16}$ " (14mm)

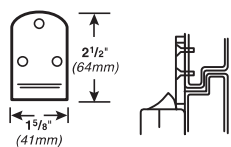
349 - Bottom strike



Projection  $\frac{1}{8}$ " (3mm)

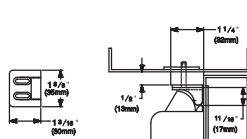
## Strikes for vertical rod devices

260U-Flush transom only



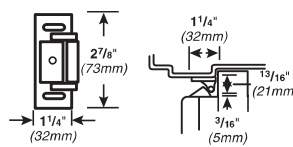
Projection  $\frac{3}{8}$ " (10mm)

266



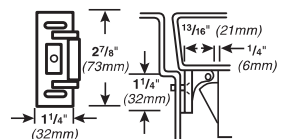
Projection  $1 \frac{1}{4}$ " (32mm)

299



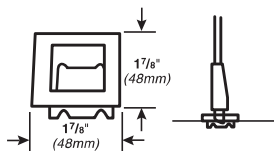
Projection  $\frac{13}{16}$ " (21mm)

299F



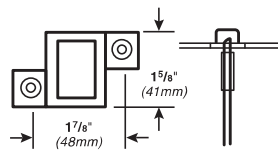
Projection  $\frac{13}{16}$ " (21mm)

304L



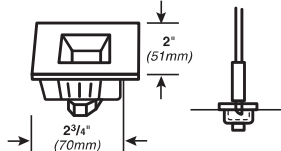
Mortise  $\frac{13}{16}$ " (21mm)

338



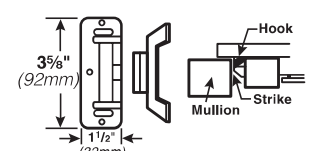
Mortise  $\frac{5}{8}$ " (16mm)

385A



Mortise  $2 \frac{1}{2}$ " (64mm)

499F



Projection  $\frac{13}{16}$ " (21mm)

## 33A/35A Mechanical options

### Dogging options

#### LD Less dogging

Less Dogging is available in all 33A/35A Panic Exit devices to remove the dogging option.

**To order, specify:** 1. Use prefix LD, example LD33AL

#### CD Cylinder dogging

Cylinder dogging is available on all 33A/35A Panic Exit devices to replace the standard hex key dogging. Unit requires a standard 1<sup>1</sup>/<sub>4</sub>" (32mm) mortise cylinder with a straight cam (Schlage Cam B502-191 reference).

**To order, specify:** 1. Use prefix, CD, example CD33AL

#### CDK Cylinder dogging kit

For field conversion, a cylinder dogging conversion kit is available. Cannot be added to fire exit hardware.

**Order:** 33A/99CDK or 35A/98CDK, specify finish



#### Dummy pushpad

The 330 dummy pushpad is designed as a companion unit for all 33A devices. The 350 dummy pushpad is a companion unit for all 35A devices. The pushpad is rigid or nonfunctioning. A push/pull operation can be accomplished by using 386DT, 360L-DT, 550DT, 392-6 trim or any Ives Pull.

The 330/350 can be equipped with a functional pushpad and will accommodate an RX switch. Specify RX-330. May also be equipped with the RX2, double RX switch. Specify RX2-330

#### To order, specify:

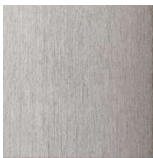

1. 330 or 350
2. Size 3' or 4' (914mm or 1219mm)
3. Finish, US3, US4, US10, US26, US26D, US28, 313AN, 315AN, 350 Only US32D.

## 33A/35A Finishes

### Finishes\*

	Color	US number	BHMA number
	Chromium, polished	US26	625
	Anodized, aluminum	US28	628
	Chromium, dull	US26D	626
	Brass, polished	US3	605
	Brass, dull	US4	606

### Special finishes

	Color	US number	BHMA number
	Satin chrome, Antimicrobial	US26D-AM	626-AM
	Satin stainless steel, antimicrobial	US32D-AM	630-AM

	Color	US number	BHMA number
	Bronze, dull	US10	612
	Satin nickel Available for 35A ONLY	US15	619
	Satin stainless steel	US32D	630
	Duranodic dark bronze	313	710
	Black, painted (not flat powder)	SPBLK	693
	Flat Black	US19/315	622/711
	Aged bronze	—	643e

### Pushpad Options — Knurled

Embossed "Push"

Braille (Caution-Stairwell), satin stainless steel only

RSS — (Emergency Exit — Push to open and sound alarm) — Red Silkscreen lettering on US32D

\* **NOTE:** Durable powder coated finishes available at specific special request. PLEASE CONTACT FACTORY.



## Mechanical options

### Push pads

#### Dummy push pad



The 330 dummy push pad is designed as a companion unit for all 99 devices. The 350 dummy push pad is a companion unit for all 98 devices. The push pad is rigid or nonfunctioning. A push/pull operation can be accomplished by using 990DT, 996DT trim or any Ives Pull.

The 330/350 can be equipped with a functional push pad and will accommodate an RX or WP-RX switch. Specify RX-330.

May also be equipped with the RX2, double RX switch.

#### To order, specify:

1. 330 or 350.
2. Size 3' or 4' (914mm or 1219mm)
3. Finish – 605, 606, 612, 625, 626, 628, 710 and 622/711. (630 – 350 only)
4. Specify RX, WP-RX or RX-2 if desired.

#### Safety glow (SG)



Self-illuminating touchpad defines the location of the exit door in dark or smoke-filled area. The safety glow coating is a special powder coat finish that glows brightly during low or no light conditions. This coating was developed to meet MEA standards where luminescent exit door markings are required in commercial facilities. There are no batteries or electronics, the coating is charged when exposed to light.

**To order, specify:** Suffix SG, EL 9927L-SG

#### Red silk screen (RSS)



Red silkscreen lettering on touchpad trim. - "Emergency Exit Only, Push To Open And Sound Alarm". This comes standard on RSS devices.

**To order, specify:** Suffix RSS, 9927L-RSS RHR

#### Braille, embossed and knurled touchpads



\* Image shown is a special order.

Braille touchpad embossed with the standard message "CAUTION STAIRWELL" in braille and raised letters provides assistance to persons with impaired vision. Letters are  $\frac{1}{2}$ " (13mm) high and braille is #2, raised height is  $\frac{3}{32}$ " (2mm). Other messages are available on special order, limited to 20 characters per line.\* **To order, specify:** Suffix BR, EL9927L-BR.

Embossed touchpad is embossed with the word "PUSH". **To order, specify:** Suffix EMB, EL9927L-EMB.

Knurled touchpad is to provide warning to persons with impaired vision. **To order, specify:** Suffix PBKN, EL9927L-PBKN.

\*Consult factory for availability.

## Nomenclature – how to order

Prefix	Device series/type		Trim/rating		Suffix/finish		Door width	Handing	Less bottom rod/cable	Trim options/finish	Lever style	Accessories	Other information													
1	2	3	4	5	6	7	8	9	10	11	12	13	14													
QEL	-	98	-	27	-	L	-	F	-	—	-	626	-	3'	-	RHR	-	LBR	-	996/626	-	299F/06	-	SNB	-	HM

## Detail

## 1 Prefixes

<b>None</b>	Standard
<b>AX</b>	Accessible device
<b>CD</b>	Cylinder dogging - panic only
<b>CDSI</b>	Cylinder dogging with security indicator
<b>CI</b>	Cylinder dogging indicator
<b>CD-CX</b>	Chexit cylinder dogging
<b>CX</b>	Chexit
<b>DI</b>	Dogging indicator
<b>E</b>	Electric locking mortise/lever
<b>EL</b>	Electric latch retraction
<b>ESL</b>	Emergency secure lockdown
<b>HDSI</b>	Hex dogging with security indicator
<b>HH</b>	Hurricane device
<b>LD</b>	Less dogging
<b>LX</b>	Latch bolt monitoring
<b>LX-LC</b>	Latch bolt monitoring, low current
<b>LX-RX</b>	Latch bolt monitoring, request to exit
<b>LX-RX-LC</b>	Latch bolt monitoring, request to exit low current
<b>PL</b>	Pullman latch
<b>PN</b>	Pneumatic latch retraction
<b>QEL</b>	Quiet electric latch retraction
<b>QM</b>	Quiet mechanical
<b>RX</b>	Request to exit
<b>RX2</b>	Double request to exit
<b>RX-AUX</b>	Request to exit, auxiliary
<b>RX-LC</b>	Request to exit, low current
<b>SD</b>	Special dogging -panic only
<b>SS</b>	Signal switch
<b>WP-RX</b>	Waterproof request to exit
<b>WS</b>	Windstorm (FEMA rated) surface vertical rod device
<b>XP</b>	Heavy protection - rim

## 2 Device series

<b>98</b>	Series 98-smooth
<b>99</b>	Series 99-grooved

## 3 Device type

<b>None</b>	Rim device
<b>27</b>	Surface mounted vertical rod device
<b>47</b>	Concealed vertical rod device
<b>47WDC</b>	Concealed vertical rod wood door device
<b>48</b>	Concealed vertical rod device
<b>49</b>	Concealed vertical cable device
<b>50WDC</b>	Concealed vertical cable wood door device
<b>52</b>	Rim device with remote trim input (pool exit hardware)
<b>57</b>	Three-point latch device
<b>75</b>	Mortise lock device

## 4 Trim functions

<b>EO</b>	For AD or CO locks, order the panic as Exit Only (EO)
<b>DT</b>	Dummy trim
<b>EO</b>	Exit only
<b>HL</b>	Hospital pull trim
<b>K</b>	Knob
<b>K-BE</b>	Knob - blank escutcheon
<b>K-DT</b>	Knob, rigid - dummy trim
<b>K-NL</b>	Knob, rigid - night latch
<b>L</b>	Lever (classroom)
<b>L-BE</b>	Lever - blank escutcheon
<b>L-DT</b>	Lever, rigid - dummy trim
<b>L-NL</b>	Lever, rigid - night latch
<b>NL</b>	Night latch
<b>NL-OP</b>	Night latch cylinder assembly, optional pull
<b>TL</b>	Turn lever
<b>TL-BE</b>	Turn lever - blank escutcheon
<b>TP</b>	Thumbpiece
<b>TP-BE</b>	Thumbpiece - blank escutcheon

## 5 Rating

<b>F</b>	Fire exit hardware
<b>Blank</b>	Panic exit hardware

## 6 Suffix

<b>-2</b>	Double cylinder (rim and mortise only)
<b>-2SI</b>	Double cylinder with security indicator (rim only)
<b>CON</b>	Connectors
<b>WH</b>	Weep holes

## 7 Finish

<b>605</b>	Bright Brass
<b>606</b>	Satin Brass
<b>612</b>	Satin Bronze
<b>619</b>	Satin Nickel
<b>622/711</b>	Matte Black/Matte Black, Anodized
<b>625</b>	Bright Chrome
<b>626</b>	Satin Chrome
<b>626AM</b>	Satin Chrome, Antimicrobial
<b>628</b>	Aluminum, Anodized
<b>630</b>	Satin Stainless
<b>630AM</b>	Satin Stainless, Antimicrobial
<b>643e</b>	Aged Bronze
<b>693</b>	Black Paint
<b>710</b>	Dark Brown, Anodized

## 8 Door width

<b>3'</b>	Standard default	<b>1 3/4"</b>	Standard
<b>4'</b>		<b>2 1/4"</b>	Optional
<b>2'</b>	Vertical only		

## Door thickness

## 9 Handing

<b>LHR</b>	Left hand reverse
<b>RHR</b>	Right hand reverse

## 10 Less bottom rod/cable

<b>LBR</b>	Less bottom rod
<b>LBL</b>	Less bottom latch
<b>LBR-AFL</b>	LBR with fire pin
<b>LBL-AFL</b>	LBL with fire pin

## 11 Trim options/finish

See trim options/finish for each device type

## 12 Lever style

<b>06</b>	Standard default (optional levers available)
-----------	--

## 13 Accessories

<b>CYL</b>	Cylinder
<b>GBK</b>	Glass bead kit
<b>SEC</b>	Security screws
<b>SLM</b>	SLM blocking
<b>SNB</b>	Sex bolts

## 14 Other information

## Touchbar options

<b>BRAILLE</b>	Vision impaired touchpad, raised letter, and braille
<b>PUSH</b>	Touchbar trim embossed 'PUSH'
<b>RSS</b>	Red silk-screened lettered touchbar trim
<b>KN</b>	Knurled touchbar
<b>SG</b>	Safety glow

## Miscellaneous

<b>CE</b>	CE labeled
<b>LCP</b>	Less cover plate
<b>IOWDA</b>	#IOWDA cover plate
<b>RAT REL</b>	Ratchet release assy

## Door material

<b>AL</b>	Aluminum door
<b>HM</b>	Hollow metal
<b>WD</b>	Wood door
<b>CP</b>	Composite door
<b>INS2</b>	Insulclad - 1/2"
<b>INS4</b>	Insulclad - 1/4"
<b>SC</b>	Steelcraft, HH device only

## Door application

<b>D</b>	Double egress
<b>P</b>	Pair of doors
<b>S</b>	Single door

Note: Not all options are listed. See the specific device type pages for complete options available.

## Device types

# 9827-F/9927-F Surface mounted vertical rod fire device

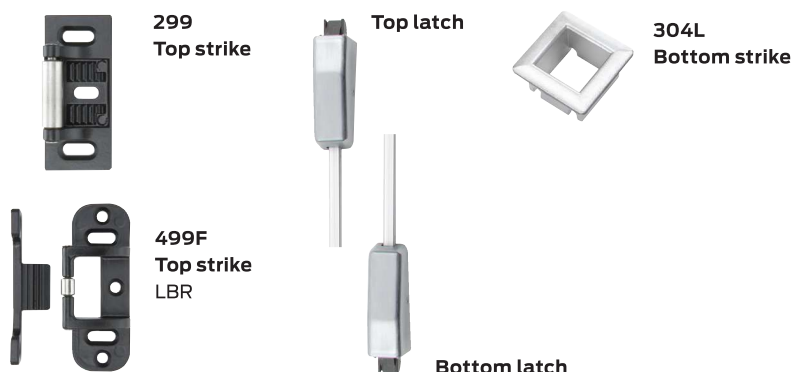


9827-F/9927-F Fire exit surface mounted vertical rod device are certified to ANSI/BHMA A156.3 2014, Grade 1 and UL listed for fire exit hardware. See page 67 for detailed information on UL fire exit hardware label and door opening size information. The 9827-F device has a smooth mechanism case and the 9927-F device has a grooved case. The surface vertical rod device is non-handed except when the following device options are used: SS (signal switch), and WS (tornado/hurricane). Vertical rod and latch guards are available to protect the bottom rod of the exit device from damage by impacts of carts or gurneys passing through doors. Rod and latch guards can be used on hollow metal or tin clad composite fire doors.

## Specifications

Device functions	Device ships EO/DT/NL; Field selectable; For TP, K or L remove NL drive screw from device
Device lengths	2' 2' (610 mm) Door size 3' 2'4" to 3' (711mm to 914 mm) Door size 4' 2'10" to 4' (864 mm to 1219 mm) Door size
Device centerline from finished floor	39 5/8" (1006 mm)
Center case	8" x 2 3/4" x 2 3/8" (203mm x 70mm x 60mm)
Mechanism case	2 1/4" x 2 1/4" (57mm x 57mm)
Projection	Pushbar neutral – 3 13/16" (97 mm) Pushbar depressed – 3 1/16" (78 mm)
Latch bolt	Deadlocking anti-friction top and bottom bolt, 5/8" (16mm) throw
Door undercut	1/4" (7mm) recommended
Top and bottom latch case	4 1/2" x 2 1/8" x 1 1/2" (114mm x 54mm x 38mm)
Vertical rods	1/2" square tubing, standard rods accommodate 7' (2134mm) doors. Top rod length: 34 15/16" (887mm); Bottom rod length: 31 1/2" (794mm). Extension rods available in 3' (914mm) for doors over 7' One piece top rod is available for 8' (2438mm) and 10' (3048mm) doors
Finishes	605, 606, 612, 625, 626/626AM, 628, 710, 711 and 643e (619 and 630 available with 98 Series only)
Fasteners and sex bolts (SNB)	Includes screw pack for 1 3/4" (44mm) to 2 1/4" (57mm) thick metal or wood doors, and 325 SNB for top and bottom latch (Optional 425 SNB available)

## Accessories



## Features and options

### Electrified options

<b>LX</b>	Latch bolt monitor switch
<b>RX</b>	Request to exit
<b>RX2</b>	Double request to exit
<b>E</b>	Electric locking and unlocking trim
<b>EL</b>	Electric latch retraction
<b>ESL</b>	Emergency secure lockdown
<b>QEL</b>	Quiet electric latch retraction
<b>SS</b>	Signal switch
<b>CX</b>	Chexit delayed exit
<b>ALK</b>	Alarm exit kit
<b>WP-RX</b>	Waterproof request to exit
<b>CON</b>	Allegion Connect

### Mechanical options

<b>-2</b>	Double cylinder
<b>-2SI</b>	Double cylinder with security indicator
<b>AX</b>	Accessible device (LBR only)
<b>GBK</b>	Glass bead kit
<b>LBR</b>	Less bottom rod
<b>PL</b>	Pullman latch
<b>PN</b>	Pneumatic latch retraction
<b>QM</b>	Quiet mechanical
<b>SNB</b>	Sex bolts
<b>SEC</b>	Security screws
<b>SLM</b>	Special laminate material blocking
<b>WH</b>	Weep holes
<b>WS</b>	Tornado and hurricane tested

### Dogging option

No mechanical dogging;  
QEL options available

### Strikes

**Top – 299F** – (499F LBR) Dull black  
**Bottom – 304L** – Unfinished

## Trim options

### 996 trim



Trim description					
Nomenclature	996EO	996L*	996L-NL*	996L-BE*	996L-DT
Trim function	Exit only plate	Lever	Lever-night latch	Lever-blank escutcheon	Lever-dummy trim
Function description	Exit only plate	Key locks and unlocks	Key retracts latch bolt	Always operable, no cylinder	Pull when dogged
ANSI function	01	08	03	14	02
Device compatibility					
98/99 Rim/Rim-F	■	■	■	■	■
XP98/XP99 Rim/Rim-F	■	■	■	■	■
98/9927/27-F	■	■	■	■	■
98/9947/47-F	■	■	■	■	■
98/9947WDC/WDC-F	■	■	■	■	■
98/9948/48-F	■	■	■	■	■
98/9949/49-F	■	■	■	■	■
98/9950WDC/50WDC-F	■	■	■	■	■
98/9952†	†	†	†	†	†
98/9957/57-F	■	■	■	■	■
98/9975/75-F	■	■	■	■	■
Dimensions					
Escutcheon plate size	2 3/4" x 10 3/4" x 27/32" (70 x 273 x 21mm)				
Pull center to center	—	—	—	—	—
Projection	—	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)
Handing					
—	Handed/reversible	Handed/reversible	Handed/reversible	Handed/reversible	Handed/reversible
Cylinder type					
Rim or vertical device	—	Rim	Rim	—	—
Mortise lock device	—	1 1/4" mortise	1 1/4" mortise	—	—

\* Specify R/V if used for rim and vertical devices, M for mortise device. Example, 996L-R/V or 996L-M.

† Default trim is 252L /L-BE. Must be ordered as EO when paired with other trims (ordered separately).

## Accessibility options

### Accessible device (AX)

The AX device is a UL certified exit device designed to meet the progressive requirements of the California Building Code for accessible openings. This device meets the 5 lbs of operating force requirement called for in chapter 11B-309.4. The AX device also exceeds ANSI/BHMA requirements. Available devices include: AX98/99, AX98/99-F, AX98/9927LBR, AX98/9927-F LBR, AX98/9949LBL, AX98/9949-FLBL, AX98/9949-F LBLAFL, AX98/9950LBL, AX98/9950-FLBL. Additionally, all AX devices will be shipped with a new UL label clearly stating "Meets California building Code (2013) Sec. 11B-309.4" and an "AX" identifier label on device center case. See images below for reference.



## Latches

### Less bottom rod, panic and fire rated (LBR)

LBR option is available, using a spring loaded auxiliary latch bolt installed in the lower door edge. When exposed to heat the auxiliary latch bolt releases, keeping the doors in alignment and closed during a fire. UL listed 3 hours on hollow metal doors double egress, 90 minute swinging same direction, and 20 minutes wood doors (consult wood door manufacturer). Fits door stiles as narrow as 3<sup>5</sup>/<sub>8</sub>".

LBR devices must be ordered in pairs or must be used in conjunction with an approved automatic or constant latching flush bolt.

### Pullman latch (PL)

When PL is specified the standard latches are replaced with pullman style latches. Pullman latches are always extended and are most commonly used in conjunction with electric strikes and LBR-less bottom rod application. Not available with Fire rated devices.

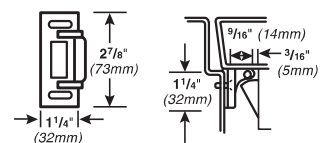
Not recommended where security is of the utmost importance since latches do not deadlock.

## Accessories

# Strikes

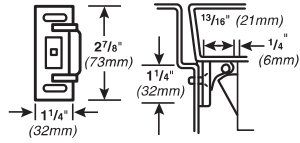
## Strikes for rim devices

264



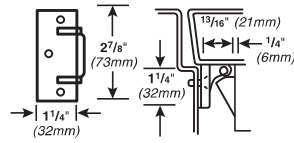
Projection 9/16" (14mm)

299



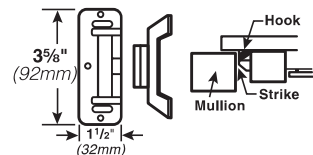
Projection 13/16" (21mm)

299F



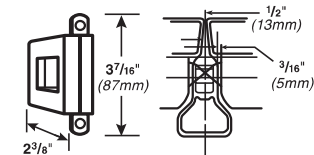
Projection 13/16" (21mm)

499F



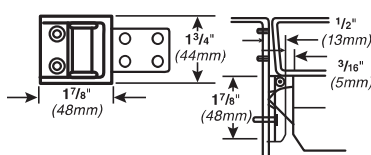
Projection 15/16" (24mm)

1408



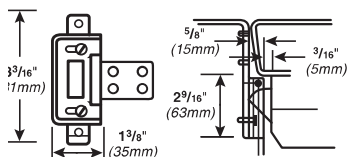
One per pair of doors

1439-Blade stop



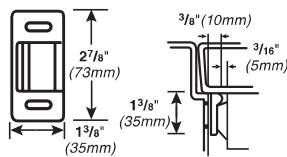
Projection 1/2" (13mm)

1410-Integral stop



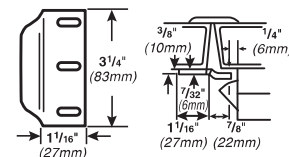
Projection 1/2" (13mm)

1606



Projection 3/8" (10mm)  
(Panic devices only)

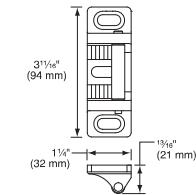
1609



- Requires coordinator
- For panic exit application only, not fire rated

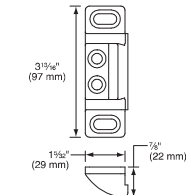
## XP Strikes for rim devices

909



Projection 13/16" (21mm)

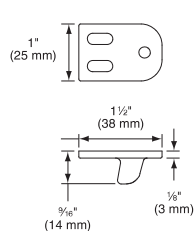
954



Projection 7/8" (22mm)  
(For fire rated double door applications)

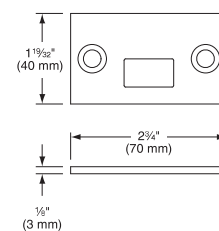
## Strikes for vertical cable devices

249 - Top strike



Projection 9/16" (14mm)

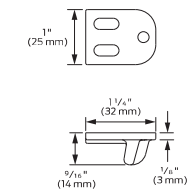
349 - Bottom strike



Projection 1/8" (3mm)

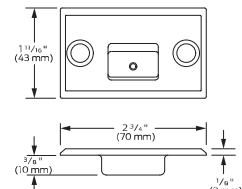
## Strikes for 98/9950WDC devices

150



Projection 9/16" (14mm)

450



Projection 1/8" (3mm)

# Strikes

## Strikes for vertical rod devices

248L-4	260U-Flush transom panic only 260U-F-Flush transom fire only	299	299F	499F
Projection $\frac{3}{8}$ " (10mm)	Projection $\frac{3}{8}$ " (10mm)	Projection $\frac{13}{16}$ " (21mm)	Projection $\frac{13}{16}$ " (21mm)	Projection $\frac{15}{16}$ " (24mm)
304L	338	385A	283	
Projection $\frac{13}{16}$ " (21mm)	Mortise $\frac{5}{8}$ " (16mm)	Mortise $2\frac{1}{2}$ " (64mm)	For use with WDC devices when used with wood frames	

## Strikes for mortise lock devices

575	575-2	576A	576B
For use on $1\frac{3}{4}$ " (44mm) or $2\frac{1}{4}$ " (57mm) Single door and $2\frac{1}{4}$ " (57mm) double door with coordinator.	For use on $1\frac{3}{4}$ " (44mm) thick double door with coordinator and astragal.	Open back strike for $1\frac{3}{4}$ " (44mm) thick double doors without coordinator.	Open back strike for $2\frac{1}{4}$ " (57mm) thick double doors without coordinator.
		<ul style="list-style-type: none"> <li>Not for use with astragals</li> <li>For use on wood doors, contact door manufacturer</li> </ul>	<ul style="list-style-type: none"> <li>Acceptable for 90 minute pair of hollow metal doors</li> </ul>

# Cylinders

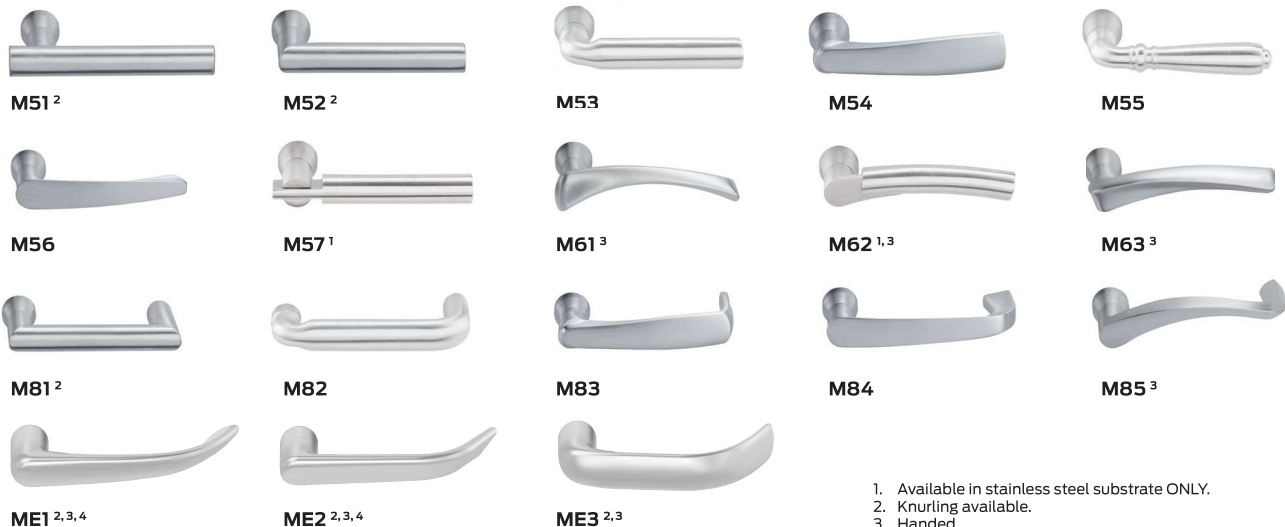
Cylinders are not furnished with device or trim and must be specified when ordering. Refer to trim pages for cylinder type.

Mortise — 3215 (Schlage 20-001, L583-477 cam)	Dogged (inverted) cam For CD, CDSI, CI and SD	Rim — 3216 (Schlage 20-022)
	<b>Undogged cam (standard operations)</b> For 2, -2SI, ALK, CX, DE5300, RCM, SS and all 98/99 Series mortise cylinder trims and controls	



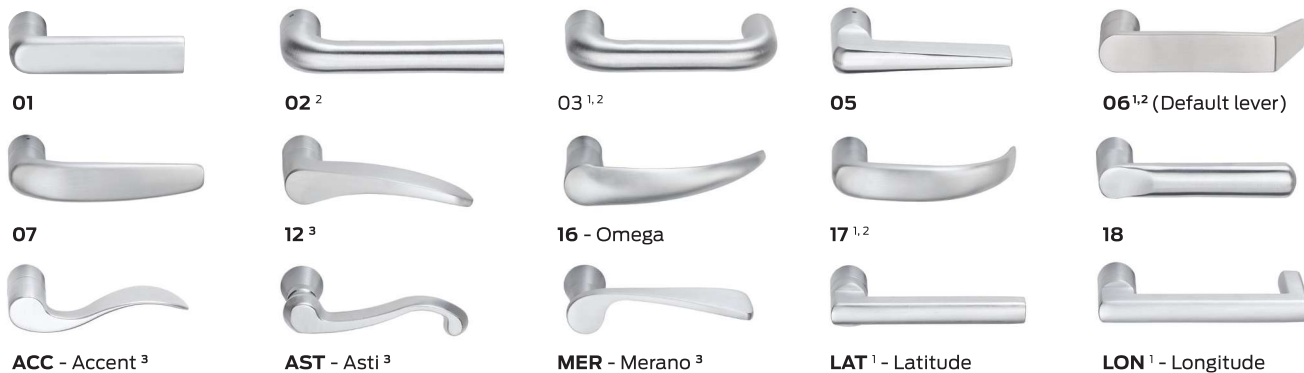
## Lever styles and finishes

### Decorative levers



- 1. Available in stainless steel substrate ONLY.
- 2. Knurling available.
- 3. Handed.
- 4. Designed with Gensler as product design consultant.

### Standard levers



- 1. Available in Stainless Steel - specify SS when ordering.
- 2. Knurling available.
- 3. Handed.

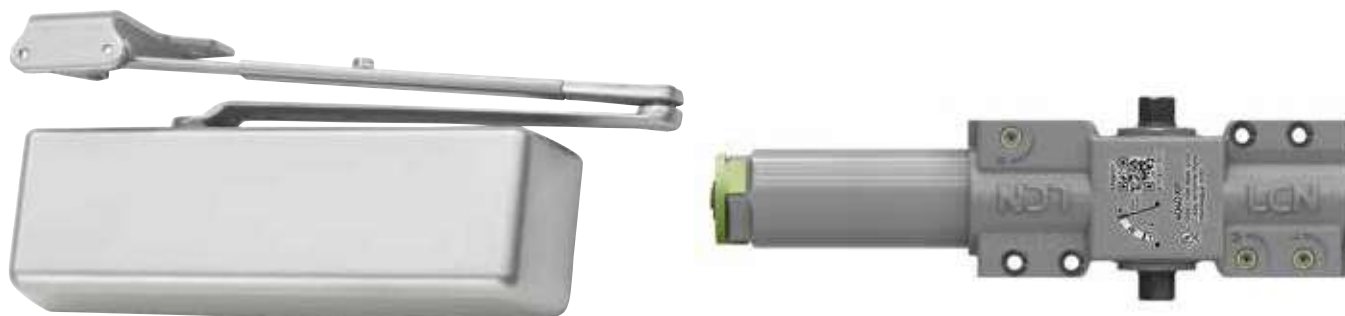
Finish options*						
Color	Bright Brass	Satin Brass	Satin Bronze	Satin Nickel	Matte Black/Anodized	Bright Chrome
ANSI/BHMA number	605	606	612	619	622/711	625

Finish options*						
Color	Satin Chrome	Aluminum, anodized	Satin Stainless	Aged Bronze	Black Paint	Dark Brown, Anodized
ANSI/BHMA number	626/626AM†	628	630/630AM†	643e	693	710

\* Durable powder coated finishes available at special request. Please contact factory.  
† AM = Antimicrobial



# 4040XP Series



The 4040XP Series is LCN's most popular door closer—and for good reason. This durable non-handed, surface-mounted heavy-duty closer, is designed for the most demanding high-use-and-abuse applications as well as for easy installation and maintenance.

## Features

<b>Certifications</b>	Grade 1 - ANSI A156.4, UL 10C, ADA, 100 hour salt spray, meets BAA - Buy American Act	<b>Cover</b>	<ul style="list-style-type: none"> <li>Redesigned snap-fit plastic cover (PC) with improved retention fit, standard</li> <li>Metal Cover (MC), optional</li> </ul>
<b>Body construction</b>	<ul style="list-style-type: none"> <li>Patent-pending positive stop</li> <li>Patent-pending regulation valve indicators</li> <li>Independent speed adjustments</li> <li>QR code for instructions and support</li> <li>Cast iron body</li> <li>Full complement bearing</li> <li>1 1/2" diameter piston</li> <li>Double heat treated pinion journal</li> </ul>	<b>Fasteners</b>	Self reaming and tapping screws (SRT)
<b>Fluid</b>	All weather liquid X fluid	<b>Mounting</b>	Hinge (pull side), top jamb (push side), parallel arm (push side)
<b>Handling</b>	Non-handed	<b>Arms</b>	Regular arm
<b>Templating</b>	Peel-n-Stick templates - 2 1/4" x 5" mounting hole pattern	<b>Finishes/colors/ powder coat</b>	<ul style="list-style-type: none"> <li>622 Matte black</li> <li>689 Aluminum</li> <li>690 Statuary bronze</li> <li>691 Light bronze</li> <li>693 Black</li> <li>695 Dark bronze</li> <li>696 Brass</li> <li>Custom colors optional</li> </ul>
<b>Size</b>	Adjustable spring size 1-6, includes LCN Green Dial		<ul style="list-style-type: none"> <li>Optional SRI primer - powder coat only</li> <li>Optional plated finishes</li> </ul>
<b>Warranty</b>	30 years		

### Special templates

Customized installation templates or products may be available to solve non-standard applications. Contact LCN Product Support for assistance.

Mounting	Finish	Cover	Cylinder	Arm function*
Hinge (pull) side	Plastic	Non-handed	Regular (double)	Regular (double)
Top jamb (pull)	Metal	Non-sized	Standard (single)	Standard (single)
Top jamb (push)		Accessibility	Hold Open	Hold Open
Parallel arm		Delay Action***	Fusible Link	Fusible Link
Stop face		CYLAVB**	EDA/HEDA	EDA/HEDA
Powder coat			CUSH/HCUSH	CUSH/HCUSH
Plated			SCUSH/SHCUSH	SCUSH/SHCUSH
			Double Egress	Double Egress

■ Available

■ Not available



Closer available with less than 5.0 lbs. opening force on 36" door.

\* Maximum opening/hold open point with standard template.

\*\* Advanced Variable Back Check.

\*\*\* Delay feature incorporates standard 4040 cylinder (not XP).

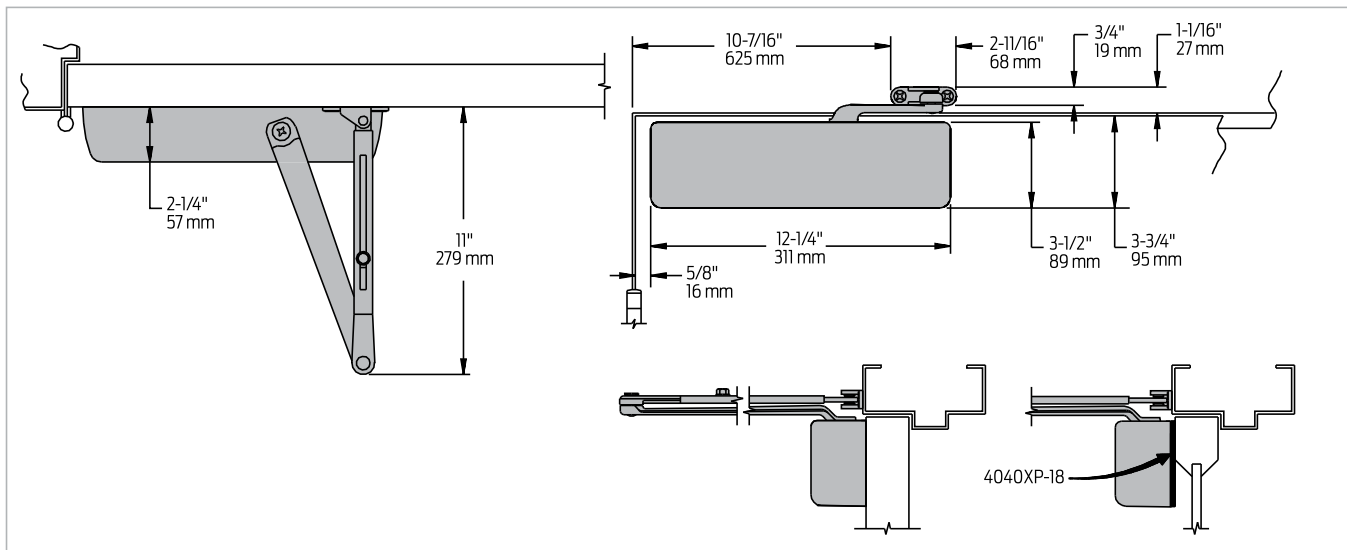
## Adjustments

There are several design features that make installation or adjustment of the 4040XP easier and more intuitive.

- **LCN Green Dial** provides a visual reference of the spring power setting, taking the guesswork out of spring power adjustments.
- **Additional adjustments** can be made to the back check, main, and latch regulation valves which are labeled for easy identification.
  - Labels correspond to a diagram with door swing zones located on the closer body.
- **Patent-pending positive stop feature** on all regulation valves. The improved staking feature prevents the screw from being backed out and causing accidental damage to the product.
  - The patent-pending regulation valve indicators provide visual color indicators of how far a screw is backed out—the more visible the component, the faster the speed.
  - This makes adjustments simpler and more intuitive.
- **New QR code** that provides on-the-spot access to interactive installation and maintenance instructions and tech support.

## Mounting details

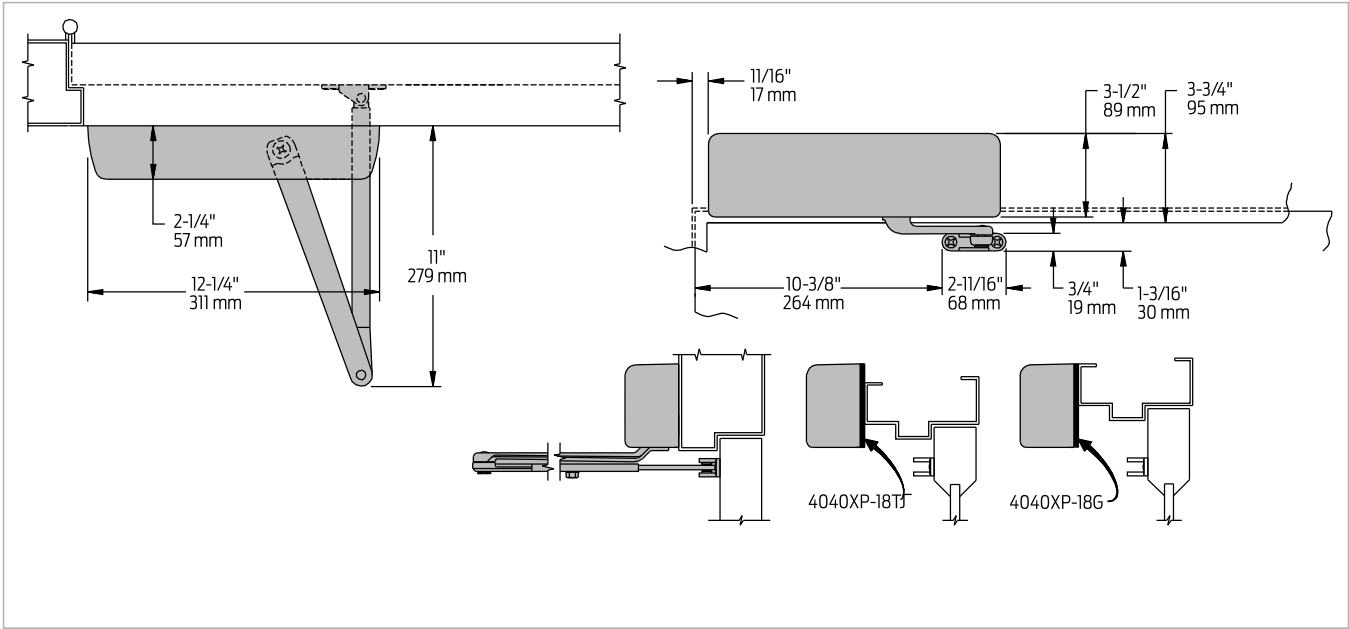
### Hinge (pull) side mounting



Butt hinges	Should not exceed 5" (127 mm) in width
Auxiliary stop	Recommended at hold open point or where a door cannot swing beyond 120°
Reveal	Should not exceed 3/4" (19 mm) for Regular or Hold Open Arm
Top rail	Less than 3 3/4" (95 mm) requires plate, 4040XP-18; Plate requires 2" (51 mm) minimum
Clearance	2 3/8" (60 mm) behind door required for 90° installation
Delay action	<ul style="list-style-type: none"> <li>■ Incorporates standard 4041 cylinder</li> <li>■ Delays closing from 120° to 70°</li> <li>■ Delay time adjustable up to approximately 1 minute</li> </ul>
Maximum opening	<ul style="list-style-type: none"> <li>■ Templating allows up to 120°</li> <li>■ Hold open points 90° up to 120° with Hold Open Arm</li> </ul>

Mounting details

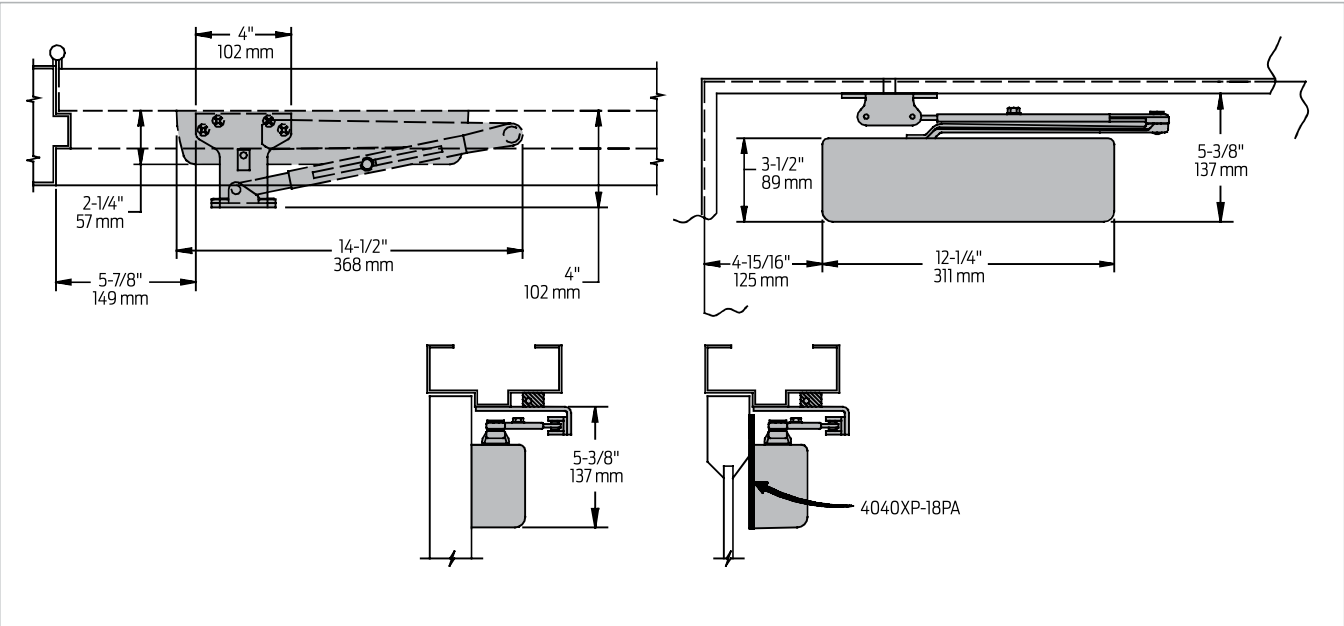
Top jamb (push) side mounting



Butt hinges	Should not exceed 5" (127 mm) in width		
Auxiliary stop	Recommended at hold open point or where a door cannot swing beyond 120°		
Reveal	Arm type	Reveal	Max opening
	Regular Arm	2 9/16"	Up to 120°
	Long Arm	4 13/16"	Up to 120°
	Hold Open Arm	2 9/16"	Up to 120°
	Hold Open Long Arm	8"	Up to 120°
Top rail	<ul style="list-style-type: none"><li>Requires 1 1/4" (32 mm) minimum</li><li>2 1/4" (57 mm) minimum with closer on plate, 4040XP-18TJ</li><li>3" (76 mm) minimum with closer on plate, 4040XP-18G</li></ul>		
Head frame	<ul style="list-style-type: none"><li>Less than 3 1/2" (89 mm) requires plate, 4040XP-18TJ</li><li>With flush ceiling, use plate, 4040XP-18G. Either plate requires 1 3/4" (44 mm) minimum</li></ul>		
Maximum opening	<ul style="list-style-type: none"><li>Templating allows up to 120°</li><li>Hold open points 85° up to 120° with Hold Open Arm</li></ul>		
Delay action	<ul style="list-style-type: none"><li>Incorporates standard 4041 cylinder</li><li>Delays closing from 120° to 70°</li><li>Delay time adjustable up to approximately 1 minute</li></ul>		

Mounting details

Parallel arm (push) side mounting



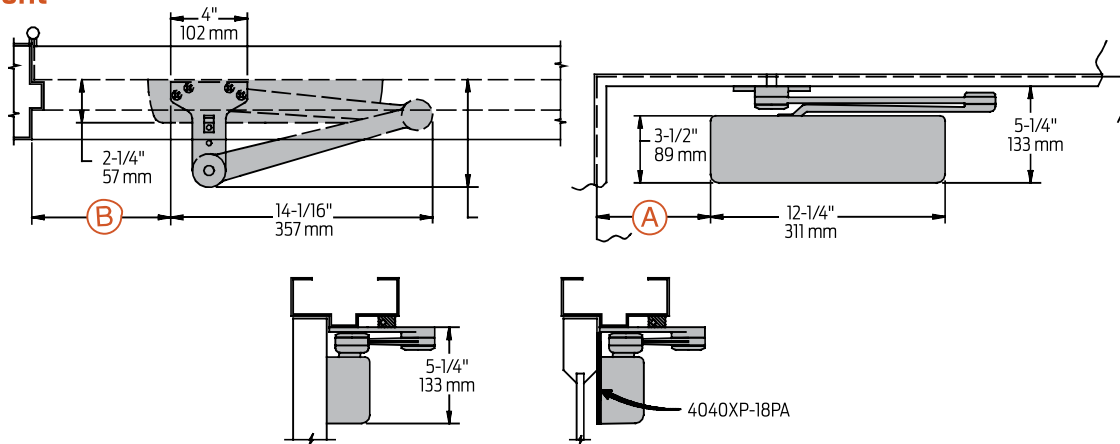
Butt hinges	Should not exceed 5" (127 mm) in width
Auxiliary stop	Recommended at hold open point, where the door cannot swing 180°, or where Cush-n-Stop Arm is not used
Reveal	Should not exceed 7/32" (6 mm)
Top rail	Less than 5 3/8" (137 mm) measured from the stop requires plate, 4040XP-18PA. Plate requires 2" (51 mm) minimum from the stop.
Head frame	Flush or rabbetted requires PA shoe adapter, 4040XP-419
Stop width	Minimum 1" (25 mm). CUSH arm requires minimum 1 1/2" (38 mm)
Blade stop	Clearance requires 1/2" (13mm) blade stop spacer, 4040XP-61
Clearance	<ul style="list-style-type: none"><li>4040XP-62PA shoe is 4" (102 mm) from door face</li><li>EDA shoe projects 5 1/2" (140 mm) from door face</li><li>CUSH shoe projects 6" (152 mm) from door face</li></ul>
Delay action	<ul style="list-style-type: none"><li>Incorporates standard 4041 cylinder, without XP cylinder</li><li>Delays closing from 120° to 70°</li><li>Delay time adjustable up to approximately 1 minute</li></ul>
Maximum opening	<ul style="list-style-type: none"><li>180° opening/hold open points with all except CUSH arms</li><li>110° opening/hold open with CUSH arms</li></ul>

- Notes:
- Optional mounting requires PA shoe, 4040XP-62PA for regular or Hold Open Arms
  - Add prefix "P" to closer description (eg. P4040XP)
  - P4040XP closer includes 4040XP-201 fifth hole spacer to support PA shoe

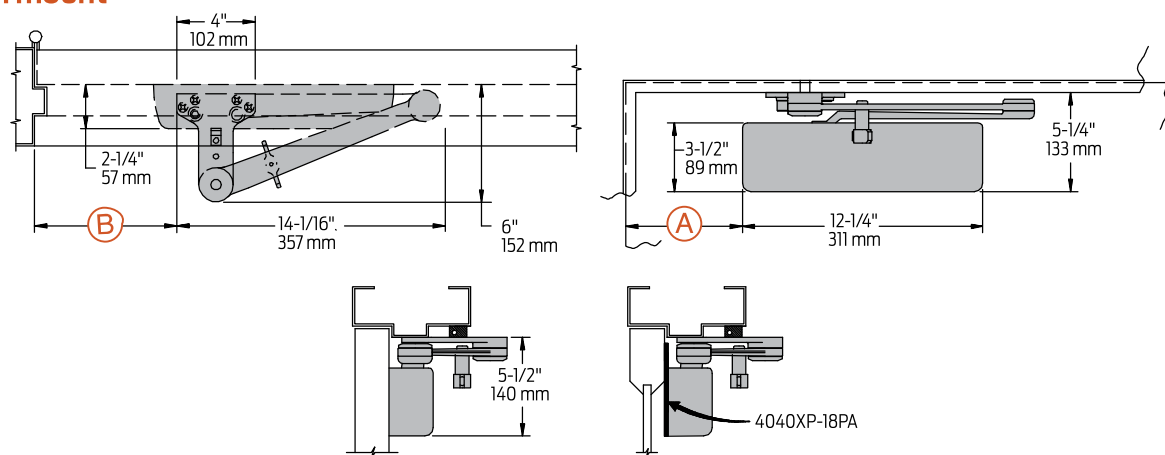
## Mounting details

### EDA and CUSH mounting

#### EDA mount



#### CUSH mount



Clearance	4040XP-62EDA is 5 1/2" (140 mm) from door face; 6" (152 mm) for CUSH	
Head frame	Flush or rabbeted requires CUSH flush panel adapter, 4040XP-419	
CUSH Arm	Requires shoe support, 4040XP-30 for fifth screw anchorage where reveal is less than 3 1/16" (78 mm)	
Delay action	<ul style="list-style-type: none"> <li>Incorporates standard 4041 cylinder, without XP cylinder</li> <li>Delays closing from maximum opening to; 115° with 180° template, 95° with 110° template, 85° with 100° template, 75° with 90° template (delay time adjustable up to approximately 1 minute)</li> </ul>	
Maximum opening	EDA arm can be templated for points at:	CUSH arms can be templated for opening/hold open point at:
	110°: A = 6 3/8" (162 mm) B = 7 3/4" (197 mm)	85°: A = 7 15/16" (202 mm) B = 9 1/8" (232 mm)
	or 180°: A = 2 7/8" (73 mm) B = 4 1/4" (108 mm)	90°: A = 7 3/16" (183 mm) B = 8 1/2" (216 mm)
	Hold open points up to maximum opening with HEDA arm	100°: A = 6 1/16" (154 mm) B = 7 1/4" (184 mm)
		or 110°: A = 5 1/16" (129 mm) B = 6 3/8" (162 mm)

#### Notes:

- 4040XP Series closers ordered with EDA or CUSH arms include 4040XP-201 fifth hole spacer to support the shoe
- SCUSH stop points are approximately 5° more than templated stop point
- Hold open at templated stop points

## Accessories

### Cylinders



**4040XP-3071**  
**Cast iron cylinder assembly (CYL)**

- Non-handed
- Heavy duty



**4041-3071 DEL**  
**Delay Action Cylinder (CYLDEL)**

- Used for delayed action closing
- Non-handed
- Heavy duty

### Covers



**4040XP-72**  
**plastic cover (PC)**

- Non-handed
- Includes 4040XP-54 snap-on cover clip
- Redesigned patent-pending snap-fit cover with improved retention fit



**4040XP-72MC**  
**metal cover (MC)**

- Handed
- Required for plated finishes and custom powder coat finishes
- Optional

### Arms



**4040XP-3077**  
**Regular Arm (REGARM)**

- Non-handed
- Mounts pull side or top jamb with shallow reveal P4041 closer includes PA shoe, 4040XP-62PA required for parallel arm mounting



**4040XP-3077L**  
**Long Arm (LONG)**

- Non-handed
- Includes long rod and shoe, 4040XP-79LR for top jamb mount
- Optional



**4040XP-3077ELR**  
**Extra Long Arm (XLONG)**

- Non-handed
- Includes extra long rod and shoe, 4040XP-79ELR for top jamb mount with deep reveal
- Optional



**4040XP-3049**  
**Hold Open Arm (H)**

- Non-handed
- Mounts pull side or top jamb with shallow reveal, hold open adjustable shoe
- 4040XP closer includes 4040XP-62PA shoe required for parallel arm mounting
- Optional



**4040XP-3049L**  
**Hold Open Long Arm (HLONG)**

- Non-handed
- Includes long head and tube, 4040XP-3048L for top jamb mount
- Optional



**4040XP-3077EDA**  
**Extra Duty Arm (EDA)**

- Non-handed
- Features forged, solid steel main and forearm for potentially abusive installations
- Optional



**4040XP-3049EDA**  
**Hold Open Extra Duty Arm (HEDA)**

- Handed
- Parallel arm features forged, solid steel main and forearm for potentially abusive installations
- Hold open function is adjusted at the shoe
- Optional



**4040XP-3077EDA/62G**  
**Extra Duty Arm with 62G Thick Hub Shoe (EDAW62G)**

- Non-handed
- Features forged, solid steel main and forearm for potentially abusive installations
- 62G shoe provides additional blade stop clearance
- Optional



**4040XP-3049EDA/62G**  
**Hold Open Extra Duty arm with 62G Thick Hub Shoe (HEDA62G)**

- Handed
- Features forged, solid steel main and forearm for potentially abusive installations
- 62G shoe provides additional blade stop clearance; hold open function is adjusted at the shoe
- Optional



**4040XP-3077CNS**  
**Cush-n-Stop Arm (CUSH)**

- Non-handed
- Features solid forged steel main arm and forearm with stop in soffit shoe.
- Optional



**4040XP-3049CNS**  
**Hold Open Cush-n-Stop Arm (HCUSH)**

- Non-handed
- Hold open function with templated stop/hold open points
- Handle controls hold open function
- Optional

## Accessories

### Arms (cont.)



#### 4040XP-3077SCNS

##### Spring Cush-n-Stop Arm (SCUSH)

- Non-handed
- For potentially abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe
- Optional



#### 4040XP-3049SCNS

##### Spring Hold Open Cush-n-Stop Arm (SHCUSH)

- Non-handed
- For potentially abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe
- Handle controls hold open function
- Optional

### Installation accessories



#### 4040XP-18 Plate

- Required for hinge side mount where top rail is less than 3 3/4" (95 mm)
- Requires minimum 2" (51 mm) minimum top rail



#### 4040XP-18G Plate

- Locates top jamb mounted closer flush with top of head frame face in flush ceiling condition
- Requires 1 3/4" (44 mm) minimum head frame



#### 4040XP-18TJ Plate

- Centers top jamb mounted closer vertically on head frame where face is less than 3 1/2" (89 mm). Plate requires 1 3/4" (44 mm) minimum head frame



#### 4040XP-18PA Plate

- Required for parallel arm mounting where top rail is less than 5 1/2" (140 mm), measured from the stop
- Requires 2" (51 mm) minimum top rail



#### 4040XP-62PA PA shoe

- Required for parallel arm mounting



#### 4040XP-30 CUSH shoe support

- Provides anchorage for fifth screw used with CUSH arms, where reveal is less than 3 1/16" (78 mm)
- Optional



#### 4040XP-61 Blade stop spacer

- Required to lower parallel arm shoe to clear 1/2" (13 mm) blade stop
- Optional



#### 4040XP-419 PA flush panel adapter

- Provides horizontal mounting surface for parallel arm shoe on single rabbeted or flush frame
- Optional



#### 4040XP-62A Auxiliary shoe

- Requires a top rail of 7" (178 mm)
- Shoe replaces -62PA for parallel arm mounting of regular arm with overhead holder/stop
- Optional



#### 4040XP-54 Snap-on cover clip

- Used to secure 4040XP-72 plastic cover to cylinder body



## Ordering information

### How-to-order 4040XP Series closers

#### 1. Select finish

- ☐ Standard powder coat \_\_\_\_\_  
Matte Black (622), Aluminum (689), Dark Bronze (695),  
Statuary Bronze (690), Light Bronze (691), Black (693),  
or Brass (696)

#### Closer options

##### Cylinder

- ☐ Delay Action Cylinder (CYLDEL)

##### Cover

- ☐ Metal (specify right or left hand)(MC)

##### Finish

- ☐ Custom powder coat (RAL) \_\_\_\_\_  
(handed metal cover required)  
☐ Plated finish, US \_\_\_\_\_  
(handed metal cover required)  
☐ SRI primer  
(use with powder coat finishes only)

##### Arm

- ☐ Regular Arm (REGARM)  
☐ Regular Arm with Parallel  
Arm Bracket (RWPA)  
☐ Regular Arm with 62A  
Auxiliary Shoe (RW62A)  
☐ Long Arm (LONG)  
☐ Extra Long Arm (XLONG)  
☐ Hold Open Arm (H)

- ☐ Hold Open with Parallel Arm  
Bracket (HWPB)  
☐ Hold Open Long Arm (HLONG)  
☐ Extra Duty Arm (EDA)  
☐ Extra Duty Arm with 62G Thick  
Hub Shoe (EDAW62G)  
☐ Hold Open Extra Duty Arm (HEDA)  
☐ Cush-n-Stop Arm (CUSH)  
☐ Hold Open Cush-n-Stop Arm  
(HCUSH)  
☐ Spring Cush-n-Stop Arm (SCUSH)  
☐ Spring Hold Open Cush-n-Stop  
Arm (SHCUSH)

##### Optional screw packs

- ☐ Through Bolt<sup>1</sup> Self Reaming and  
Tapping Screws (TBSRT)  
☐ Wood and Machine Screws  
(WMS)  
☐ Through Bolt<sup>1</sup> Wood and Machine  
Screws (TBWMS)  
☐ Torx Machine Screws (TORX)

#### Closer will be shipped with:

- Standard cylinder
- Standard cover
- Regular arm
- Self reaming and tapping screws  
(unless options listed below are selected)

- ☐ Through Bolt<sup>1</sup> and Torx Machine  
Screws (TBTRX)

#### Installation accessories

- ☐ Plate, 4040XP-18  
☐ Plate, 4040XP-18TJ  
☐ Plate, 4040XP-18G  
☐ Plate, 4030-18PA  
☐ CUSH shoe support,  
4040XP-30  
☐ Blade stop spacer, 4040XP-61  
☐ Auxiliary shoe, 4040XP-62A  
☐ PA flush panel adapter,  
4040XP-419

#### Special template

- ☐ ST- \_\_\_\_\_

1. Specify door thickness if other than 1 3/4".

### Table of sizes

- 4040XP cylinders are adjustable from size 1 through size 6 and is shipped set to size 3
- Closing power of 4040XP Series closers may be adjusted 50%

#### Exterior (and vestibule) door width

	24"	30"	36"	42"	48"
	610mm	762mm	914mm	1067mm	1219mm
*4040XP	size 3	size 4	size 5	size 6	
	Minimum door width				

#### Interior door width


	24"	30"	38"	48"	54"	60"
	610mm	762mm	965mm	1219mm	1372mm	1524mm
*4040XP	size 2	size 3	size 4	size 5	size 6	
	Minimum door width					

➔ Indicates recommended range of door width for closer size.  
\* Adjustable Size 1 thru 5.

### Reduced opening force 4040XP Series closers

**CAUTION!** Any manual door closer, including those certified by BHMA to conform to ANSI Standard A156.4, that is selected, installed and adjusted based on ADA or other reduced opening force requirements may not provide sufficient power to reliably close and latch a door.

Refer to Automatic Operators catalog for information on systems that meet reduced opening force requirements without effecting closing power.

	Door width	36"	42"	48"
	8.5* lbs.	4040XP	4040XP	4040XP
	5.0* lbs.	4040XP	4040XP	4040XP

\* Maximum opening force.



## Finishes

### Standard powder coat finishes

LCN powder coating provides superior protection against the effects of weather conditions and is an environmentally friendly process. The high quality finish is chip resistant. Corrosion resistance surpasses 100 hours salt spray testing (four times the industry standard). Non-metallic components also provide the same high resistance to the effects of the elements. All LCN products must be shipped with a finish.

#### LCN standard finishes (ANSI/BHMA number):

622 Matte Black Paint



689 Aluminum Paint



690 Statuary Bronze Paint



691 Light Bronze Paint



693 Gloss Black Paint



695 Dark Bronze Paint



696 Brass Paint



### Optional custom powder coat finishes

LCN offers custom powder coating to provide a custom appearance and all the corrosion resistance of standard powder coat finishes at a nominal additional cost. LCN uses the RAL numbering system for the 150+ custom colors available. Contact your local RSO representative for a brochure showing the available custom colors.

Note: Custom powder coat finishes require a metal cover.

### Optional plated finishes

Visible components such as metal covers, arms, fasteners, and finish plates are plated to match the selected finish. Surface mounted tracks are powder coated to compliment the plated finish. Hidden assemblies such as cylinders, tracks, and mounting plates are supplied with a powder coated finish. Plated finishes require handing of closers.

#### Plated finishes:

616 Satin Bronze, Blackened	646 Satin Nickel
632 Bright Brass	651 Bright Chrome
633 Satin Brass	652 Satin Chrome
639 Satin Bronze	

### Special Rust Inhibitor (SRI) process

For installations where a higher level of protection against weather conditions, or the effects of a potentially corrosive atmosphere is required, LCN offers a Special Rust Inhibitor (SRI) process. Ferrous metal components receive an SRI pretreatment and a standard powder coat finish of your choice, or a custom powder coat finish for a nominal additional cost. Closers treated with the SRI process exceed the 100 hour protection level available with standard LCN powder coated finishes. For details, contact your local RSO representative or the LCN factory.

### Standard anodized finishes

LCN Senior Swing and Benchmark electromechanical automatic operators are offered with an anodized finish. Anodizing is an electrochemical process that thickens and toughens the protective oxide on aluminum metal.

#### LCN anodized finishes:

628 Aluminum, Clear Anodized  
710 Dark Brown, Anodized

## Materials

The LCN offering consists of well-made, reliable, long-lasting products that work in real-life applications. In addition to the mechanical advantages derived from proven designs, much of the durability of the closer and arm system is directly related to the materials used in their manufacturing.

Precision machined cast iron cylinders and forged steel pistons work together because of the compatibility of their basic elements. Heat-treated pinions and pistons spread the load over a large gear tooth system to better handle the wear and stress of millions of operating cycles. Upper and lower full complement pinion bearings provide the support and load capacity required by the design of the closer. All-weather fluid, Liquid X, reduces the amount of adjustments and maintenance needed and ensures consistent performance through every season.

Forged steel main arms are a durable alternative to lower-cost stamped steel arms. Specially designed shoe and elbow joints help each closer fit securely onto a variety of opening applications. A state-of-the-art, powder coat process delivers a high quality, corrosion resistant finish on all metal parts in popular architectural finishes.

Through state-of-the-art equipment, processes and people, we believe LCN will continue to provide the best solutions for our customers.

## GSH 1180 - (1, 2, 3 OR 4) 12" C/C

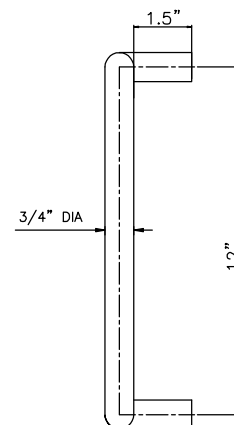
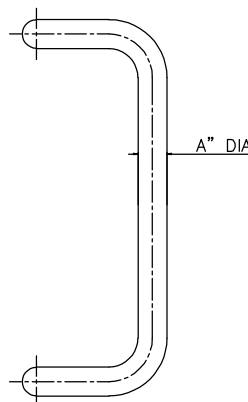
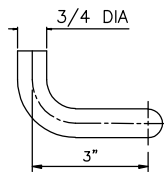


GallerySpecialty.com

1.800.267.1236



- Wrought Brass, Bronze, Aluminum and Stainless Steel
- Fasteners for 1 3/4" Door provided
- C3, C4, C9, C10, C10B, C14, C15, C26, C26D, C28 and C32D
- 1=3/4" DIA
- 2=1" DIA
- 3=1-1/4" DIA
- 4=1-1/2" DIA



676 Petrolia Road, Toronto, ON, Canada M3J 2V2  
Tel: 416.667.9593 Fax: 416.667.0806  
Email: [info@galleryspecialty.com](mailto:info@galleryspecialty.com)

All product specifications are subject to change. For the most updated product features, contact our customer service department Toll Free at 1.800.267.1236

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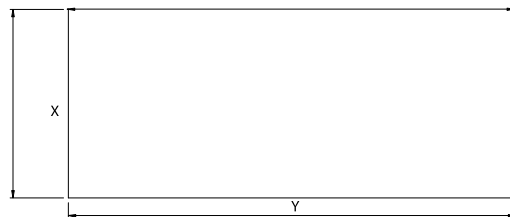
## GSH 80 KICK PLATE



GallerySpecialty.com  
1.800.267.1236



- Base Metal: Brass, Bronze, Aluminum and stainless steel (Type 304).
- Screw Mounting with Beveled Standard Edges
- Finishes: All Standard
- Tape Mounting available
  - GSH80 = 20ga
  - GSH80A = 18ga
  - GSH80B = .062ga
  - GSH80C = .125ga



676 Petrolia Road, Toronto, ON, Canada M3J 2V2  
Tel: 416.667.9593 Fax: 416.667.0806  
Email: [info@galleryspecialty.com](mailto:info@galleryspecialty.com)

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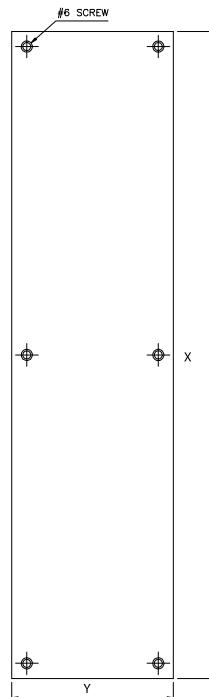
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**MADE TO ORDER P.O.A.**

## GSH 81 PUSH PLATE



GallerySpecialty.com  
1.800.267.1236



- Base Metal: Brass, Bronze, Aluminum and stainless steel (Type 304).
- Screw Mounting with Beveled Edges Standard
- Finishes: All Standard
- Tape Mounting available
  - GSH80 = 20ga
  - GSH80A = 18ga
  - GSH80B = .062ga
  - GSH80C = .125ga

676 Petrolia Road, Toronto, ON, Canada M3J 2V2  
Tel: 416.667.9593 Fax: 416.667.0806  
Email: [info@galleryspecialty.com](mailto:info@galleryspecialty.com)

All product specifications are subject to change. For the most updated product features, contact our customer service department Toll Free at 1.800.267.1236

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**MADE TO ORDER P.O.A.**

# 100 Series concealed overhead door holders/stops



## 100 Series heavy-duty

Glynn-Johnson offers a complete line of overhead door holders and stops, accommodating virtually all openings with solutions for even the most complex door control problems. These concealed holders and stops provide the most attractive and reliable heavy-duty door control available.

Glynn-Johnson 100 Series holders and stops provide the most reliable and versatile concealed overhead door control. They are designed for installation on virtually all types of doors mounted on conventional type butt hinges, pivots, continuous hinges, swing clear hinges and numerous other specialty hinges. When used in conjunction with many surface-applied door closers, 100 Series holders and stops provide the most effective control for entrance doors and vestibule doors of all types, as well as heavy or often used interior doors. Templates provided allow for variable mounting positions, ranging from 85° - 110° of opening.

### Five models:

- 100H Series hold-open model
- 100HP Series internal hold-open model
- 100F Series friction hold-open model
- 100S Series stop-only model
- 100SE Series special stop-only model

### Six sizes:

- Each model comes in six sizes.
- Simple
- Standardized

### Three options:

- ADJ—Adjustable jamb bracket
- CJ—Jamb Bracket for use with LCN 5030 closer
- SOC—Pin-in-socket security screw package

### Unmatched convenience:

- Non-handed
- Improved compatibility with door closers
- Single/double-acting doors
- Interior/exterior applications

- Reduced door prep
- Durable
- Improved corrosion resistance
- Function conversion kits are available

### Materials and finishes

In heavy gauge brass or 300 Series stainless steel, these models offer the broadest range of finishes in the industry, complementing any design and offering the highest resistance to corrosion. Available in the following finishes:

Finishes	Description
US3	Polished brass
US4	Satin brass
US10	Satin bronze
US10B	Oil rubbed bronze
US32	Polished stainless steel
US32D	Satin stainless steel
SP4	Powder coat brass
SP10	Powder coat bronze
SP28	Powder coat aluminum
SP313	Powder coat dark bronze
SPBLK	Powder coat black

## Models

These models provide a wide range of optional features, and are ideal for use on entrance and vestibule doors, large doors, doors opened frequently, or doors subject to abuse. These models are also furnished with an offset-style jamb bracket.

Designed for heavy-duty applications, 100 Series models will provide long-lasting protection to doors, frames, hinges, related hardware and surrounding walls or obstructions.

### 100H Series hold-open

(Suffix H) The hold-open function should be used where it is desired to hold a door open at a predetermined position for short or long periods of time, permitting an unobstructed traffic flow through the opening.

These models are both selective and adjustable, featuring the most reliable hold-open mechanism available. They feature a control knob which protrudes from the face of the door and turns the hold-open function on or off. Set in the inactive position, the unit acts as a stop and shock absorber. The tension on the hold-open mechanism can be adjusted using an allen wrench to offset air currents or other exterior conditions. The hold-open tension adjustment is located in the bottom of the track in the top of the door.

### 100HP Series internal hold-open

These models provide a hold-open unit with the hold-open mechanism built into the channel, thus reducing the door prep. The 100HP have a preset hold-open force that is not adjustable. The hold-open feature is not selectable in these units, so the doors are always held open.

### 100F Series friction hold-open

(Suffix F) Friction hold-open models provide an alternative holding method, ideal for heavy patient room doors, closet doors or similar applications where multiple hold-open positions are desired. The friction tension is adjusted using an allen wrench and an open end wrench. The friction tension adjustment is located on the top of the slider in the channel.

### 100S Series stop-only

(Suffix S) When the hold-open function is not required, the stop-only function provides the same effective door control minus the hold-open feature. The stop-only model may be used on fire doors.

### 100SE Series special stop-only

(Suffix SE) When stop-only models are used in conjunction with single point hold-open electronic door closers, they may be ordered without the shock-absorbing mechanism. Used as an auxiliary stop with these closers, they will prolong the life of the closer. The stop location is adjusted using an allen wrench on the stop block located in the channel. The SE option cannot be added to an existing unit. It must be factory ordered.

Note: Caution should be taken when using this option in other applications, as the elimination of the shock-absorbing spring can put added stress on the door and frame.

## Application Information

### UL Classification

The 100 Series stop-only models are classified by Underwriters Laboratories (UL) as miscellaneous fire door accessories. This classification applies to use on either hollow metal fire doors or wood fire doors. Where wood door manufacturer's listing allows for the cutout required for installation, concealed overhead stops may be used on those wood fire doors. These units may be used on doors of any rating. As a reminder, the miscellaneous fire door accessories (GVUX) section is defined by UL as: "Miscellaneous fire door accessories are intended in the individual listings. The accessories have been investigated to determine that when installed in accordance with the manufacturer's instructions, the accessories do not adversely affect the fire rating of the fire door and/or fire door frames."

### Dead stop templating

If a wall or similar obstruction is in place at 110° or less opening angle (i.e. doors that open back-to-back), dead stop templating should be used. This includes all hold-open, friction and stop-only models, except when the "SE" option is used. The dead stop position is reached when the shock-absorbing spring is fully compressed, the initial degree of opening will be 5° to 7° less than the dead stop opening.

Example: If the holder is templated to a 100° dead stop, the door will hold open at an angle between 93° and 95° but no further than 100°.

Note: Do not use dead-stop templating on the 100SE Series since there is no shock-absorbing spring.

### Environmental considerations

Environmental factors should always be considered when specifying overhead holders and stops. Doors that are positioned on a building's exterior or subject to corrosive conditions should be equipped with a holder constructed primarily of stainless steel or brass materials. For interior applications, steel is acceptable, though brass substrates generally provide a more attractive architectural-grade finish.

## Options

### Suffix ADJ (adjustable jamb bracket)

An additional option on the 100 Series is the adjustable jamb bracket, which allows the degree of hold-open or stop angle to be adjusted after installation. Suffix "ADJ" is available in all functions, but only in sizes 3, 4, 5 and 6. ADJ jamb bracket requires additional frame prep. The ADJ option cannot be added to an existing unit, it must be factory ordered.

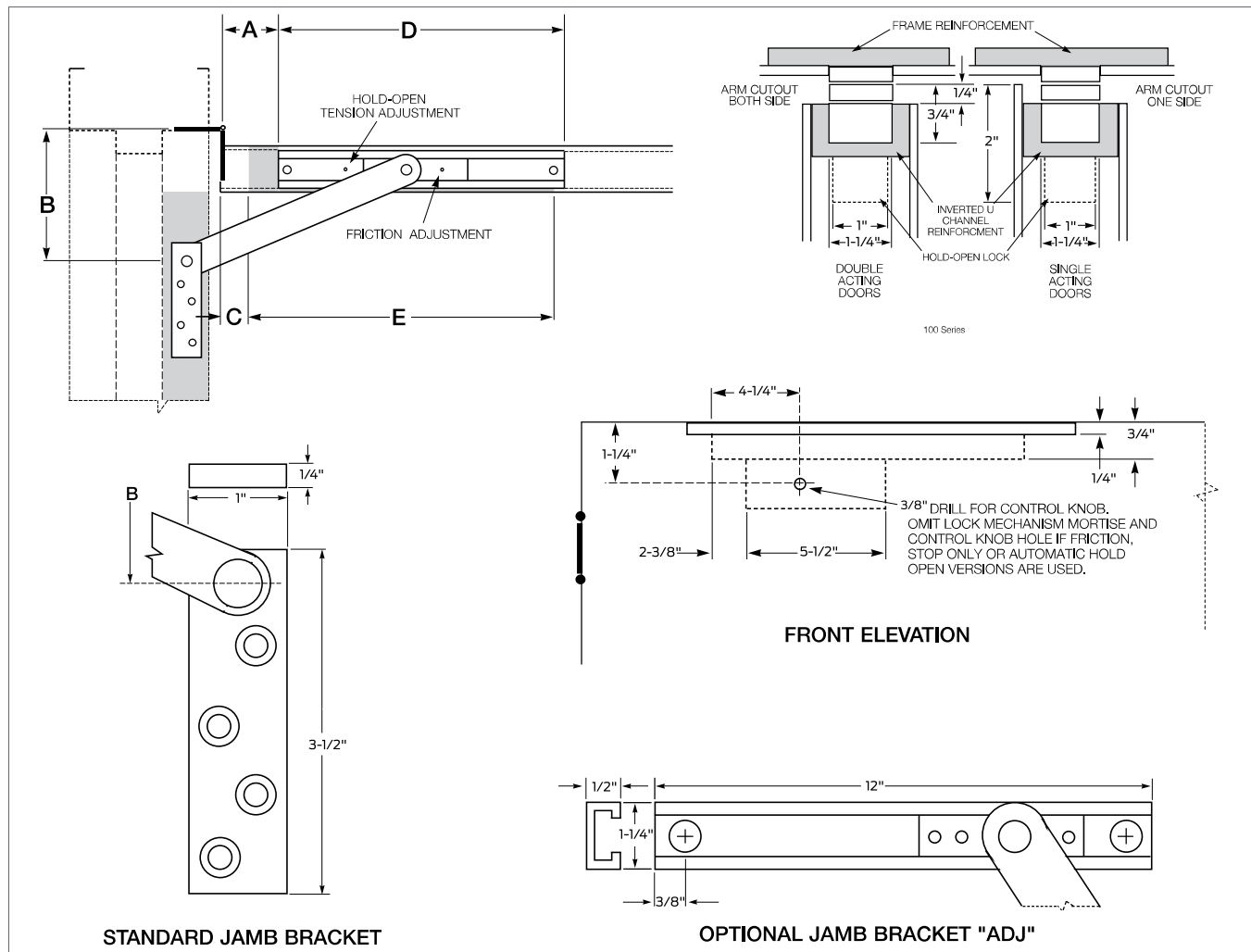
### Suffix CJ (closer jamb bracket)

Provides a special jamb bracket needed for 100 Series units used with LCN 5030 closers. These special jamb brackets are handed, so handing will need to be specified when ordering the "CJ" option, CJLH for a left hand door and CJRH for a right hand door. The CJ option cannot be added to an existing unit, it must be factory ordered.

### Suffix SOC (Pin-in-socket security screw package)

A screw package with pin-in-socket screws for mounting the jamb bracket to the frame is provided instead of the standard screw package.

# 100 Series concealed overhead door holders/stops



## 100 Series sizing chart<sup>2</sup>

### Butt/offset pivots

Size	Door opening	Stop only	Hold open	Friction
1 <sup>1</sup>	18" - 23"	101S	101H	101F
2 <sup>1</sup>	23 1/16" - 27"	102S	102H	102F
3	27 1/16" - 33"	103S	103H	103F
4	33 1/16" - 39"	104S	104H	104F
5	39 1/16" - 45"	105S	105H	105F
6	45 1/16" - 51"	106S	106H	106F

### Center hung

Door opening	Stop only	Hold open	Friction
-	-	-	-
-	-	-	-
33 1/16" - 39"	103S	103H	103F
39 1/16" - 45"	104S	104H	104F
45 1/16" - 51"	105S	105H	105F
51 1/16" - 59"	106S	106H	106F

Note: This chart illustrates the most common types of hinging and door opening sizes.  
For unusual door details, contact Glynn-Johnson for availability.

<sup>1</sup>These sizes are not available for use with offset pivots. Also not available with the ADJ option.

<sup>2</sup>Wood doors with automatic flush bolts or roller latches, consult factory.

## BHMA/ANSI, A156.8 and Fed. spec. cross reference

G-J model	BHMA*	Fed. spec.
101-106 H	C01511	1160
101-106 S	C01541	-
101-106 F	C01531	-

\* First numeral (0) designates optional material.

To specify:  
Brass material, change 0 to 1 (i.e. C11511)  
Stainless steel material, change 0 to 5 (i.e. C51511)

BHMA:  
All 100 Series models are designed for heavy-duty applications and far exceed BHMA cycle test and force test requirements for Grade 1 holders and stops.

The template information on this page is for reference only and is not intended to serve as an installation template.  
For more information, reference the Template Directory in the Document Library at [usallegion.com](https://www.usallegion.com).





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## Finishes

Finish no.	Description
US3	Polished brass
US4	Satin brass
US10	Satin bronze
US10B	Oil rubbed bronze
US26	Polished chrome
US26D	Satin chrome
US28	Clear anodized aluminum
US32	Polished stainless steel
US32D	Satin stainless steel
313AN	Dark bronze anodized aluminum
652	Chrome-like coating on steel
SP4	Powder coat brass
SP10	Powder coat bronze
SP28	Powder coat aluminum
SP313/695	Powder coat dark bronze
SPBLK	Powder coat black

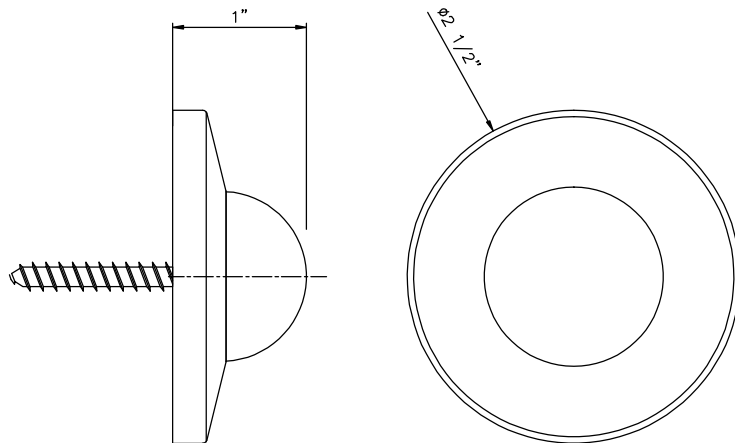
## GSH 240 WALL STOP

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specialty hardware ltd.



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- Through the rubber mounting
- Fasteners Included
- C3, C4, C10, C10B, C26D, and C32D



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All product specifications are subject to change. For the most updated product features, contact our customer service department Toll Free at 1.800.267.1236

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# 90 Series surface overhead door holders/stops



## 90 Series heavy-duty

Glynn-Johnson 90 Series holders and stops are the most rugged models available for heavy-duty applications. The channel is surface-mounted to the door, most often with sex bolts, and the jamb bracket is surface mounted to the jamb, requiring minimal door and frame preparation.

These versatile units can be used in conjunction with most surface-applied door closers. The provided templates allow for variable mounting positions, ranging from 85° to 110° hold-open/stop angle. These templates are designed for installation in almost all types of doors, including doors with conventional butt-type hinges or specialty hinges.

### Four models:

- 90H Series hold-open model
- 90S Series stop-only model
- 90F Series friction hold-open model
- 90SE Series special stop-only model

### Five sizes:

- Simple
- Standardized
- Each model is available in five sizes

### Three options:

- J—Angle jamb bracket
- SHIM—Blade stop shim kits
- SOC—Pin-in-socket security screw package

### Unmatched convenience:

- Non-handed
- Improved compatibility with door closers
- Single-acting doors
- Interior/exterior applications
- Durable
- Easy to install
- Improved corrosion resistance
- Function conversion kits available

### Materials and finishes

In 300 Series stainless steel, brass and steel substrates, these models are available in the largest selection of finishes in the industry. Stainless steel models offer the highest resistance to corrosion. Available in the following finishes:

Finish	Description
US3	Polished brass
US4	Satin brass
US10	Satin bronze
US10B	Oil rubbed bronze
US32	Polished stainless steel
US32D	Satin stainless steel
SP4	Powder coat brass
SP10	Powder coat bronze
SP28	Powder coat aluminum
SP313	Powder coat dark bronze
SPBLK	Powder coat black
652	Chrome-like coating

## Models

Glynn-Johnson 90 Series door holders and stops provide long-lasting protection for doors, frames and hardware. All models incorporate a heavy-duty channel/slide-arm design and offset jamb bracket. This unique design allows for simple field modification of functions, should user requirements change.

### 90H Series hold-open

(Suffix H) Hold-open models provide a convenient method of holding the door open at a predetermined position for short or long periods of time, permitting an unobstructed traffic flow through the opening. The hold-open function can easily be turned on or off by simply rotating the serrated knob on the bottom of the channel. This knob engages the hold-open mechanism, allowing the door to be held open at a predetermined position ranging from 85° to 110°. When the knob is flipped over, it acts as a stop and shock absorber.

The tension on the hold-open mechanism can be adjusted using a phillips screwdriver to offset air currents or other exterior conditions. The hold-open tension adjustment is located on the top of the slider in the channel.

### 90S Series stop-only

(Suffix S) When the hold-open function is not a requirement, stop-only models provide a reliable method of door control. Stop-only models provide the same shock-absorbing capability as hold-open models. The stop-only model may be used on fire doors.

### 90F Series friction hold-open

(Suffix F) Friction hold-open models are ideal for patient room doors, wardrobe and closet doors or similar applications where multiple hold-open positions are desired. The friction tension can be adjusted through the top of the channel using an allen wrench. The friction tension adjustment is located on the top of the slider in the channel. The SE option cannot be added to an existing unit. It must be factory ordered.

### 90SE Series special stop-only

(Suffix SE) When stop-only models are used in conjunction with single-point, hold-only electronic door closers, the stop-only function may be ordered without the shock-absorbing mechanism. Used as an auxiliary stop, these models prolong the life of the closer. The stop location is adjusted using an allen wrench on the stop block located in the channel.

**Note:** Caution should be taken when using this option in other applications, as the elimination of the shock-absorbing spring can put added stress on the door and frame.

## Application Information

### UL Classification

The 90 Series stop-only models are classified by Underwriters Laboratories (UL) as miscellaneous fire door accessories. This classification applies to use on either hollow metal fire doors or wood fire doors. These units may be used on doors of any rating. As a reminder, the miscellaneous fire door accessories (GVUX) section is defined by UL as: "Miscellaneous fire door accessories are intended in the individual listings. The accessories have been investigated to determine that when installed in accordance with the manufacturer's instructions, the accessories do not adversely affect the fire rating of the fire door and/or fire door frames."

### Dead-stop templating

Dead-stop templating is recommended for applications where a wall or similar obstruction is placed at an opening angle of 110° or less (i.e., doors that open back-to-back). Dead-stop templating can be applied to hold-open, stop-only and friction models. The dead-stop position is the point at which the shock-absorbing spring is fully compressed. Therefore, when dead-stop templating is used, the initial degree of opening will be 5° to 7° less than the dead-stop opening.

**Example:** If the holder is templated to a 100° dead stop, the door will hold open at an angle between 93° and 95° but no further than 100°.

**Note:** Do not use dead-stop templating on the 90SE Series since there is no shock-absorbing spring.

### Environmental considerations

Environmental factors should always be considered when specifying overhead holders and stops. Doors that are positioned on a building's exterior or subject to corrosive conditions should be equipped with a holder constructed primarily of stainless steel or brass materials. For interior applications, steel is acceptable, though brass substrates generally provide a more attractive architectural-grade finish.

## Options

### Suffix J (angle jamb bracket)

An angle jamb bracket is available for converting standard models to hinge-side or flush transom mounting. The angle jamb bracket affixes to the standard jamb bracket. If ordered with the unit add suffix J. If needed separately order 90J by finish needed.

### Suffix SOC (pin-in-socket security screws)

A screw package with pin-in-socket screws for mounting the door bracket and the jamb bracket is provided instead of the standard screw package.

### Suffix SHIM (blade stop shims)

Shim kits are available in 3 sizes

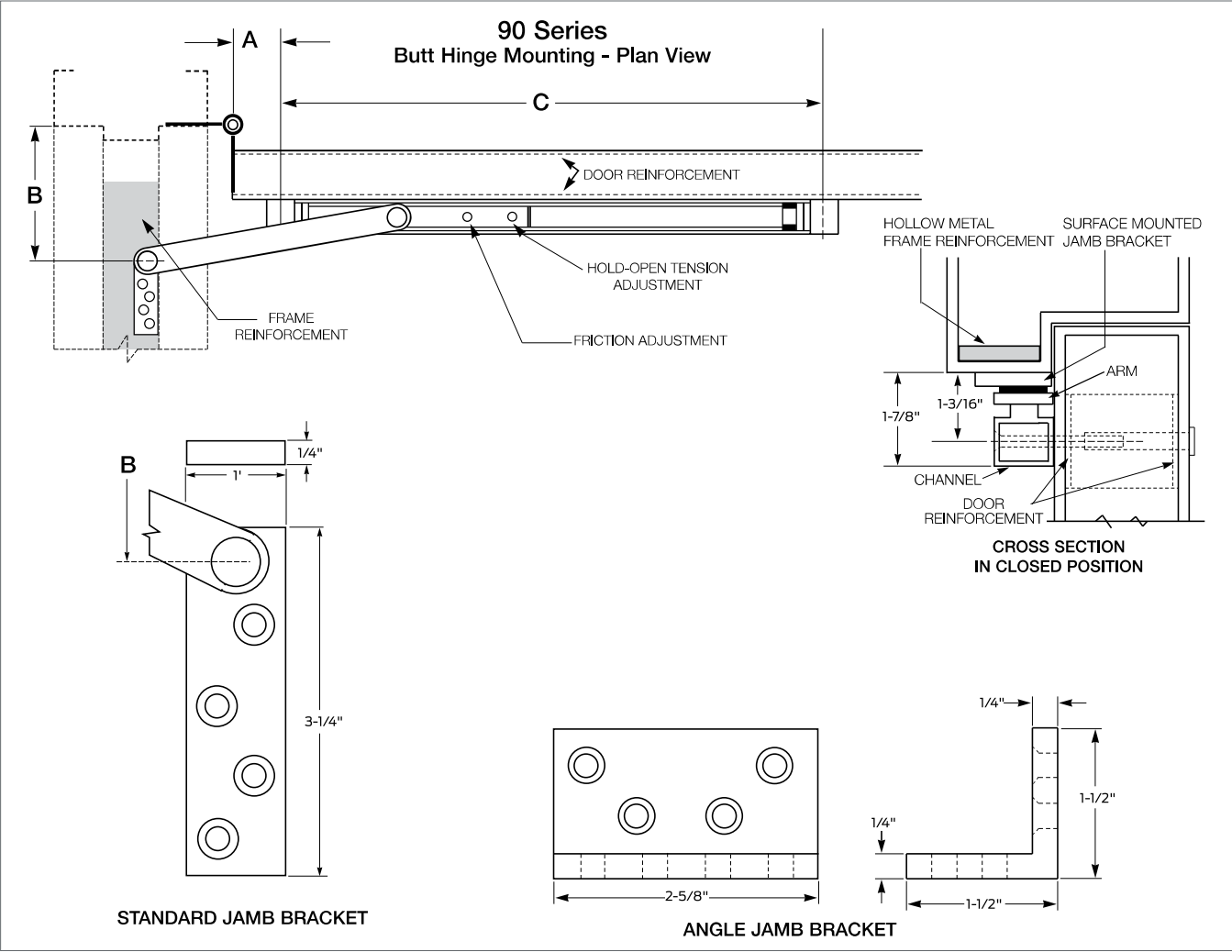
90 SHIM1 is a 1/4" shim kit

90 SHIM2 is a 1/2" shim kit

90 SHIM3 is a 3/4" shim kit

If ordered with overhead, add suffix SHIM (1, 2 or 3). If needed separately order 90 SHIM (1, 2 or 3)—finish.

# 90 Series surface overhead door holders/stops



90 Series sizing chart					BHMA/ANSI, A156.8 and Fed. spec. cross reference			
Butt/offset pivots					Center hung			
Size	Door opening	Stop only	Hold open	Friction	Door opening	Stop only	Hold open	Friction
1	-	-	-	-	-	-	-	-
2	23 1/16" - 27"	902S	902H	902F	27 1/16" - 33"	902S	902H	902F
3	27 1/16" - 33"	903S	903H	903F	33 1/16" - 39"	903S	903H	903F
4	33 1/16" - 39"	904S	904H	904F	39 1/16" - 45"	904S	904H	904F
5	39 1/16" - 45"	905S	905H	905F	45 1/16" - 51"	905S	905H	905F
6	45 1/16" - 51"	906S	906H	906F	51 1/16" - 59"	906S	906H	906F

G-J model	BHMA*	Fed. spec.
902-906 H	C02511	1161
902-906 S	C02541	1161A
902-906 F	C02531	-

\* First numeral (0) designates optional material.

To specify:  
Brass material, change 0 to 1 (i.e. C12511)  
Stainless steel material, change 0 to 5 (i.e. C52511)  
Steel material, change 0 to 8 (i.e. C82511)

Note: This chart illustrates the most common types of hinging and door opening sizes.  
For unusual door details, contact Glynn-Johnson for availability.

The template information on this page is for reference only and is not intended to serve as an installation template.  
For more information, reference the Template Directory in the Document Library at [us.allegion.com](https://www.allegion.com).



## How to order

	<b>90</b>	<b>4</b>	<b>H</b>	—	<b>US32D</b>	—	<b>J</b>
<b>Overhead Series:</b>							
<b>90</b>							
<b>Size (door opening using butt or offset pivots):</b>							
<b>2</b>	(23 1/16"–27")						
<b>3</b>	(27 1/16"–33")						
<b>4</b>	(33 1/16"–39")						
<b>5</b>	(39 1/16"–45")						
<b>6</b>	(45 1/16"–54")						
<b>Function:</b>							
<b>H</b>	Hold-open						
<b>F</b>	Friction hold-open						
<b>S</b>	Stop-only						
<b>SE</b>	Special stop-only						
<b>Finishes:</b>							
<b>US3</b>	Polished brass						
<b>US4</b>	Satin brass						
<b>US10</b>	Satin bronze						
<b>US10B</b>	Oil rubbed bronze						
<b>US32</b>	Polished stainless						
<b>US32D</b>	Satin stainless steel						
<b>SP4</b>	Powder coat brass						
<b>SP10</b>	Powder coat bronze						
<b>SP28</b>	Powder coat aluminum						
<b>SP313</b>	Powder coat dark bronze						
<b>SPBLK</b>	Powder coat black						
<b>652</b>	Chrome-like coating						
<b>Options:</b>							
<b>J</b>	Angle jamb bracket						
<b>SHIM</b>	Blade stop shims						
	SHIM 1 1/4" kit						
	SHIM 2 1/2" kit						
	SHIM 3 3/4" kit						
<b>SOC</b>	Pin-in-socket security screws						

# EM SERIES



**Dual voltage capability and an adjustable catch plate provide versatility for varying applications.**  
The DORMA EM Series door holders are composed of a door mounted catch plate and a floor- or wall-mounted electromagnet. This series serves as an economical package for use in conjunction with DORMA door closers whenever controlled release and closing of doors is necessary for safety or convenience such as in hotels, hospitals, and nursing homes.

The EM Series magnets offer superior reliability with built-in protection and low residual

magnetism so they release easily even in applications meeting ADA requirements with minimal spring force door closers. Brackets are not required for recessed, flush, or surface mounting. The catch plate on the door features a ball-shaped pivot arm for adjustability to further ensure perfect alignment. Optional extension rods are available to accommodate greater distances between the door and wall.

- Technical Details**
- Dual voltage capability reduces stocking requirements.
  - Low current draw allows savings on power supplies and backup batteries.

- Optional extension rods fit on standard catch plate to accommodate deeper door to wall conditions.
- Low residual magnetism allows easy release of door.
- All electrical values +10% to -15%.
- Floor- and wall-mounted styles.
- Can be manually pulled from hold open position.
- Silent operation.
- Holding force 15–25 lb nominal.

- Certifications**
- ANSI/BHMA A156.15 Grade 1 certified.
  - UL and CUL listed under their continuing reinspection programs.
  - California State Fire Marshall (CSFM) approved.



**Specifications**  
All electromagnetic door holders shall be DORMA EM Series with wall or floor-mounted magnets and door-mounted catch plates. Available as surface, flush, or floor mount. Floor-mounted magnets shall be provided for both single and double door applications. Each magnet to have the following voltage capability: 24 VAC or DC and 120 VAC. Specify type of mount.

- Optional Specifications**
- Magnet to have 1-1/2" catch plate extension. Specify ER-1.5.
  - Magnet to have 2" catch plate extension. Specify ER-2.0.
  - Magnet to have adjustable catch plate extension. Specify either ER-7 or ER-12.

- Finishes**
- Powder Coated Finishes**
- Aluminum: 689\*
  - Bronze: 695 (Dark Duranodic)
- \*The EM-509 is furnished with a 630 faceplate when ordered in 689 finish.

- Painted Finish**
- 696: Gold (Satin)

**Warranty**  
For details, refer to **DORMA Limited Warranty** on our website at [go.dorma.com/terms](http://go.dorma.com/terms).

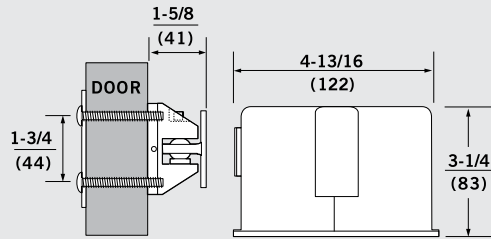
## HOW TO ORDER

Application		Options (Packaged Separately)		Finish	
Completely Flush	509	2-5/8" Catch Plate	CP LONG		
Surface	508	2" Catch Plate	CP SHORT		
Semi-Flush, Short Catch	505	8-3/8" to 12" Adjustable Extension	ER 12	696	Satin Brass Painted
Semi-Flush, Long Catch	504	6-3/8" to 8" Adjustable Extension	ER 7	695	Dark Duranodic Bronze Powder Coated
Double Floor	502	2" Extension	ER 2.0	689	Aluminum Powder Coated
Single Floor	501	1-1/2" Extension	ER 1.5		
EM 504		24120		689	
EM Series		24120 — Dual Voltage 24 VDC, 120 VAC			
		Electrical Specification			

# MODELS

## Floor-Mount (Single Door)

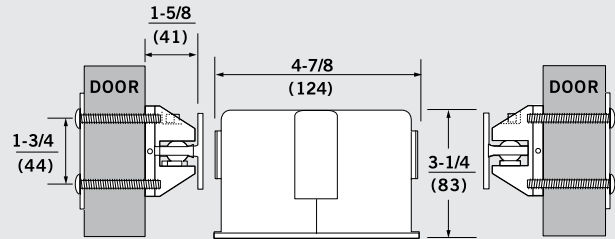
Model	Volts	Amps
EM501 24120	24 V AC or DC, 120 VAC	.015



Overall Projection: 6-7/16" (164)

## Floor-Mount (Double Door)

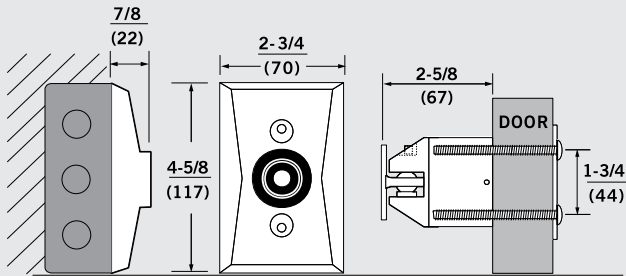
Model	Volts	Amps
EM502 24120	24 V AC or DC, 120 VAC	.030



Overall Projection: 8-1/8" (206)

## Semi-Flush Wall-Mount (Long Catch Plate)

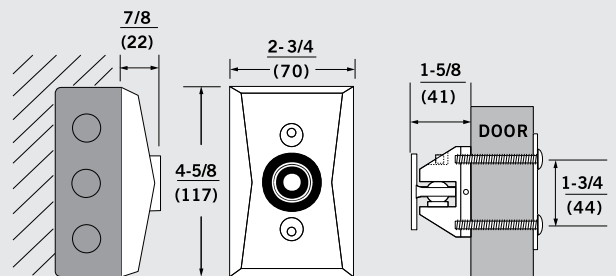
Model	Volts	Amps
EM504 24120	24 V AC or DC, 120 VAC	.015



Overall Projection: 3-1/2" (89)

## Semi-Flush Wall-Mount (Short Catch Plate)

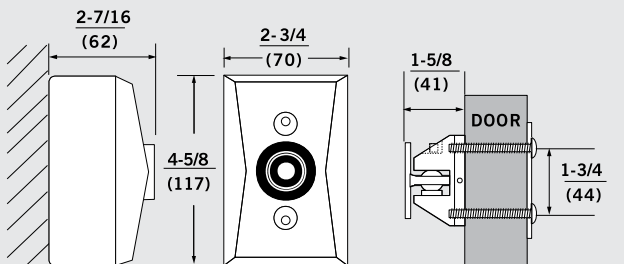
Model	Volts	Amps
EM505 24120	24 V AC or DC, 120 VAC	.015



Overall Projection: 2-1/2" (64)

## Surface Wall-Mount (Short Catch)

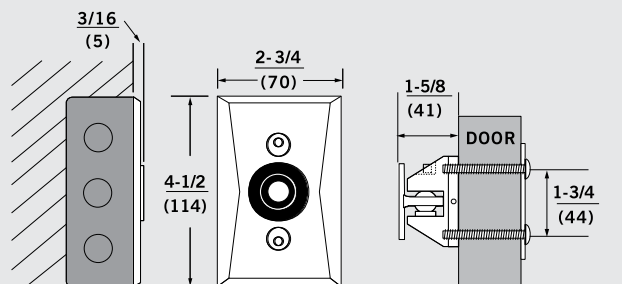
Model	Volts	Amps
EM508 24120	24 V AC or DC, 120 VAC	.015



Overall Projection: 4-1/16" (103)

## Completely Flush Wall-Mount (Low Projection)

Model	Volts	Amps
EM509 24120	24 V AC or DC, 120 VAC	.015



Overall Projection: 1-13/16" (46)



# 450 Series surface overhead door holders/stops



## 450 Series medium-duty

Glynn-Johnson provides the most complete line of overhead holders and stops, offering solutions for the most demanding door control problems. These holders and stops offer the widest variety of functions, materials and finishes to fit all medium- to light-duty applications. The channel is surface-mounted to the door, most often with sex bolts, and the jamb bracket is surface mounted to the jamb, requiring minimal door and frame preparation.

Glynn-Johnson 450 Series holders and stops provide reliable and versatile surface-mounted overhead door control for all medium to light-duty applications. The visible components are available in a wide variety of architectural finishes to complement any design.

The 450 Series holders and stops are designed for installation in virtually all types of doors and frames including doors with conventional butt hinges, offset pivots, continuous hinges, swing clear hinges and many other specialty hinges. The templates provided allow for variable mounting positions, ranging from 85° - 110° of opening.

### Four models:

- 450H Series hold-open model
- 450S Series stop-only model
- 450F Series friction hold-open model
- 450SE Series special stop-only model

### Five sizes:

- Simple
- Standardized
- Each model is available in five sizes

### Three options:

- J—Angle jamb bracket
- SHIM—Blade stop SHIM kit
- Soc—Pin-in-socket security screw package

### Unmatched convenience:

- Non-handed
- Improved compatibility with door closers

- Improved jamb bracket design
- Single acting doors
- Interior applications
- Durable
- Easy to install
- Improved corrosion resistance

### Materials and finishes

In brass, 300 Series stainless steel or steel, these models offer the broadest range of finishes in the industry to complement any design. Brass and stainless steel offer the highest resistance to corrosion, while all these base materials are suitable for normal interior use.

Finish	Description
US3	Polished brass
US4	Satin brass
US10	Satin bronze
US10B	Oil rubbed bronze
US32	Polished stainless steel
US32D	Satin stainless steel
SP4	Powder coast brass
SP10	Powder coat bronze
SP28	Powder coat aluminum
SP313	Powder coat dark bronze
SPBLK	Powder coat black
652	Chrome-like coating

## Models

Glynn-Johnson 450 Series holders and stops are designed for medium to light-duty applications. They're ideal for openings that are subject to normal activity, providing protection for the door, frame, hinges and surrounding walls or obstructions.

Designed for improved compatibility with most door closers, all models incorporate popular channel/slide arm design and offset jamb brackets. The improved design makes it easier to change functions in the field, should user requirements change.

### 450H Series hold-open

(Suffix H) These models conveniently hold doors open at a predetermined position, permitting unobstructed traffic flow.

These models feature an adjustable automatic hold-open that is activated when the door is opened to a preset angle. The hold-open tension can be adjusted using an allen wrench through the end of the slider located in the channel at the top of the door. Each meets the 250,000 test cycles required for Grade 1 classification.

### 450S Series stop-only

(Suffix S) When the hold-open function is not required, the stop-only function provides the same effective door control without keeping the door held open. The stop-only model may be used on fire doors.

### 450F Series friction hold-open

(Suffix F) Friction hold-open models provide an alternative holding method ideal for patient room doors, wardrobe or closet doors, or similar applications where multiple hold-open positions are desired. The friction tension can be adjusted using an allen wrench on the slider located in the channel at the top of the door.

### 450SE Series special stop-only

(Suffix SE) When stop-only models are used in conjunction with single point hold-open electronic door closers, the function may be ordered without the shock absorbing mechanism. Used as an auxiliary stop with these closers, they will prolong the life of the closer. The stop location is adjusted using an allen wrench on the stop block located in the channel. The SE option cannot be added to an existing unit. It must be factory ordered.

Note: Caution should be taken when using this option in other applications, as the elimination of the shock-absorbing spring can put added stress on the door and frame.

## Application information

### Closer applications

Glynn-Johnson 450 Series models require minimal door and frame preparation. They may be used in conjunction with most surface-applied door closers. In some cases, optional drop brackets may need to be mounted on the closers. These brackets are available from the closer manufacturer.

### UL classification

The 450 Series stop-only models are classified by Underwriters Laboratories (UL) as miscellaneous fire door accessories. This classification applies to use on either hollow metal fire doors or wood fire doors. These units may be used on doors of any rating. As a reminder, the miscellaneous fire door accessories (GVUX) section is defined by UL as: "Miscellaneous fire door accessories are intended in the individual listings. The accessories have been investigated to determine that when installed in accordance with the manufacturer's instructions, the accessories do not adversely affect the fire rating of the fire door and/or fire door frames."

### Dead-stop templating

For situations where a wall or similar obstruction is in place at an opening angle of 110° or less (e.g. doors

that open back-to-back), dead stop templating should be used. This includes all hold-open, Friction and stop-only models, except when the "SE" option is used.

The dead stop position is reached when the shock-absorbing spring is fully compressed, allowing an initial degree of opening of 5° to 7° less than the dead stop opening.

Example: If the holder is templated to a 100° dead stop, the door will hold open at an angle between 93° and 95° but no further than 100°.

Note: Do not use dead-stop templating on the 450SE Series since there is no shock-absorbing spring.

### Environmental conditions

To assure a long operating life for holders and stops, consider the environment where they will be used. Doors that open to the exterior of a building or are subject to corrosive conditions should have a holder constructed primarily of stainless steel, brass or bronze materials. For interior doors, steel material may be acceptable, although brass and bronze substrates will provide a more attractive architectural grade finish.

### Heavy-use applications

Where doors and frames are subject to heavy use and abuse, a heavy-duty holder or stop should be considered. Also heavy-duty units should be considered on exterior doors subject to wind.

## Options

### Suffix J (angle jamb bracket)

An additional option on the 450 Series is the angle jamb bracket for hinge-side or flush transom mounting. The angle jamb bracket affixes to the standard jamb bracket. If ordered with the overhead add suffix J. If needed separately order 450J-finish.

### Suffix SHIM (blade stop shims)

Shim kits are available in 3 sizes:

450 SHIM1 is a  $\frac{3}{16}$ " shim kit

450 SHIM2 is a  $\frac{3}{8}$ " shim kit

450 SHIM3 is a  $\frac{9}{16}$ " shim kit

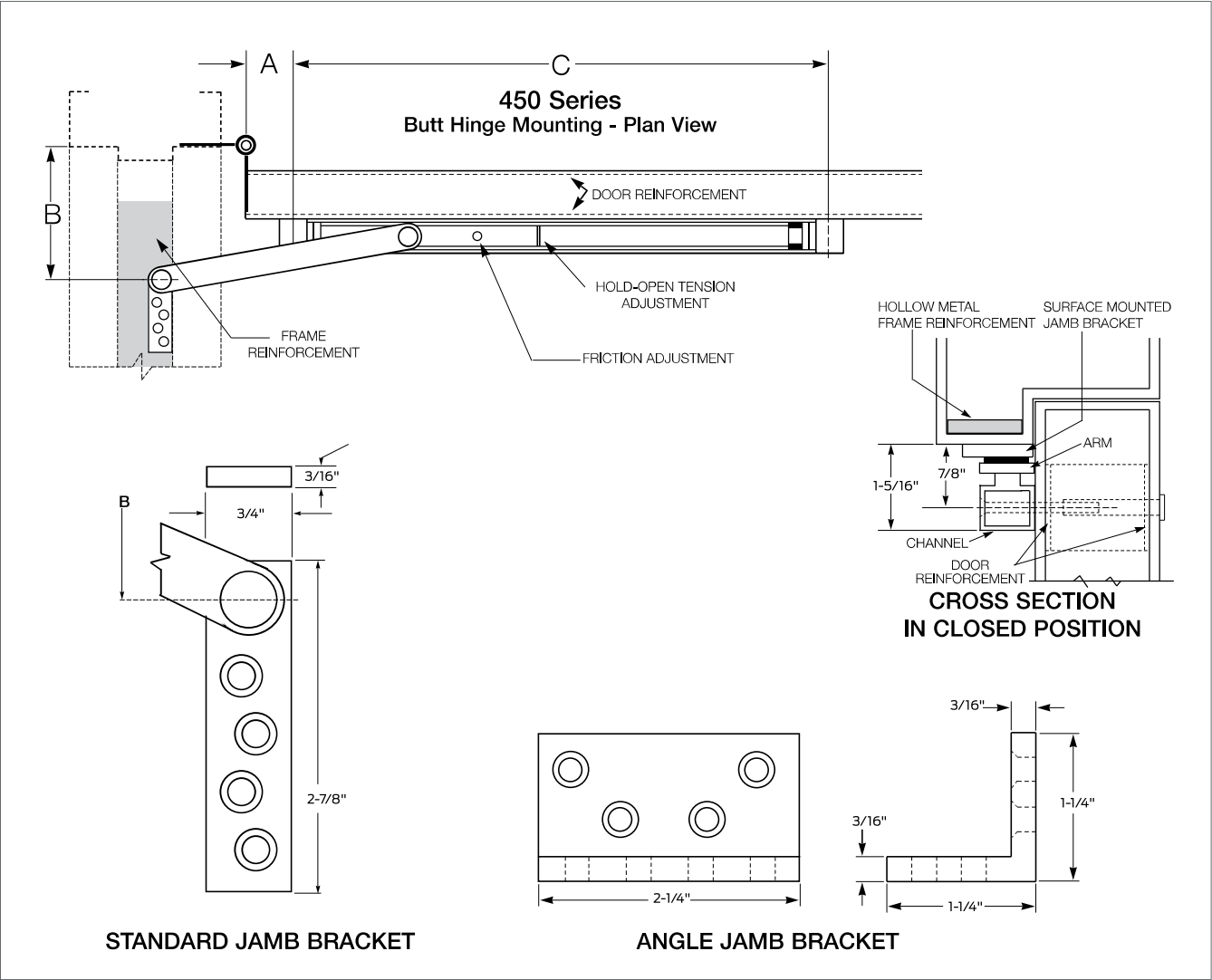
If ordered with overhead, add suffix SHIM (1, 2 or 3).

If needed separately order 450SHIM (1, 2 or 3)—finish.

### Suffix SOC (Pin-in-socket security screw package)

A screw package with pin-in-socket screws for mounting the channel to the door and the jamb bracket to the frame is provided instead of the standard screw package.

# 450 Series surface overhead door holders/stops



450 Series sizing chart									BHMA/ANSI, A156.8 and Fed. spec. cross reference		
Butt/offset pivots					Center hung				G-J model	BHMA*	Fed. spec.
Size	Door opening	Stop only	Hold open	Friction	Door opening	Stop only	Hold open	Friction	451-455 H	C05511	1166
1	18" - 23"	451S	451H	451F	23 1/16" - 27"	451S	451H	451F	451-455 S	C05541	1166A
2	23 1/16" - 27"	452S	452H	452F	27 1/16" - 33"	452S	452H	452F	451-455 F	C05531	1164
3	27 1/16" - 33"	453S	453H	453F	33 1/16" - 39"	453S	453H	453F	* First numeral (0) designates optional material.  To specify: Brass/bronze material, change 0 to 1 (i.e. C15511) Stainless steel material, change 0 to 5 (i.e. C55511) Steel material, change 0 to 8 (i.e. C85511)		
4	33 1/16" - 39"	454S	454H	454F	39 1/16" - 45"	454S	454H	454F			
5	39 1/16" - 45"	455S	455H	455F	45 1/16" - 51"	455S	455H	455F			

Note: This chart illustrates the most common types of hinging and door opening sizes. For unusual door details, contact Glynn-Johnson for availability.

The template information on this page is for reference only and is not intended to serve as an installation template. For more information, reference the Template Directory in the Document Library at [usallegion.com](https://www.usallegion.com).



## How to order

	<b>45</b>	<b>1</b>	<b>H</b>	—	<b>US32D</b>	—	<b>J</b>
<b>Overhead Series:</b>							
<b>45</b>							
<b>Size (door opening using butt or offset pivots):</b>							
<b>1</b>	(18" - 23")						
<b>2</b>	(23 1/16" - 27")						
<b>3</b>	(27 1/16" - 33")						
<b>4</b>	(33 1/16" - 39")						
<b>5</b>	(39 1/16" - 45")						
<b>Function:</b>							
<b>H</b>	Hold-open						
<b>F</b>	Friction hold-open						
<b>S</b>	Stop-only						
<b>SE</b>	Special stop-only						
<b>Finishes:</b>							
<b>US3</b>	Polished brass						
<b>US4</b>	Satin brass						
<b>US10</b>	Satin bronze						
<b>US10B</b>	Oil rubbed bronze						
<b>US32</b>	Polished stainless						
<b>US32D</b>	Satin stainless steel						
<b>SP4</b>	Powder coat brass						
<b>SP10</b>	Powder coat bronze						
<b>SP28</b>	Powder coat aluminum						
<b>SP313</b>	Powder coat dark bronze						
<b>SPBLK</b>	Powder coat black						
<b>652</b>	Chrome-like coating						
<b>Options:</b>							
<b>J</b>	Angle jamb bracket						
<b>SHIM</b>	Blade stop shims						
	SHIM 1 3/16" kit						
	SHIM 2 3/8" kit						
	SHIM 3 9/16" kit						
<b>SOC</b>	Pin-in-socket security screws						

# 9500 Surface Mounted Electric Strike

*Works with rim exit devices up to 3/4" throw Pullman latchbolt*



## The durable, fire rated surface mounted solution.

The 9500 Series Electric Strike is a three hour fire rated, surface mounted electric strike designed to accommodate rim exit devices with a 3/4" throw Pullman latchbolt. All components are completely encased within its 3/4" thick stainless steel housing, so no cutting on the frame is required for installation. Simply place the electric strike on the surface of the frame, align it with the exit latchbolt and install. Adjustments have never been easier as the base is now separate from the cover.

The 9500 exceeds Grade 1 standards for strength and performance. It is field selectable for fail safe / fail secure operation, and for 12 or 24 VDC. This unique electric strike complies with NFPA 80-07 guidelines for retrofit into fire rated frames.

## Features

### Standard Features

- Installs in metal or wood frames (wood screws not included)
- Separate base and decorative cover for easy adjustments
- Stainless steel construction
- Tamper resistant
- Static strength 1,500 lbs
- Dynamic strength 70 ft-lbs
- Endurance 1 million cycles
- Field selectable fail safe/fail secure
- Horizontal adjustability
- Non-handed
- Internally mounted solenoid
- Accommodates up to 3/4" [19mm] Pullman latch
- SecuriCare five-year, no-fault, no questions asked warranty (*Addition of SMART Pac® III extends the warranty to 10 years*)

### Optional Features

- **LBM** Latchbolt monitor
- **LBSM** Latchbolt strike monitor

### Accessories

- **9000-116-XXX** 1/16" Spacer plate (Available in 613E, 628E, 630 & BSP finishes)
- **9000-108-XXX** 1/8" Spacer plate (Available in 613E, 628E, 630 & BSP finishes)
- **9000-MTK** Metal template kit
- **SMB** Surface mounting box
- **2001M** Plug-in bridge rectifier
- **2004M** ElectroLynx® adapter
- **2005M3** SMART Pac® III
- **2006M** Plug-in buzzer



Grade 1



SecuriCare  
Warranty



Rim Exit  
Devices



Field Selectable  
(Fail secure  
/Fail safe)



Dual Voltage  
12/24



Fire Rated



Outdoor  
Rated



Burglary  
Rated



# 9500 Surface Mounted Electric Strike

## Specifications

### Certifications

- ANSI/BHMA A156.31, Grade 1
- UL 1034 burglary-resistant listed and suitable for outdoor use
- UL 294 listed
- UL 305 listed
- RoHS compliant
- UL 10C fire rated, 3-hour single door (fail secure only)
- CAN/ULC-S104 fire door conformant
- NFPA-252 fire door compliant
- ASTM-E152 fire door compliant
- California Fire Marshal listed
- NFPA 80-07 compliant
- WHI fire door listed

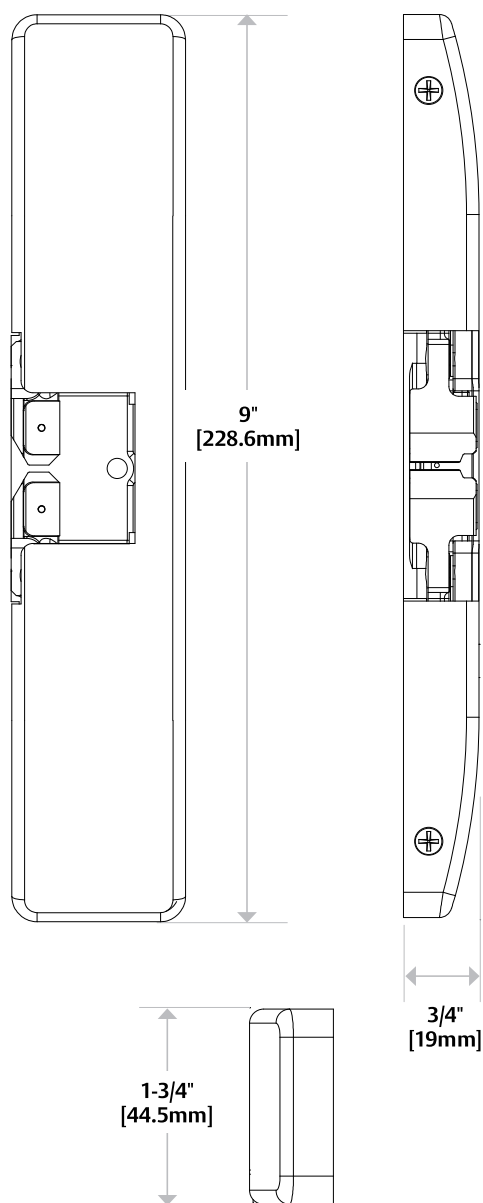
### Frame Application

- Metal
- Wood

### Electrical (DC Continuous Duty)

- Dual voltage 12/24 VDC
- 450 mA at 12 VDC/250 mA at 24 VDC

## Dimensions



## How to Order

SERIES	FINISH	OPTION (S)
<b>9500</b>	<b>- 630</b>	<b>- LBM</b>
<b>9500</b> Surface-Mounted Electric Strike for 3/4" Pullman Rim Exit Devices, fire rated; no faceplates required	<b>605</b> Bright Brass	<b>LBM</b> Latchbolt Monitor
	<b>606</b> Satin Brass	<b>LBSM</b> Latchbolt Strike Monitor
	<b>612</b> Satin Bronze	
	<b>613</b> Bronze Toned	
	<b>613E</b> Dark Oxidized Satin Bronze Powder	
	<b>629</b> Bright Stainless Steel	
	<b>630</b> Satin Stainless Steel	

NOTE: Electric strike compatibility is determined at time of electric strike product release. ASSA ABLOY is not responsible for incompatibility of products that have changed in design or craftsmanship by their respective manufacturers. When compatibility is a concern, contact Customer Support for application assistance.

# 5000 Electric Strike

*Works with cylindrical locksets  
up to a 5/8" throw latchbolt*

Also available in  
a Complete One  
Box Solution



## The Grade 1, low-profile solution for cylindrical locksets.

The 5000 Series Electric Strike is a compact, high performance electric strike designed for low profile openings where there is limited space behind the jamb. Its strength is derived from a unique keeper pin locking design, enabling the 5000 to exceed the ratings of the frame, door and locking hardware. This field selectable fail safe/fail secure unit is easy to install and accommodates latchbolts up to 5/8" throw.

## Features

### Standard Features

- Tamper resistant
- Static strength 1,500 lbs
- Dynamic strength 70 ft-lbs
- Endurance 1 million cycles
- Field selectable fail safe/fail secure
- Non-handed
- Internally mounted solenoid
- Accommodates 1/2" – 5/8" [12.7mm – 15.9mm] latchbolt (5/8" [15.9mm] with 1/8" [3.2mm] door gap)
- Strike body depth 1-1/16" [27.3mm]
- Plug-in connector
- Trim enhancer included
- SecuriCare five-year, no-fault, no questions asked warranty (Addition of SMART Pac® III extends the warranty to 10 years)

### Optional Features

- **LBM** Latchbolt monitor

### Accessories

- **150** Strike latch guard
- **HES-CUT-MTK** Metal template kit
- **2001M** Plug-in bridge rectifier
- **2004M** ElectroLynx® adapter
- **2005M3** SMART Pac® III
- **2006M** Plug-in buzzer
- **5104-1/2** 1/2" [12.7mm] stackable lip extension
- **5104-1** 1" [25.4mm] stackable lip extension
- **5104-1-1/4** 1-1/4" [32mm] stackable lip extension



Grade 1



SecuriCare  
Warranty



Cylindrical  
Locksets



Field Selectable  
(Fail secure  
/Fail safe)



Dual Voltage  
12/24



PoE  
Friendly



Outdoor  
Rated



Burglary  
Rated



Specifications

Certifications

- ANSI/BHMA A156.31, Grade 1
- UL 1034 burglary-resistant listed and suitable for outdoor use
- UL 294 listed
- RoHS compliant

Frame Application

- Metal
- Wood

Electrical (DC Continuous Duty)

- Dual voltage 12/24 VDC/VAC
- 240 mA at 12 VDC/120 mA at 24 VDC
- PoE friendly

Dimensions

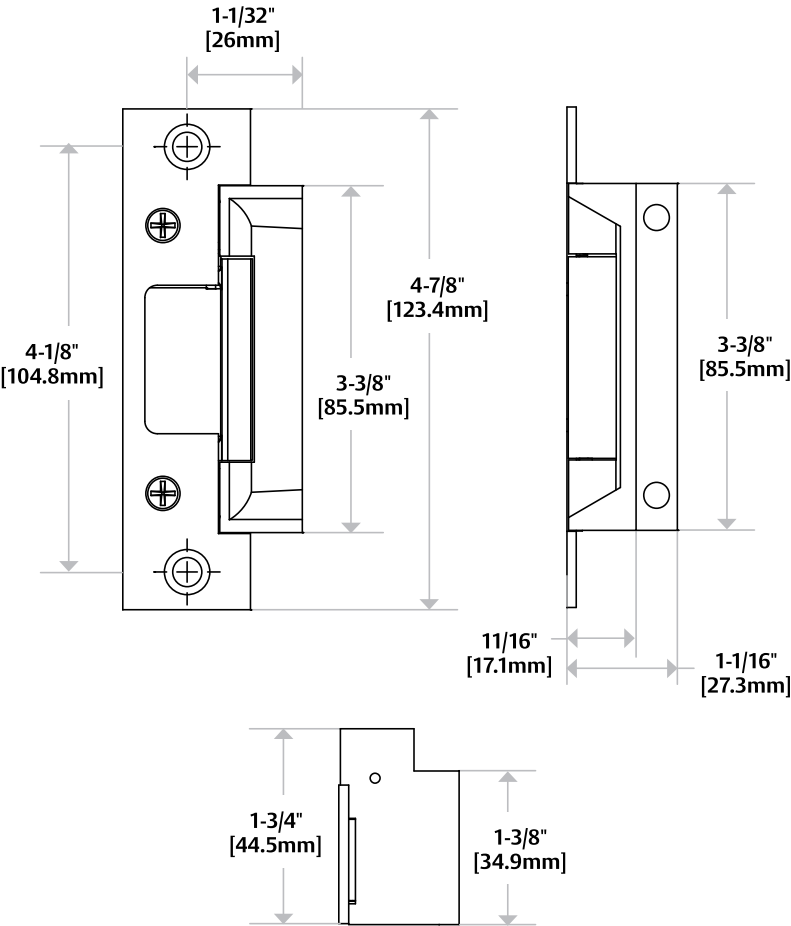


Diagram shown with 501 Option

How to Order

SERIES	MODEL	FINISH	OPTION (S)
5000	—	— 630	— LBM
5000 Universal Electric Strike; faceplates ordered separately	C* Complete Electric Strike; includes the 501 and 501A faceplates	605 Bright Brass	(blank) No Monitor
		606 Satin Brass	LBM Latchbolt Monitor
		612 Satin Bronze	
		613 Bronze Toned	
		629 Bright Stainless Steel	
		630 Satin Stainless Steel	
		BLK Black	

\*Complete Pacs are only available in the 630 finish

NOTE: Electric strike compatibility is determined at time of electric strike product release. ASSA ABLOY is not responsible for incompatibility of products that have changed in design or craftsmanship by their respective manufacturers. When compatibility is a concern, contact Customer Support for application assistance.



# 9400 Surface Mounted Electric Strike

*Works with rim exit devices  
up to 1/2" throw latchbolt*



## The slim-line, surface mounted solution.

The 9400 Series Electric Strike is a slim-line, surface mounted electric strike designed to accommodate rim exit devices with a 1/2" throw Pullman latchbolt. All components are completely encased within its 1/2" thick stainless steel housing, so no cutting on the frame is required for installation. Simply place the electric strike on the surface of the frame, align it with the exit latchbolt, and install.

An 1/8" spacer plate is provided to accommodate varying door gaps. The 9400 exceeds Grade 1 standards for strength and performance. It is field selectable for fail safe/fail secure operation, and for 12 or 24 VDC. The 9400 features a smooth cover to conceal the mounting screws and provide a sleek surface for superior looks.

## Features

### Standard Features

- Installs in metal and wood frames
- Wood screws not provided
- One 1/8" [3.2mm] spacer plate included
- Decorative cover for sleek look
- Stainless steel construction
- Tamper resistant
- Static strength 1,500 lbs
- Dynamic strength 70 ft-lbs
- Endurance 1 million cycles
- Field selectable fail safe/fail secure
- Horizontal adjustability
- Non-handed
- Internally mounted solenoid
- Accommodates up to 1/2" [12.7mm] Pullman latch
- SecuriCare five-year, no-fault, no questions asked warranty (Addition of SMART Pac® III extends the warranty to 10 years)

### Optional Features

- **LBM** Latchbolt monitor
- **LBSM** Latchbolt strike monitor

### Accessories

- **9000-116-XXX** 1/16" Spacer plate (Available in 613E, 628E, 630 & BSP finishes)
- **9000-108-XXX** 1/8" Spacer plate (Available in 613E, 628E, 630 & BSP finishes)
- **9000-MTK** Metal template kit
- **SMB** Surface mounting box
- **2001M** Plug-in bridge rectifier
- **2004M** ElectroLynx® adapter
- **2005M3** SMART Pac® III
- **2006M** Plug-in buzzer
- **9000-ASB-XXX** Aluminum Spacer Bracket (available 613E, 628E, 630 & BSP finis)
- **BN-250** 1/4-20 Blind Nuts



Grade 1

SecuriCare  
WarrantyRim Exit  
DevicesField Selectable  
(Fail secure  
/Fail safe)Dual Voltage  
12/24Outdoor  
RatedBurglary  
Rated

## Spacer Plate Included

The 9400 ships with one 1/8" [3.2mm] spacer plate included in the box. Units ordered in a 630 finish are stainless steel. All other finishes have a black suede powder stainless steel spacer. Additional black spacer plates can be ordered as an accessory.



# 9400 Surface Mounted Electric Strike

## Specifications

### Certifications

- ANSI/BHMA A156.31, Grade 1
- UL 1034 burglary-resistant listed and suitable for outdoor use
- UL 294 listed
- UL 305 listed
- RoHS compliant

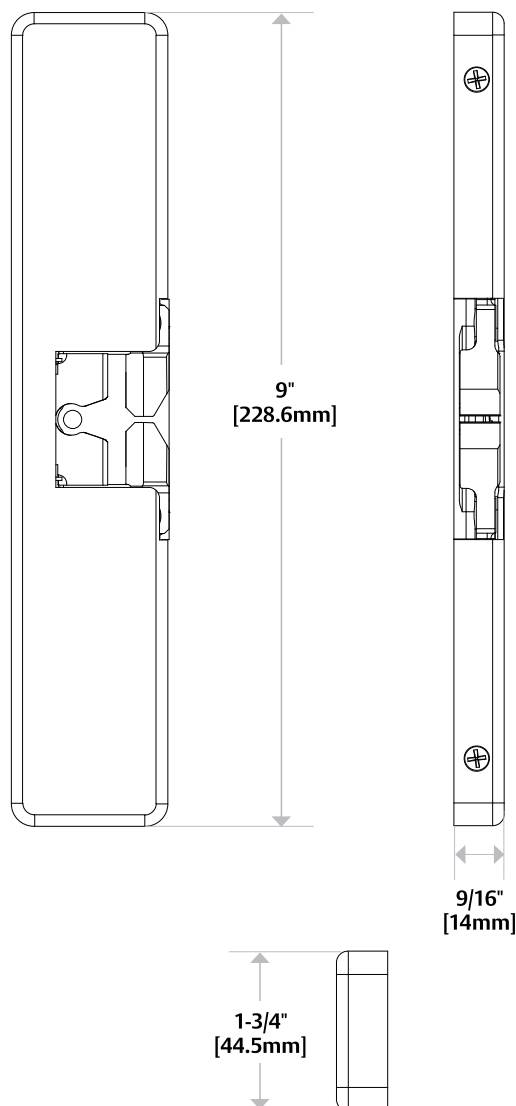
### Frame Application

- Metal
- Wood

### Electrical (DC Continuous Duty)

- Dual voltage 12/24 VDC
- 450 mA at 12 VDC/250 mA at 24 VDC

## Dimensions



## How to Order

SERIES	FINISH	OPTION (S)
<b>9400</b>	<b>– 630</b>	<b>– LBM</b>
<b>9400</b> Surface-Mounted Electric Strike for 1/2" Pullman Rim Exit Devices; no faceplates required	<b>605</b> Bright Brass	<b>LBM</b> Latchbolt Monitor
	<b>606</b> Satin Brass	<b>LBSM</b> Latchbolt Strike Monitor
	<b>612</b> Satin Bronze	
	<b>613</b> Bronze Toned	
	<b>613E</b> Dark Oxidized Satin Bronze Powder	
	<b>629</b> Bright Stainless Steel	
	<b>630</b> Satin Stainless Steel	
	<b>BSP</b> Black Suede Powder	

NOTE: Electric strike compatibility is determined at time of electric strike product release. ASSA ABLOY is not responsible for incompatibility of products that have changed in design or craftsmanship by their respective manufacturers. When compatibility is a concern, contact Customer Support for application assistance.

# 1500 Electric Strike

*Works with most brands  
of cylindrical and mortise  
locksets without a deadbolt*

Also available in  
a Complete One  
Box Solution



The most advanced, modular electric strike that works with most brands of cylindrical or mortise locks designed to work with a 4-7/8" strike plate.

The 1500 Series Electric Strike sets a new standard in the industry by offering dynamic integrated adjustability and field configurable options compatible with any cylindrical or mortise lock. The modular design of the platform makes stocking and installing easier with interchangeable faceplates and accessories. For the first time, the aesthetics of an electric strike are complementary to other surrounding door hardware and blend in with the opening due to the fully finished design, available in eight finishes.

## Features

### Standard Features

- Stainless steel construction
- Tamper resistant
- Static strength 1,500 lbs
- Dynamic strength 70 ft-lbs
- Endurance 1 million cycles
- Field selectable fail safe/fail secure
- Non-handed
- Interchangeable faceplates and accessories
- Field replaceable components
- Fully finished faceplate, keeper, case and trim
- Field adjustable integrated shim
- Strike body depth 1-3/8" [34.9mm]
- SecuriCare ten-year, no-fault, no questions asked warranty

### Optional Features

- **LM** Lock monitor
- **DLM** Dual lock monitors
- **LMS** Lock monitor and strike monitor
- **DLMS** Dual lock monitors and strike monitor

### Accessories

- **157** Torx screws
- **HESCU-MTK** Metal template kit
- **1500-104-xxx** Lip extension trim adapter (finish to match)
- **1500-106-xxx** 4500 adapter and trim enhancer kit (finish to match)
- **OPT-1SRK** Spring replacement kit
- **OPT-1LM** Single lock monitor
- **OPT-1DLM** Dual lock monitors
- **MOD-1SOL** Solenoid replacement module



Grade 1



SecuriCare  
Warranty



Mortise Locks  
without  
Deadbolt



Cylindrical  
Locksets



Field Selectable  
(Fail secure  
/Fail safe)



Dual Voltage  
12/24



PoE  
Friendly



Fire Rated



Windstorm  
Resistant



Outdoor  
Rated



Burglary  
Rated



## Specifications

### Certifications

- ANSI/BHMA A156.31, Grade 1
- UL 1034 burglary-resistant listed and suitable for outdoor use
- UL 294 listed
- RoHS compliant
- UL 10C fire rated, 3-hour single door (fail secure only)
- UL 10C fire rated, 1-1/2 hour double door (fail secure only)
- CAN/ULC-S104 fire door conformant
- NFPA-252 fire door compliant
- ASTM-E152 fire door compliant
- California Fire Marshal listed
- ANSI/SDI A250.13 windstorm resistant
- Florida Building Code approved TAS 201, 202, 203
- ANSI-ASTM E330
- Sustainability documentation

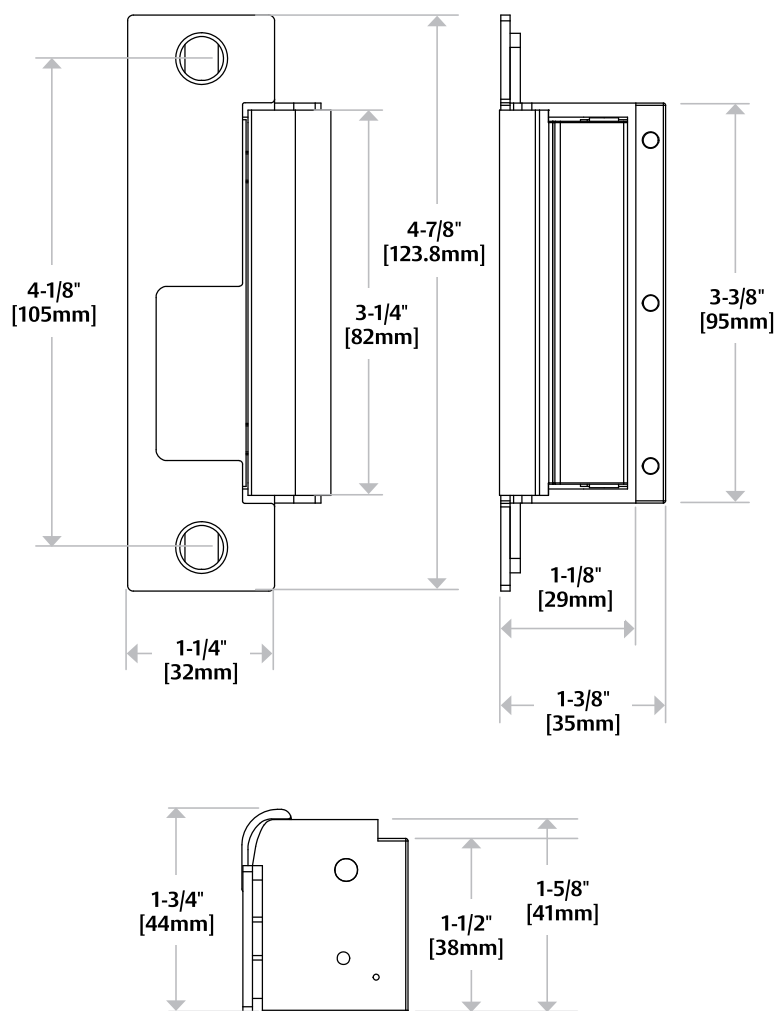
### Frame Application

- Metal
- Wood

### Electrical (DC Continuous Duty)

- Dual voltage 12/24 VDC/VAC
- 240 mA at 12 VDC/120 mA at 24 VDC
- PoE friendly

## Dimensions



## How to Order

SERIES	MODEL	FINISH*	OPTION(S)**
<b>1500</b>	<b>—</b>	<b>— 630</b>	<b>— LM</b>
<b>1500</b> Universal Electric Strike; faceplate option kits ordered separately	<b>C*</b> Complete Electric Strike; includes 1LB faceplate kit for latchbolts	<b>605</b> Bright Brass <b>606</b> Satin Brass <b>612</b> Satin Bronze <b>613</b> Bronze Toned <b>613E</b> Dark Oxidized Satin Bronze Powder <b>629</b> Bright Stainless Steel <b>630</b> Satin Stainless Steel <b>BSP</b> Black Suede Powder	<b>(blank)</b> No Monitor <b>LM</b> Lock Monitor <b>DLM</b> Dual Lock Monitor <b>LMS</b> Lock Monitor and Strike Monitor <b>DLMS</b> Dual Lock Monitors and Strike Monitor

\*Complete Pacs are only available in the 630 finish \*\*LMS/DLMS factory installed only option.

NOTE: Electric strike compatibility is determined at time of electric strike product release. ASSA ABLOY is not responsible for incompatibility of products that have changed in design or craftsmanship by their respective manufacturers. When compatibility is a concern, contact Customer Support for application assistance.

# Mullions: Aluminum, Steel and Electrified

80 Series

**SARGENT**  
**ASSA ABLOY**

## Aluminum Mullions

Product Designation	650A	980	L980
Description	Removable	Removable	Lockable
Material	Aluminum	Aluminum	Aluminum
Standard Finish	US28/Satin Anodized Aluminum	Prime Coat	Aluminum Prime Coat
Options	Specify "650A x 10B" for 313AN to match 10B	Specify "980A" for Anodized US28/Satin Aluminum	Specify: "L980A" Anodized Aluminum Specify: "L980A x10B" for 313AN to match 10B
Stk Size	96"	86"	86"
Max Stk Height	120"	120"	120"
Pre-prepped	658 Strikes Included	No	No
Cylinder Size	Not Required	Not Required	#41
Shape	1-1/2" x 2-1/2"	T Shaped 2-1/2" x 3"	T Shaped 2-1/2" x 3"
Misc. Information and Accessories	Includes 651 Stabilizers and imbedded Weather Stripping Top Retainer 94-2050 Bottom Retainer 94-2051	Top Retainer - 511 Bottom Retainer - 502 Adapter for narrow transom: 507 - Aluminum Prime Coated 507A - Anodized Aluminum	All Cylinder Options Available Wall Mount Kit 98-2578 Top Ret Pack 98-2526 Bottom Ret Pack 98-2525 Cylinder Kit 980C1*

## Electrified

EL980
Electrical Lockable
Steel
Gray Paint
Wall Mounting Kit: 98-2580 Top Ret Pack :98-2558 Bottom Ret Pack: 98-2556
86"
120"
No
#46 Only
Rectangular 2" x 3"
For use with Electric Strikes and Monitoring, Quick Connect Wiring Supplied Cylinder Kit 980C2*

\*Note: Cylinder Kits must be ordered separately

## Steel Mullions

Product Designations	HC980	980S	L980S	HCL980	12-HD980
Description	Hurricane Code	Standard Mullion	Lockable	Lockable Hurricane Code	Heavy Duty
Material	Steel	Steel	Steel	Steel	Steel
Fire Rated	Specify 12-HC980	Specify 12-980	Specify 12-L980	Specify 12-HCL980	Specify 12-HD980
Fire Rated Max Height	96"	96"	96"	96"	120"
Finish	Gray Paint	Gray Paint	Gray Paint	Gray Paint	Gray Paint
Stk Size	86"	86"	86"	86"	120"
Max Stk Height	96"	120"	120"	96"	120"
Pre-prepped	No	No	No	No	No
Cylinder Size	Not Required	Not Required	#41 Std (#42 & #43 available)	#41 Std (#42 & #43 available)	Not Required
Shape	Rectangular 2" x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"
Misc. Information	Designed for severe wind load conditions due to hurricanes or windstorms. Tested to Dade County Protocols & ASTM Standards	For 12-8800 - Channel Iron & Malleable iron top & bottom retainers. Mullions longer than 86" must be ordered as 12-option x 120" length and cut to size in the field. Fire rating is valid only up to 96"	Fire rated for 8'0" x 8'0" paired openings. Mullions longer than 86" must be ordered as 12-option x 120" length and cut to size in the field. Fire rating is valid only up to 96"	See Notes Below	12-HD980 is for pair of doors over 8'0" to 10'0" for use with 12-8800 Rim Exits includes two piece strikes
Accessories	Top Ret Pack - 98-2599 Bottom Ret Pack - 98-2600 Top Retainer Shim Kit - 601	Top Ret Pack - 98-2190 Bottom Ret Pack - 98-2191 Top Retainer Shim Kit - 601	Wall Mounting Kit - 98-2579 Top Ret Pack - 98-2559 Bottom Ret Pack - 98-2556 Top Retainer Shim Kit - 601 Cylinder Kit - 980C1*	Top Retainer Pack: 98-2593 Bottom Retainer Pack: 98-2594 Top Retainer Shim Kit - 601 Cylinder Kit - 980C1*	Top Ret Pack - 98-2599 Bottom Ret Pack - 98-2600 Top Retainer Shim Kit - 601

\*Note: Cylinder Kits must be ordered separately

### Note for HC980/12-HC980 Mullions:

- Designed for severe wind load conditions due to hurricanes or tornadoes
  - Tested to Dade County protocols and ANSI 250.13 ASTM Standards and FEMA 361
  - 12- Fire labeled version
  - Replacement lock kits are available for lockable mullions
- Part numbers for each model are listed in the price book

### HCL980 Mullion Information

- Model 12-HC-L980 may be supplied for doors UL fire rated up to and including 3 hrs not exceeding 8 ft in width and height
- Meets the following standards: ANSI 250.13, ASTM E330, ASTM 1886, ASTM 1996, TAS 201, TAS 202 & TAS 203
- Designed for use with UL Classified HC8810, HC8800 and 12-HC8800 rim exit devices

# Mullion Accessories and Stabilizers

80 Series

**SARGENT**  
**ASSA ABLOY**

## Mullion Accessories

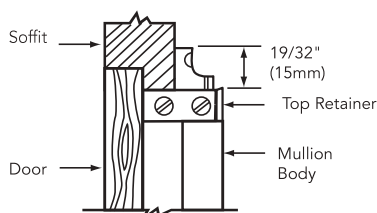
### RK980

Latchbolt assembly retrofit kit with top and bottom retainers for 980 aluminum mullion



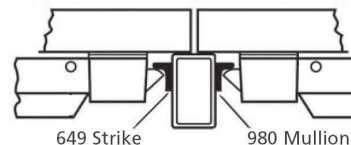
## 507 Narrow Transom Bars Adapter

- Available with 980 and 980A
- Required when soffit is 1-1/4" (32mm) to 2" (51mm) wide
- Order as a: 507 for 980 mullion or 507A for 980A mullion



## 980S Mullion Application

- All steel mullions are 2" x 3"

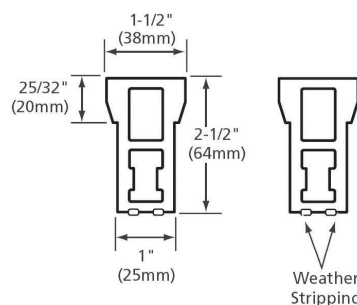


## 651 Mullion Stabilizer Kit

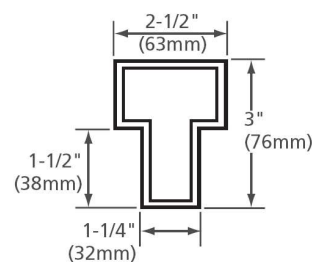


- Stabilizer block
- Furnished standard w/650A Mullion
- Order as a 651 Kit

## 650A Mullion



## 980 Mullion & L980 Lockable Mullion

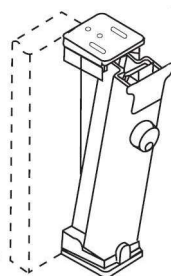


## 980C1 Cylinder Mullion Kit



- Lockable mullions only
- Aluminum and steel
- Includes cylinder and collar
- Available in 26D & 10B finish

## Lockable Mullion



## Lockable Mullion Cylinder Kit Options\*

L980, L980A, L980S & HC-L980 mullions are available with these options: 10, 10-21-, 10-63-, 11-, 11-21-, 11-60, 11-63-, 11-64-, 11-72-7P-, 11-65-73-7P-, 11-73-7P-, 21-, 22-, 60-, 63-, 64-, 70, 72-, 73-, 65-73-, 65-73-7P-, 73-7P-, 81-, 82-, F1-82-, 83-, F1-83-, 84-, SC- & SE-.

## EL980 mullion is available with these options:

10, 10-21-, 10-63-, 11-, 11-21-, 11-60, 11-63-, 11-64-, 11-72-7P-, 11-65-73-7P-, 11-73-7P-, 21-, 22-, 60-, 63-, 64-, 70, 72-, 73-, 65-73-, 65-73-7P-, 73-7P-, 81-, 82- & F1-82-.

\*Lockable mullions are shipped without cylinders. Order Cylinder Mullion Kit separately.

## 980C2 Cylinder Mullion Kit



- Lockable mullions
- Electrified only
- Includes cylinder and collar
- Available in 26D finish only

## Mullion Weights & Packaging

Product	Avg Wt	Case
Exit Device with Trim	15 lbs	1 ea
980 Mullion	18 lbs	1 ea
12-980 Mullion	40 lbs	1 ea
650A Mullion	18 lbs	1 ea
SM980S Split Mullion	40 lbs	1 ea

# Finishes and Finish Care

## 80 Series

### Finish

SARGENT#	BHMA#	Description	How to clean	Avoid these cleaners
3	605	Polished brass, clear coated	Mild non-abrasive detergent with damp cloth or sponge	Abrasive cleaners, bleach solvents, steel or bronze wool
4	606	Satin brass, clear coated		
9	611	Polished bronze, clear coated		
10	612	Satin bronze, clear coated		
BSP	—	Black Suede Powder Coat		
10B	613	Oxidized bronze, oil rubbed	Lemon oil polished with dry cloth	Abrasive cleaners, bleach solvents, steel or bronze wool
10BE	613E	Dark oxidized satin bronze, equivalent		
10BL	613L	Oxidized satin, bronze, clear coated	Mild non-abrasive detergent with damp cloth or sponge	Abrasive cleaners, bleach solvents, steel or bronze wool
14*	618*	Polished nickel, clear coated		
15*	619*	Satin nickel, clear coated		
20D	624	Statuary dark bronze, clear coated		
26*	625*	Polished chrome		
26D*	626*	Satin chrome		
32*	629*	Polished stainless steel		
32D*	630*	Satin stainless steel	Plastic pad or bronze wool	Cleaners, solvents, bleach, steel wool

\* Exit devices are available in all standard finishes, except 14, 15, 26 & 26D. With these finishes, exit devices are supplied in 32 or 32D to match accordingly. 32 or 32D is automatically supplied when 26 or 26D is specified. For nickel finishes, specify 14/32 or 15/32D to receive nickel finished trims and stainless exit devices.

**Note:** FLW & FSW are NOT available in 32 or 32D

**Note:** Pulls and thumb piece trims are not available in 14, 15, 26 or 26D except FLW & FSW which are available in 14 and 15.

### Lock/Cylinder Finish

Device Finish	Cylinder/Core*
03, 04, 09, 10, 10B, 10BE, 10BL, 20D	04
14, 15, 26, 26D, 32, 32D	15
BSP	BSP

\*Finish when cylinder provided with Device

### To avoid discoloration and pitting:

- Keep stainless steel away from contact with other metals
- Avoid cleaning with mineral acids or chlorine products
- Avoid cleaning with abrasive products like sandpaper or steel wool

### To maintain the finish:

- Remove any contamination before damage occurs
- Protect with a metal polish or car wax



## Column™ 9", 36" & 7536VR Series Push Plate Switches



Listed  
Components



Compliant



Camden CM-75 Series Column™ switches offer greater user convenience and lower installation costs by providing a single activation device in place of two high/low switches, as required by a growing number of building codes across North America.

CM-75 Series Column™ switches feature solid aluminum or stainless steel construction and are available in a range of finishes, with the option for Kinetic™ no-battery wireless or Lazerpoint RF™ battery powered wireless transmitters.

CM-7536VR Series Column™ Switch with Sensor uses active infra-red technology to eliminate the spread of germs.

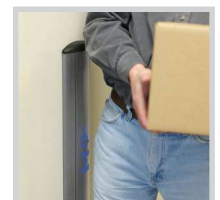
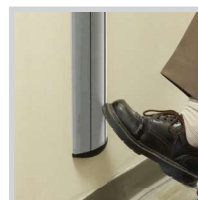


### Standard Features

- Low profile contoured design with easy activation from any angle
- Adjustable leveling screws for easy installation on uneven walls
- Exceeds state and provincial building code requirements
- Available with clear, bronze or blue anodized finishes, as well as stainless steel
- A wide selection of switch graphics

### 7536VR Features

- IR sensor provides stable and reliable operation
- Red/green light ring with switch or remote activation
- Adjustable sensor range 2" to 8" (5 cm to 20 cm)
- Adjustable sensor time delay (0.5 sec. to 20 sec.)
- Weather/water resistant sensor, IP65 rated





## SPECIFICATIONS

VOLTAGE:	<b>CM-7509/7536:</b> N/A <b>CM-7536VR:</b> 12-24 VDC +/- 10%
CONTACT TYPE:	<b>CM-7509/7536:</b> SPDT Momentary, Form 'C' <b>CM-7536VR:</b> Common / N.O. / N.C.
CONTACT RATING:	<b>CM-7509/7536:</b> 15 Amps @ 30 VDC <b>CM-7536VR:</b> 1 Amps @ 30 VDC
DIMENSIONS:	<b>CM-7509:</b> 5-7/8"W x 10-5/8"H x 1-1/2"D (150mm x 270mm x 38mm) <b>CM-7536:</b> 5-7/8"W x 37-1/2"H x 1-1/2"D (150mm x 953mm x 38mm) <b>CM-7536VR:</b> 5-7/8"W x 37-1/2"H x 1-1/2"D (150mm x 953mm x 38mm)

## MODELS

<b>CM-7509</b>	9" Tall Column™ Push Plate Switch, Anodized Aluminum, option for Bronze or Blue finish
<b>CM-7536</b>	36" Tall Column™ Push Plate Switch, Anodized Aluminum, option for Bronze or Blue finish
<b>CM-7536VR</b>	36" Tall Column™ Push Plate Switch with Hands Free Sensor, Anodized Aluminum, option for Bronze or Blue finish
<b>CM-7536SS</b>	36" Tall Column™ Push Plate Switch, Brushed Stainless Steel, US32 / 630
<b>CM-7536SSVR</b>	36" Tall Column™ Push Plate Switch with Hands Free Sensor, Brushed Stainless Steel, US32 / 630

## WATERPROOFING OPTION

<b>-WT</b>	Add '-WT' to Product # for Boot & Water Tight Coating
------------	---

Optional DPDT Switch. DPDT switches not available. Use Camden CX-IRB relay if required.

## DIMENSIONS

<b>CM-7509</b>	<b>CM-7536</b>	<b>CM-7536VR</b>

## 9" & 36" PUSH PLATE SWITCHES

<b>CM-7509/4</b>	<b>CM-7536/4</b>	<b>CM-7536SS/4</b>	<b>CM-7536VR/4</b>

## OPTIONAL ARCHITECTURAL FINISHES

<b>-BRZ</b>	Add Suffix '-BRZ' to Model # for Anodized Dark Bronze finish (BHMA 710, 313AN)
<b>-BLU</b>	Add Suffix '-BLU' to Model # for Anodized Blue finish

## OPTIONAL WIRELESS

<b>-K</b>	Add Suffix 'K' to Model # for (2) built-in Kinetic™ no-battery wireless transmitter switches.
<b>-TX</b>	Add Suffix '-TX' to Model # for (1) CM-TX-9 Lazerpoint RF™ wireless transmitter and alkaline battery pack, mounted in switch cap
<b>CM-RX90V2</b>	Kinetic™ and Lazerpoint RF™ compatible receiver

## GRAPHIC OPTIONS

<b>CM-xx/1</b>	<b>CM-xx/2</b>	<b>CM-xx/A2</b>	<b>CM-xx/2AL</b>	<b>CM-xx/2AR</b>
<b>CM-xx/4</b>	<b>CM-xx/A4</b>	<b>CM-xx/4AL</b>	<b>CM-xx/4AR</b>	<b>CM-xx/8B</b>

Add 'F' to graphic option for French language

<b>CM-xx/1:</b>	CM-7536 only, not available with 'BRZ', 'BLU' or 'SS' finishes
<b>/2AL &amp; /2AR:</b>	Not available on stainless steel models
<b>/A2 &amp; /A4:</b>	Not available on stainless steel models
<b>/8B:</b>	Only available on aluminum models



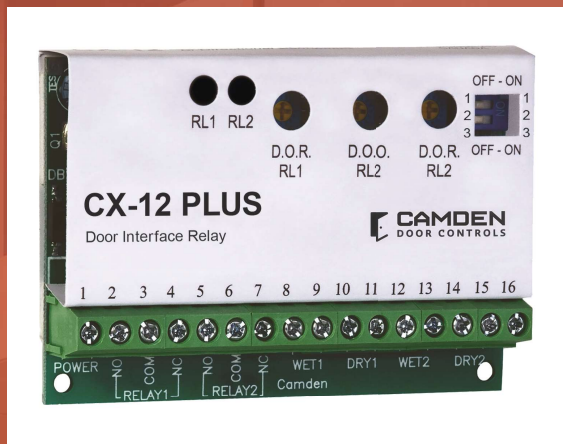
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Part #: MKTG-LIT-SP-CM-75SERV4

# CX-12 PLUS Door Interface Relay



BEST VALUE



EASIER  
INSTALLATION

**CX-12 PLUS Door Interface Relay is an economical solution for interconnecting automatic doors with access control, fire alarm and time systems.**

This versatile relay is also designed to control two automatic doors in vestibule applications as well as control of automatic doors in basic restroom control applications.

CX-12 PLUS has eight built-in operating modes with delay-on-release and delay-on-operate time adjustment, and (2) heavy duty Form C relays.

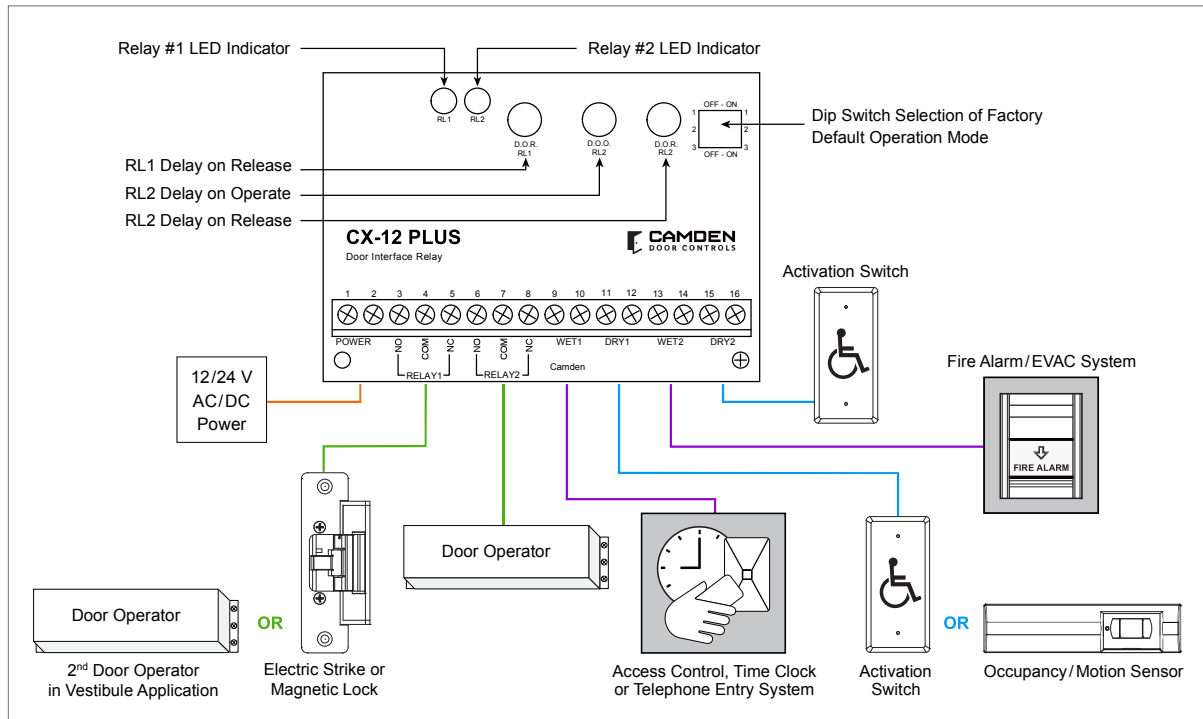
## Features

- Designed for easy interconnection of automatic doors with access control, time control, telephone entry and fire alarm systems
- Bi-directional sequencing of two door operators in vestibule applications
- New 'PLUS' feature supports basic restroom control (locked & unlocked)
- 8 Programming modes with (3) adjustable time delays, each up to 30 seconds
- (2) Dry, (2) Wet inputs, and (2) SPDT Form 'C' outputs
- Momentary, maintained and latching (ratchet or alternative action) relay operation
- Compact design fits anywhere



## APPLICATIONS

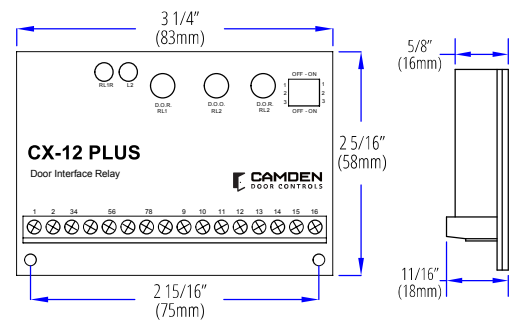
The CX-12 PLUS Interface Relay is ideal for control and integration of automatic doors utilizing electro-mechanical locks (including electric strikes and magnetic locks) in any commercial, institutional and multi-unit residential application. Operating modes support bi-directional sequencing of two vestibule doors, basic restroom control, both secured and unsecured, a maintained output for fire alarm integration, and a telephone entry panel input that simplifies wiring, and eliminates the need for an isolating relay.



## SPECIFICATIONS

VOLTAGE:	12/24V AC/DC	ELECTRICAL LIFE TIME:	100,000 @ Rated Capacity
CURRENT DRAW:	20 mA Idle	MODES:	8
	60 mA Operating	TIME DELAY	D.O.R. #1: 1-30 Seconds
RESPONSE TIME:	0.3 Seconds		D.O.R. #2: 1-30 Seconds
INPUTS:	2 Wet, & 2 Dry, N.O.		D.O.R. #3: 1-30 Seconds
OUTPUTS:	2 x Form C (SPDT)	DIMENSIONS:	3-1/4"W x 2-5/16"H x 11/16"D
CONTACT RATING:	3 Amps @ 30V DC		(83mm x 58mm x 18mm)

## DIMENSIONS



## ORDERING INFORMATION

### Door Interface Relay



#### CX-12PLUS

Door Interface Relay

(8) Programming modes with (3) adjustable time delays, each up to 30 seconds  
(2) Dry, (2) Wet inputs, and (2) SPDT Form 'C' outputs

## SINGLE GANG MOUNTING BOXES

### CM-CPC1 Single Gang

**Type:**

Clear plastic protection cover

**Construction:**

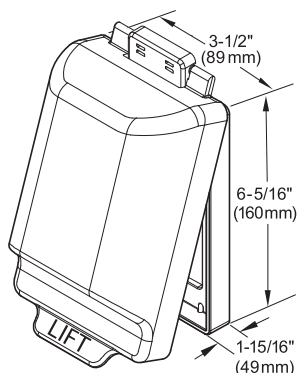
Molded polycarbonate

**Application:**

Indoor / outdoor

**For Switch Series:**

Any Camden single gang flush mounted Push/Exit Switch, Keypad/Key Switch



### CM-RH-SG Single Gang

**Type:** Flush mount rain hood

**Construction:**

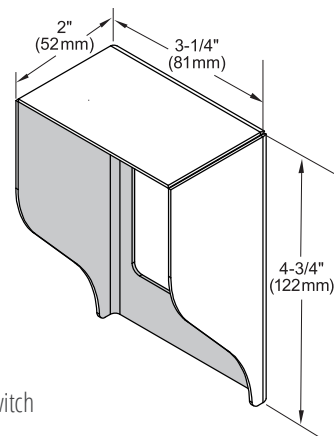
Heavy gauge stainless steel

**Application:**

Foam gasket between hood and mounting surface on irregular surfaces

**For Switch Series:**

Any Camden single gang flush mounted Push/Exit Switch, SureWave™ Switch, Keypad/Key Switch



## DOUBLE GANG / SQUARE MOUNTING BOXES - SURFACE

### CM-43LP Double Gang, 2 Pieces, Shallow

**Type:** Surface mount box

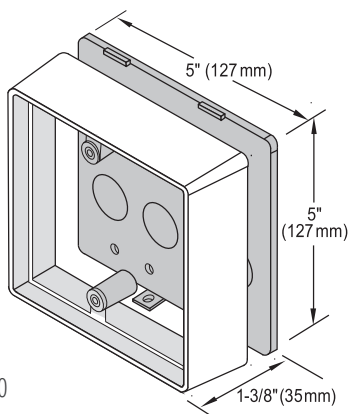
**Construction:** Provision for wireless, flame & impact resistant black polymer (ABS)

**Application:**

Indoor / outdoor

**For Switch Series:**

CM-41, CM-45, CM-46.  
Add suffix 'A' for use with CM-324 / 325 / 330 Series double gang Hands Free Switches.  
Add suffix 'B' for use with CM-2520 double gang vestibule switches



### CM-43CBL / CBLA 5" Square, Standard Depth

**Type:** Surface mount box

**Construction:**

Flame & impact resistant black polymer (ABS)

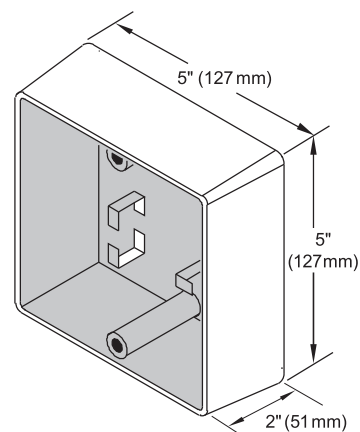
**Application:**

Indoor / outdoor, wired.  
Required for wireless.

**For Switch Series:**

CM-41, CM-45, CM-46  
CM-43CBLA: surface box for CM-324 / 325 / 336W switches

**Cover Plate:** CM-43CP



### CM-53 5" Square, Standard Depth

**Type:**

Surface mount box

**Construction:**

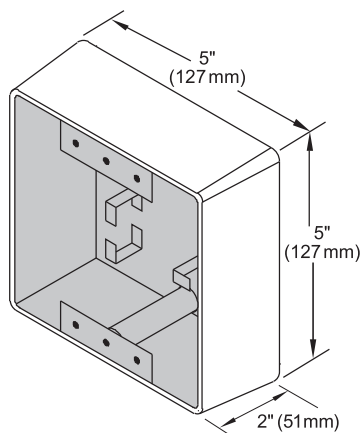
Flame & impact resistant black polymer (ABS)

**Application:**

Indoor / outdoor, for double gang switches and vestibule switches

**For Switch Series:**

CM-500, CM-2510, CM-2520, CM-3200, CM-3500



### CM-54i 5-1/4" Square, Standard Surface Depth

**Type:** AURA™ Illuminated surface box - CM-54i: Green/Red

**Construction:**

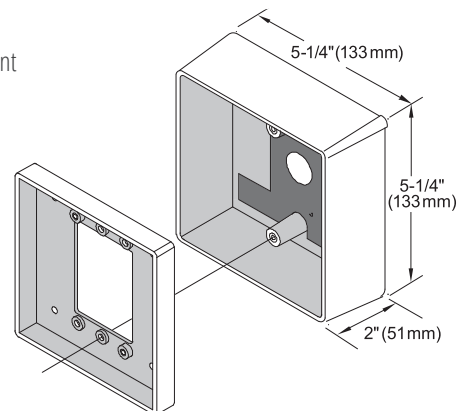
Flame & impact resistant black polymer (ABS)

**Application:**

Surface 4-1/2" square push plate switch enclosure, room for wireless

**For Switch Series:**

CM-45, CM-46, SPDT models only

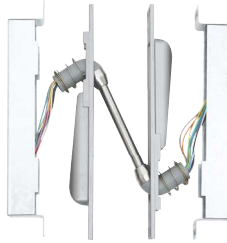


## Power transfers and electromagnetic locks

### Electrical power transfer (EPT)

#### Pneumatic transfer (PNT)

Electric Power Transfer provides a means of transferring electrical power from a door frame to the edge of a swinging door. The units are completely concealed when the door is in the closed position, and are ideal for installations involving abuse or heavy traffic.



Two models are available; EPT-2, two 18 gauge wires and EPT-10, ten 24 gauge wires. The EPT-2, EPT-10, and PNT-1 are UL listed as "miscellaneous fire door accessories". UL Listed for use on fire doors. PNT-1 has one 5/32" tube.

#### Door applications:

Degree of opening	Hinge type	Door thickness
0-180	Up to 5" butt hinges	1 3/4"
0-180	Up to 3/4" offset pivots	1 3/4"
0-130	5 1/2" butt hinges	1 3/4"
0-110	6" butt hinges	1 3/4"
0-90	Swing clear hinges	1 3/4"

#### Finishes

SP28 (sprayed aluminum)

SP313 (sprayed duranodic)

#### Dimensions

Housing	9" x 1 1/4" x 1 5/8" (229mm x 32mm x 38mm)
EPT-2	Two 18 gauge wires, Up to 2 AMPS @ 24VDC, with a 16 AMPS Maximum Surge
EPT-10	Ten 24 gauge wires, Up to 1 AMPS @ 24VDC, with a 16 AMPS Maximum Surge
PNT-1	5/32" Tubing

#### To order, specify:

1. EPT-2, EPT-10 or PNT-1.
2. Finish, SP28 or SP313.

### Electromagnetic locks

Schlage has a rich heritage in electronic security. For years we have led the industry by providing a broad portfolio of solutions to meet the diverse needs of the market. Today, our electromagnetic locking portfolio continues to evolve to meet your changing needs.

Schlage electromagnetic locks are used to secure the door in conjunction with push bars, request to- exit devices, or credential readers for fail-safe applications when code compliance permits. You can use them on a single standalone door or as part of an access control system. Electromagnetic locks do not contain moving parts, making them extremely durable and preferred for high security applications.

Electromagnetic locks consist of an armature and a coil assembly, which become magnetized when an electric current passes through them. This magnetic field secures the door. Electromagnetic locks are fail-safe by design. To unlock the door simply remove power.

#### M400 Series electromagnetic locks

The M400 Series is a robust line of electromagnetic locks with unique new design elements that make them easy to install and secure.

#### Features:

- Auto voltage selection is standard
- Plus Package (P) adds magnetic bond sensor, relocking time delay, door status monitor
- Optional mounting kits available including: Top Jamb Mount, Double and Glass Door

#### Certifications:

- UL 1034
- UL 10C 3 hour fire rating
- BHMA Grade 1
  - M420 – 500 lb. hold force for traffic control
  - M450 – 1000 lb. hold force for high security
  - M490 – 1500 lb. hold force for max security

#### Electromagnetic specialty locks

Schlage's electromagnetic specialty locks provide flexibility for a variety of applications. They offer a depth of features and a proven record of performance.

#### Features and certifications:

**M490DE:** Delays egress with 15 second timer: includes integrated alarm

- Designed to meet NFPA 101 & BOCA, UL 10C 3 hr fire rating, UL 294, and BHMA 1500 lb. hold force

**M490G:** Gate lock is weather resistant for exterior swinging and sliding gates

- BHMA 1500 lb. hold force rated GF3000: Concealed locking mechanism enhances security and appearance
- UL 10C 3 hr fire rating, BHMA 1500 lb. hold force 320M: MiniLine is mortise designed for interior sliding doors
- UL 10C 3 hr fire rating, UL 1034 listed

#### 40/70 Series Electromagnetic Locks

Ease of installation makes the 40/70 Series a perfect choice for retrofit applications. It is also easy to select and stock.

#### Features and Certifications:

- Magnetic bond sensor and door status monitor standard
- UL 10C 1 hour fire rating and BHMA Grade 1:
  - 40 Series – 500 lb. hold force
  - 70 Series – 1000 lb. hold force



**A**  
Hinges & pivots

**B**  
Pulls & plates

**C**  
Flush bolts & coordinators

**D14**  
Latches, catches & bolts

**E**  
Stops

**F**  
Exterior hardware

**G**  
Miscellaneous hardware



## 325 Magnetic catch

- Double pole
- Self aligning magnet ensures maximum pull
- Case design allows easy magnet adjustment on cabinet or small door applications.
- Packed with sheet metal screws
- 5 lbs. load capacity

### Certifications

- Meets ANSI/BHMA A156.9, B43171

### Material substrate

- Case made from aluminum

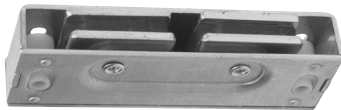
### Dimensions

- Case: 1-1/8" wide x 2-1/16" long x 5/8" thick

### Finishes

BHMA	Description	Substrate	Finish
666	Bright brass	Aluminum	A3
673	Aluminum clear coat	Aluminum	A92

For other colors, consult factory.



## 326 Magnetic catch, dual double pole

- Dual double pole
- Self-aligning magnets ensure maximum pull
- Can be surface mounted or mortised
- Packed with sheet metal screws, 2 short strikes and 1 long strike
- 9 lbs. load capacity

### Certifications

- Meets ANSI/BHMA A156.9, B43161

### Dimensions

- Case: 1" wide x 3-1/8" long x 9/16" thick

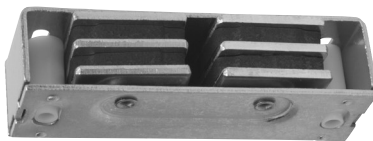
### Material substrate

- Case made from aluminum

### Finishes

BHMA	Description	Substrate	Finish
666	Bright brass	Aluminum	A3
673	Aluminum clear coat	Aluminum	A92

For other colors, consult factory.



## 327 Magnetic catch, dual triple pole

- Dual triple pole
- Self-aligning magnets insure maximum pull
- Can be surface mounted or mortised.
- Packed with sheet metal screws, 2 short strikes and 1 long strike
- 14 lbs. load capacity

### Certifications

- Meets ANSI/BHMA A156.9, B43161

### Dimensions

- Case: 1" wide x 3-1/8" long x 3/4" thick

### Material substrate

- Case made from aluminum

### Finishes

BHMA	Description	Substrate	Finish
666	Bright brass	Aluminum	A3
673	Aluminum clear coat	Aluminum	A92

For other colors, consult factory.

---

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 07 92 00 Joint Sealants
- .2 Section 08 11 00 Metal Doors and Frames
- .3 Section 08 14 16 Flush Wood Doors
- .4 Section 08 50 00 Aluminum Doors, Windows and Screens
- .5 Section 08 87 13 Solar Control Films
- .6 Section 08 87 20 Decorative Window Films
- .7 Section 08 88 13 Fire Resistant Glazing
- .8 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 D1929-20 Standard Test Method for Determining Ignition Temperature of Plastics
  - .8 ASTM D2240-15e1 Standard Test Method for Rubber Property—Durometer Hardness
  - .9 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .10 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - .11 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 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
- .4 CSA Group (CSA)
  - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
- .5 Consumer Product Safety Commission
  - .1 CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials.
- .6 Environmental Choice Program (ECP).
  - .1 CCD-045-95 Sealants and Caulking.
- .7 Flat Glass Manufacturers Association (FGMA).
  - .1 FGMA Glazing Manual - 1997.
- .8 Glass Association of North America (GANA)
  - .1 GANA Glazing Manual 50th Anniversary Edition-2008.

- .2 GANA 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).
- .9 South Coast Air Quality Management District, California State (SCAQMD)
  - .1 SCAQMD Rule 1168-03, Adhesives and Sealants Applications.
- .10 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 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.
- .5 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



- .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.
- .2 Insulating glass units in combination with aluminum window or storefront framing specified elsewhere shall be designed by the supplier to comply with energy efficient requirements specified in MMAH Supplementary Standard SB-10. Submit engineered shop drawings, calculations and certificates certifying compliance with that standard.

1.7 Design Requirements

- .1 Design glass, glazing channels, connections, attachments and glazing accessories to withstand loads designated by the Ontario Building Code and to accommodate all building deflections.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a design pressure of 1.2 kPa as measured in accordance with ANSI/ASTM E330.
- .3 Limit glass deflection to 1/200 with full recovery of glazing materials.
- .4 Glass thicknesses indicated are minimum and are for detailing only. Confirm glass thickness by analyzing project conditions, including in-service conditions and loads. Provide glass lites for various size openings in nominal thicknesses indicated but not less than required to meet performance requirements of referenced standards including energy efficiency requirements of MMAH-SB-10. Coordinate glass thicknesses with manufacturers of framing systems.

1.8 Project Conditions

- .1 Install glazing when ambient temperature is 10 ° C minimum. Maintain ventilated environment for 24 hours after application.
- .2 Maintain minimum ambient temperature before, during and for 24 hours after installation of glazing compounds.

1.9 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

- .3 Provide glass units with interleaving protection between lites. Keep glass and interleaving dry and store cases in clean, cool, dry areas with temperatures above the dew point. Circulation of cool, dry air in storage areas is essential. Open cases and inspect units periodically for moisture accumulation.
- .4 Do not store glass in direct sunlight without an opaque protective covering over same.

#### 1.10 Waste Management and Disposal

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

#### 1.11 Warranty

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of ten years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.
- .2 Warrant insulating glass units for ten years from date of Substantial Performance against seal failure, interpane dusting, or interpane misting.
- .3 Warrant low-emissivity coatings when applied to the second or third surfaces of an insulating glass unit, for ten years against peeling or coating deterioration due to product failure.
- .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 Tempered Safety Glass: To CAN/CGSB-12.1, transparent, 10 mm thick unless indicated otherwise. Type 2-tempered.
  - .1 Class B-float.
  - .2 Category 1
  - .3 Edge treatment: ground, bevel edge.
- .4 Mirror Glass: Silvered mirror glass: to ASTM C1503, minimum 6 mm thick.
  - .1 Type 1B-Float glass for high humidity use. All edges ground and polished.

#### 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.
- .1 Insulating Glass Units: To CAN/CGSB-12.8-M, double glazed sealed units, not less than 25 mm thick. Minimum 12.7 mm air space
  - .1 Exterior Units: Insulating Glass Type 1:
    - .1 Outboard Lite: 6 mm clear tempered with Solarban 67 low-e coating on second surface.
    - .2 12.7 mm air space, argon filled.

- .3 Inboard Lite: 6mm clear
- .4 Performance: All performance data shall be calculated according to ASHRAE standard procedures and verified using the LBL "Window 4.1" program:
  - .1 Winter nighttime U value: 0.24
  - .2 Summer Daytime U value: 0.22
  - .3 Shading Coefficient: 0.33
  - .4 Solar Heat Gain Coefficient: 0.29
  - .5 Relative Heat Gain: 68.7
  - .6 LSG: 1.86
  - .7 Visible Light Transmittance: 54%
  - .8 Ultraviolet Transmittance: 11%
- .5 Product: Vitro 6mm Solarban 67 (2) on Clear + 12.7 mm Argon + 6mm Clear

## 2.2 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 three (3) colours will be selected.

## 2.3 Fire Rated Glass

- .1 Refer to Section 08 88 13

## 2.4 Window Film

- .1 As specified in Section 08 87 13 and 08 87 20.

## 2.5 Glazing Products

- .1 Select appropriate glazing sealants, tapes, gaskets and other glazing materials of proven compatibility with other materials that they contact. These include glass products, insulating glass unit seals and glazing channel substrates under installation and service conditions, as demonstrated by testing and field experience.
- .2 Setting blocks: Neoprene 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .3 Spacer shims: Neoprene 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .4 Glazing tape:
  - .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D 2240; coiled on release paper; black colour.
  - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal.
- .5 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, colour as selected.
- .6 Lock-strip gaskets: to ASTM C542.

- .7 Glazing Gaskets: To ASTM C864.
- .8 Mirror adhesive: Synthetic rubber based adhesive, waterproof and mildew resistant: Lepage PL 610 Construction Mirror Adhesive. Low VOC compliant to SCAQMD Rule 1168-03.
- .9 Mirror Clips: CRL zinc plated steel Vancouver type 'H' clips. Size to suit.
- .10 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.
- .10 Install wired glass in fire rated doors and screens to meet requirements of NFPA 80.

**3.8**      Mirrors

- .1 Install frameless mirrors in adhesive and with steel H clips, concealed fasteners.
- .2 Install mirrors in one piece unless shown otherwise.
- .3 Framed mirrors are specified in Section 10 28 10.

**3.9**      Window Film

- .1 Install window film where indicated in accordance with manufacturer's instructions and reviewed shop drawings. Refer to Section 08 87 13 and 08 87 20.

3.10 Glazed Doors and Sidelights

- .1 Doors and sidelights in a barrier-free path of travel consisting of a sheet of glass shall be marked with a continuous opaque strip conforming to Article 3.3.1.18 of the Ontario Building Code.

3.11 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.

3.12 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 08 80 05 Glazing
- .2 Section 08 87 20 Decorative Window Films
- .3

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM E903-20 Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- .2 National Fenestration Rating Council (NFRC)
  - .1 NFRC 302-2023 Verification Program for Optical Spectral Data.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit for each product specified indicating:
  - .1 Performance properties.
  - .2 Preparation and installation instructions and recommendations.
  - .3 Storage and handling recommendations.
- .3 Samples: For each type of solar control film specified, two (2) samples, 12 inches square
- .4 Provide maintenance data for solar control films for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

### 1.5 Definitions

- .1 Neutral Solar Control Films: Film products that have a very uniform (flat) transmission throughout the visible portion of the solar spectrum, resulting in excellent transmitted colour balance and no region of the color spectrum being preferentially transmitted over the others.

### 1.6 Performance Requirements

- .1 Neutral solar control film products shall help improve solar heat and UV reduction, glare reduction, privacy, fade protection, and aesthetic characteristics when applied to glass surfaces.
- .2 Ultraviolet Transmission: Provide solar control films with UV absorbing materials that limit the weighted UV Transmission to one (1) percent or less when measured according to ASTM E903.
- .3 Provide solar control films that do not have a masking sheet.
- .4 Product Standard: Comply with NFRC 302 for window film energy performance ratings.

- .5 Window Film Energy Performance Certification: NFRC certified with label attached to each product package.

#### 1.7 Quality Assurance

- .1 Manufacturer Qualifications: A qualified manufacturer that has a minimum of 10 years of documented experience manufacturing solar control films similar to be used for this project.
- .2 Installer Qualifications: A firm that is authorized by solar control film manufacturer to install film in accordance with guidelines set forth by the manufacturer.
- .3 Source Limitations: Obtain each type of solar control film from same manufacturer.
- .4 Mock-ups: Build mock-ups to verify selections made under sample submittals and to evaluate surface preparation techniques and application workmanship.
  - .1 Construct mock-ups in the location and of the size indicated or, if not indicated, as directed by Consultant.
  - .2 Approved mock-ups may become part of the completed work if undisturbed at time of Substantial Performance.
  - .3 Pre-installation Conference: Conduct conference at project site to discuss methods and procedures relating to installation of the solar control films.

#### 1.8 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, store and handle materials in manufacturer's protective packaging.
- .3 Store and protect materials according to manufacturer's written recommendations to prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

#### 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 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.
  - .1 Warranty shall fully cover material and labour costs to remove and replace defective film without proration.

### PART 2 PRODUCTS

#### 2.1 Manufacturer

- .1 Basis-of-Design Product: The design for neutral solar control films is based on LLumar Neutral Series Solar Control Films manufactured by CPFilms Inc., 575 Maryville Centre Drive, St. Louis, Missouri 63141; Telephone: 800-255-8627; Email address: commercialalerts@eastman.com; Web Site: www.llumar.com.



## 2.2 Products

- .1 Solar Control Film:
  - .1 3M Night Vision 15 or equivalent as approved by the Consultant with the following performance characteristics when applied to the interior surface of single-pane, 6.4 mm clear glass
    - .1 % Visible Light Reflected Interior: 9
    - .2 % Visible Light Reflected Exterior: 35
    - .3 % Visible Light Transmitted: 13
    - .4 % Total Solar Energy Rejected: 72
    - .5 Solar Heat Gain Coefficient (G Value): 0.28
    - .6 U-Value: 5.6 w/m<sup>3</sup>K
    - .7 % Solar Heat Reduction: 66
    - .8 % UV Light Rejected: 99.9
    - .9 % Glare Reduction: 85
    - .10 Visible Light to Solar Heat Gain ratio: 0.5

## 2.3 Accessories

- .1 General: Provide accessories either manufactured by or acceptable to solar control film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- .2 Adhesive: Water- activated, dry-adhesive system that forms a molecular bond between the film and glass. Protect adhesive from contamination by applying a release liner that will be removed and discarded at installation.
- .3 Cleaners, Primers, and Sealers: Types recommended by solar control film manufacturer

## PART 3 EXECUTION

### 3.1 Examination

- .1 Examine substrates for compliance with requirements and for conditions affecting performance of solar control film including glass that is broken, chipped, cracked, abraded, or damaged in any way.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 Preparation

- .1 Clean substrates thoroughly prior to installation. Provide additional scrubbing of perimeter area with X-100 solution.
- .2 Prepare substrates using methods recommended by film manufacturer to achieve the best results for the substrate under project conditions.
- .3 Protect window frames and surrounding surfaces to prevent damage during installation.

### 3.3 Installation

- .1 Install in accordance with manufacturer's written instructions.

- .2 Install with no gaps or overlaps.
- .3 If seamed, make seams non-overlapping.
- .4 Do not remove release liner from film until just before each piece of film is cut and ready for installation.
- .5 Custom cut to the glass with neat, square corners and edges to within 3.0 mm of the window frame. Use manufacturer recommended solution for application
- .6 Remove air bubbles, blisters, and other defects. Be careful to remove “fingers” to eliminate any contamination or excess water pockets. It is crucial to remove as much water as possible during installation.

**3.4**     Field Quality Control

- .1 After installation, view film from a distance of 3 meters against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, wrinkles, banding, thin spots or pinholes.
- .2 If installed film does not meet these criteria, remove and replace with new film.

**3.5**     Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.
- .3 Use cleaning methods recommended by solar control film manufacturer.
- .4 Replace films that cannot be cleaned.
- .5 Protect installed products until completion of project.
- .6 Touch-up, repair or replace damaged products before Substantial Completion.

End of Section

## 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 80 05 Glazing
- .4 Section 08 87 13 Solar Control Films

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM E308-22 Standard Practice for Computing the Colors of Objects by Using the CIE System
  - .3 ASTM E903-20 Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
  - .4 ASTM G155-21 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Materials

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Manufacturer's data sheets on each product to be used, including:
  - .1 Preparation instructions and recommendations.
  - .2 Storage and handling requirements and recommendations.
  - .3 Installation methods.
- .3 Selection Samples: For each product specified, two complete sets of samples representing manufacturer's full range of available colours and patterns.
- .4 Where custom film artwork is required, supplier shall prepare graphic images in digital format as needed for approvals, fabrication & installation.
- .5 Verification Samples: For each finish product specified, two samples representing actual product, colour, and patterns.
- .6 Provide maintenance data for decorative window films for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

### 1.5 Performance Requirements

- .1 Fire Performance: Surface burning characteristics when tested in accordance ASTM E84:
  - .1 Flame Spread: maximum 25.
  - .2 Smoke Developed: maximum 450.

1.6 Quality Assurance

- .1 Manufacturer Qualifications: All primary products specified in this Section will be supplied by a single manufacturer with a minimum of ten years of experience.
- .2 Installer Qualifications: All products listed in this Section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
- .3 Provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film manufacturer.
- .4 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - .1 Finish areas designated by Consultant.
  - .2 Do not proceed with remaining work until workmanship, colour, and sheen are approved by Consultant.
  - .3 Refinish mock-up area as required to produce acceptable work.

1.7 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Store products in manufacturer's unopened packaging until ready for installation.
- .3 Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.8 Project Conditions

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

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 Manufacturer

- .1 Acceptable Manufacturer: 3M Window Film.

2.2 Single Patterned Film

- .1 Privacy film 1 – 3M Milky White SH2MAML

- .2 Privacy film 2- 3M Opaque Black SH2BKOP

### PART 3 EXECUTION

#### 3.1 Examination

- .1 Do not begin installation until substrates have been properly prepared.
- .2 If substrate preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

#### 3.2 Preparation

- .1 Clean surfaces thoroughly prior to installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### 3.3 Installation

- .1 Install in accordance with manufacturer's instructions.

#### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Remove left over material and debris from Work area.
- .3 Use necessary means to protect film before, during, and after installation.
- .4 Touch-up, repair or replace damaged products before Substantial Performance.
- .5 After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 07 92 00 Joint Sealants
- .2 Section 08 11 00 Metal Doors and Frames
- .3 Section 08 14 16 Flush Wood Doors
- .4 Section 08 80 05 Glazing

### 1.3 References

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA 80 - 2022 Standard for Fire Doors and Other Opening Protectives
  - .2 NFPA 252 - 2022 Standard Methods of Fire Tests of Door Assemblies.
  - .3 NFPA 257 - 2022 Standard on Fire Test for Window and Glass Block Assemblies.
- .2 Underwriters Laboratories, Inc. (UL)
  - .1 UL 9 Fire Tests of Window Assemblies.
  - .2 UL 10B for Fire Tests of Door Assemblies.
  - .3 UL 10C Positive Pressure Fire Tests of Door Assemblies.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S104-15 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

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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 Stud Framing
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 06 16 43 Gypsum Sheathing
- .4 Section 07 21 13 Building Insulation
- .5 Section 07 26 00 Vapour Retarders
- .6 Section 07 27 00 Vapour Permeable Air Barriers
- .7 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .8 Section 07 84 00 Firestopping
- .9 Section 07 92 00 Joint Sealants
- .10 Section 09 22 16 Non-Structural Metal Framing
- .11 Section 09 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C514-04(2020) Standard Specification for Nails for the Application of Gypsum Board
  - .2 ASTM C840-20 Standard Specification for Application and Finishing of Gypsum Board
  - .3 ASTM C954-22 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
  - .4 ASTM C1002-22 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - .5 ASTM C1047-19 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
  - .6 ASTM C1278/C1278M-17 Standard Specification for Fiber-Reinforced Gypsum Panel
  - .7 ASTM C1396/C1396M - 17 Standard Specification for Gypsum Board
  - .8 ASTM C1629/C1629M-19 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
  - .9 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  - .10 ASTM E814-13a(2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
  - .11 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems
- .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-214-2022 Recommended Levels of Gypsum Board Finish.
  - .2 GA-216-2021 Application and Finishing of Gypsum Board.
- .6 Wall and Ceiling Bureau (WCB)
  - .1 Technical Bulletin Control Joint Placement in Gypsum Board Assemblies

#### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

#### 1.5 Quality Assurance

- .1 Dry wall installers: minimum 5 years proven experience.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .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 Provide fire resistance rating of installed partitions as indicated and according to referenced ULC design.

#### 1.7 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .3 Protect gypsum board materials before, during and after installation and to protect the installed work and materials of other trades affected by this work. Store materials in a dry area inside the building. Do not remove wrapping until ready for use. Prevent damage to all edges and surfaces.

## 1.8 Project Conditions

- .1 Maintain temperature minimum 10 ° C, maximum 21 ° C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

## 1.9 Waste Management and Disposal

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

## PART 2 PRODUCTS

### 2.1 Gypsum Board

- .1 To ASTM C1396/C1396M. Standard for non-rated applications, Type X for rated applications, 1220 mm wide x maximum practical length, ends square cut, edges tapered with round edge, 12.7 mm thick or to thickness indicated on drawings. All fire rated board shall be minimum 16 mm thickness.
- .2 Water and Moisture Resistant Board: to ASTM C1396, 12.7 mm thick, 1220 mm wide with tapered edges.

### 2.2 Fastening and Adhesives

- .1 Drywall Screws: To ASTM C954 or ASTM C1002 self-drilling, self-tapping, case hardened, length to suit board thickness and provide minimum 12 mm penetration into support.
- .2 Joint Tape: To ASTM C475, 50 mm perforated with preformed seam, mould and mildew resistant.
  - .1 Joint tape for abuse resistant gypsum board: CGC Mould Resistant Fiberglass Drywall Tape.
- .3 Joint Filler and Topping: To ASTM C475 vinyl or latex base, slow setting.
- .4 Laminating Compound: as recommended by manufacturer, asbestos-free.

### 2.3 Acoustic Insulation

- .1 Acoustic 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, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process 0.5 mm base thickness, perforated flanges, one piece length per location.
- .2 Insulating Strip: Rubberized, moisture resistant, 3.0 mm thick, 12 mm wide closed cell neoprene strip, with self-sticking permanent adhesive on one face; lengths as required.
- .3 Sealants: as specified in Section 07 92 00 - Joint Sealants.

### PART 3 EXECUTION

#### 3.1 General

- .1 Prior to installation of gypsum wallboard, ensure that all required vapour barriers, air seals, gaskets and the like installed under another Section have been inspected and accepted by Municipal authorities and the Consultant. Failure to do so will result in removal of all gypsum board installed prior to approval and replacement, at no additional cost to the Owner.
- .2 Unless otherwise indicated on the drawings, all gypsum board partitions shall extend from floor level to the underside of floor or roof structures above.

#### 3.2 Acoustic Insulation

- .1 Install acoustic blankets full width and length, with tight joints, between wall framing and around penetrating electrical service boxes, piping, air ducts and frames.
- .2 Place acoustic blankets where indicated on the Drawings and to thickness required to obtain acoustic performance indicated for the assembly.
- .3 Place acoustic blankets between studs ensuring friction fit, free of sags, folds or open joints that may let sound pass through.
- .4 Install blankets from the bottom up, tightly adjusted and trim accurately with a utility knife.

#### 3.3 Gypsum Board Application

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 and/or GA-216 except where specified otherwise.
- .2 Do not apply gypsum board until bucks, anchors, blocking, electrical, and mechanical work are approved.
- .3 Apply gypsum board at right angles to framing members or furring using screw fasteners. Maximum spacing of screws 300 mm o.c.

- .4 Apply water or moisture resistant gypsum wallboard where indicated. Apply water resistant sealant to edges, ends and cut outs which expose gypsum core.
- .5 Apply single layer gypsum board to concrete and masonry surfaces, where indicated, using laminating adhesive.
  - .1 Comply with gypsum board manufacturer's recommendations.
  - .2 Brace or fasten gypsum board until fastening adhesive has set.
  - .3 Mechanically fasten gypsum board at top and bottom of each sheet.
- .6 Carry gypsum board from floor to underside of floor or roof structure above. Furr out and carry gypsum board around any structural members as may be required. Neatly cope gypsum board to fill deck flutes where gypsum board abuts floor or roof deck.

### 3.4 Accessories

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.
- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.
- .3 Install insulating strips continuously at edges of gypsum board or casing beads abutting exterior door or window frames, to provide thermal break.
- .4 Install continuous bead of acoustic sealant at all penetrations through sound control partitions.
- .5 Provide control joints in gypsum board facing. Construct control joints in accordance with ASTM C840 and as described in Wall and Ceiling Bureau Technical Bulletin "Control Joint Placement in Gypsum Board Assemblies". Place control joints consistent with lines of building spaces as indicated. Where not indicated install as directed at maximum 6.0 m spacing. Control joints shall be supported with metal studs or furring channels on both sides of the joint. Construct joints using back-to-back casing beads filled with a low modulus sealant capable of flexible joint movement. Maintain fire-resistance rating of wall assemblies. Control joints shall be provided:
  - .1 At abutting structural elements, steel columns.
  - .2 At expansion or control joints in the substrate.
  - .3 At each door jamb.

### 3.5 Access Doors

- .1 Install access doors to electrical and mechanical fixtures specified in respective Sections.
- .2 Rigidly secure frames to furring or framing systems, to satisfy fire rating requirements.

### 3.6 Taping and Filling

- .1 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces. Finish to GA-214 Level 5.
- .2 Finish corner beads, control joints and trims as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

- .3 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after painting is completed.
- .4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.

3.7 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 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-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM C645-18 Standard Specification for Nonstructural Steel Framing Members
  - .3 ASTM C754-20 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  - .4 ASTM C841-03(2018) Standard Specification for Installation of Interior Lathing and Furring.
  - .5 ASTM C1002-22 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - .6 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  - .7 ASTM E814-13a(2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
  - .8 ASTM E1966-15(2019) Standard Test Method for Fire-Resistive Joint Systems
- .2 Canadian General Services Board (CGSB)
  - .1 CAN/CGSB-1.40-97 Primer, Structural Steel, Oil Alkyd Type.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 ULC List of Equipment and Material, Volume III, Fire Resistance Ratings.
- .4 CSSBI Lightweight Steel Framing Manual

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

### 1.5 Quality Assurance

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.



1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.7 Waste Management and Disposal

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

**PART 2 PRODUCTS**

2.1 Metal Stud Framing Systems

- .1 Non-load bearing channel stud framing: to ASTM C645, stud size as indicated, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
  - .1 Thickness of materials to conform to referenced standards unless noted otherwise.
  - .2 Thickness of materials shall be selected from manufacturer's standard span tables to suit total height requirements.
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.
- .3 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .4 Tie Wire: 0.90 mm, galvanized, soft annealed, steel wire or clip as recommended by the manufacturer of furring channels.
- .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 Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .5 Deflection Track: Bailey Multi-Slot Track MST 250, size to suit studs, and top deflection clips TDC 350 and TDC 587.

- .6 Horizontal Flange attachment: Bailey Horizontal Flange Attachment Clip (HFA Clip)
- .7 Hangers: minimum 4.1 mm diameter (or as required by ULC fire rating design requirements) mild steel rods.

## 2.2 Fasteners

- .1 Powder activated fasteners: to suit structural conditions and fastening requirements and in accordance with manufacturer's recommendations: Ramset; Hilti; or approved equivalent.
- .2 Sheet Metal Screws: To ASTM C1002, self-drilling, self-tapping, case hardened, length to suit board thickness and provide minimum 12 mm penetration into support.

## 2.3 Accessories

- .1 Acoustic sealant: As specified in Section 07 92 00.
- .2 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self-sticking adhesive on one face, lengths as required.
- .3 Zinc Rich Paint: to CGSB 1-GP-181M. Low VOC type.

## PART 3 EXECUTION

### 3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant.

### 3.2 Erection

- .1 Comply with ASTM C754.
- .2 All gypsum board shall be supported with steel framing whether indicated or not.
- .3 Unless otherwise indicated on the drawings, all gypsum board partitions shall extend from floor level to the underside of floor or roof structures above.
- .4 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum. Provide top deflection tracks where indicated or as required to permit structural deflection. Install top deflection clips as necessary to increase load capacity.
- .5 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .6 Place studs vertically at 400 mm on centre unless noted otherwise and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's

instructions.

- .7 Erect metal studding to tolerance of 1:1000.
- .8 Attach studs to bottom and ceiling track using screws.
- .9 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .10 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .11 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .12 Install heavy thickness single jamb studs at openings.
- .13 Erect track at head of door/window openings and sills of window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .14 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .15 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .16 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .17 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks.
- .18 Erect drywall resilient furring transversely across studs and joists, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screws.
- .19 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed
- .20 Install continuous insulating strips to isolate studs from un-insulated surfaces.
- .21 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 ceilings and bulkheads in accordance with ASTM C754 and ASTM C841 except where specified otherwise and indicated on drawings.
- .2 Securely anchor hanger to structural supports 1220 mm o.c. maximum along runner channels and not more than 150 mm from ends. Under no circumstances shall hanger wires be secured to or supported from mechanical or electrical materials or equipment or penetrate mechanical ductwork.
- .3 Space runner or furring channels as shown on drawings and not more than 610 mm o.c. maximum nor 150 mm from walls. Run channels in long direction of board. Bend hanger sharply under bottom flange of runner and securely wire in place with a saddle tie. Provide channels below mechanical or electrical equipment and mechanical ductwork to maintain maximum spacing.
- .4 Install furring channels transversely across runner channels in short direction of wallboard at 610 mm o.c. maximum or 150 mm from walls and interruptions in ceiling continuity. Secure channels to support with furring clips or wire. Where splicing is necessary lap minimum 200 mm and wire tie each end with double loops of 0.90 mm galvanized tie wire, 25 mm from each end of overlap.
- .5 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 610 mm around perimeter of fixture. Coordinate with Electrical.
- .6 Install work level to tolerance of 1:1200.
- .7 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, etc.
- .8 Install furring channels parallel to, and at exact locations of steel stud partition header track.
- .9 Furr for gypsum board faced vertical bulkheads within or at termination of ceilings.

**3.5 Gypsum Board**

- .1 Installation of gypsum board is specified in Section 09 21 16

**3.6 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 04 20 00 Concrete Unit Masonry
- .3 Section 07 92 00 Joint Sealants
- .4 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ACTM C144-18 Standard Specification for Aggregate for Masonry Mortar
  - .2 ASTM C150/C150M-22 Standard Specification for Portland Cement
  - .3 ASTM C207-18 Standard Specification for Hydrated Lime for Masonry Purposes
  - .4 ASTM C627-18e1 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems using the Robinson-Type Floor Tester
- .2 American National Standards Institute (ANSI)
  - .1 ANSI A108/A118/A136.1:2017 American National Specifications for the Installation of Ceramic Tile.
  - .2 ANSI A118.10 Waterproof Membrane
  - .3 ANSI A137.1: 2017 American National Standard Specifications for Ceramic Tile
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 71-GP 22M 1978 Adhesive, Organic, for Installation of Ceramic Wall Tile
- .4 International Standards Organization (ISO)
  - .1 ISO 10545 Series Ceramic Tiles, Standards for Testing
  - .2 ISO 13006-2012 Ceramic Tiles, Definitions, Classifications, Characteristics and Marking.
  - .3 ISO 13007-2010 Ceramic Tiles, Grouts and Adhesives.
- .5 Terrazzo, Tile and Marble Association of Canada (TTMAC)
  - .1 TTMAC 2019-2021 Specifications Guide 09 30 00, Tile Installation Manual.
  - .2 TTMAC Hard Surface Maintenance Guide.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Provide product data. Include manufacturer's information on:
  - .1 Ceramic tile, marked to show each type, size, and shape required.
  - .2 Mortar and grout.
  - .3 Divider strip.
  - .4 Levelling compound.
  - .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 Shop drawings: submit tiling plans giving all details of special fittings, expansion joints, joint layout, etc.
- .6 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 Performance Requirements

- .1 Floor Traffic Load Bearing performance: Provide installations rated for the following load bearing performance in accordance with ASTM C627 for ceramic tile installed on walkway surfaces:
  - .1 Moderate: passes cycles 1 through 10.

1.7 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver packaged materials in original unopened containers.
- .3 Keep delivered material dry and free from stains. Store cementitious material off damp surfaces.
- .4 Use all means necessary to protect materials, before, during and after installation and to protect the installed work and materials of all other trades.
- .5 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Consultant and at no additional cost to the Owner.
- .6 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.8 Project Conditions

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 °C for 48 hours before, during and after installation.
- .2 Do not install tiles at temperatures less than 12 °C or above 38 °C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 °C or above 25 °C.
- .4 Provide and maintain temporary lighting. Lighting levels shall be sufficient to complete work including inspections. Provide minimum lighting levels of 400 lux at work areas.

1.9 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.

1.10 Waste Management and Disposal

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

1.11 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.

1.12 Warranty

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of five years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

**PART 2 PRODUCTS**

2.1 Materials

- .1 Materials shall be graded and containers grade sealed, delivered to the job site in their original packages or containers with the manufacturer's labels and seals intact.
- .2 Tile and grout colours shall be selected by the Consultant from the manufacturer's standard range of colours.
- .3 Tile shall conform to ANSI A137.1.
- .4 Floor tile shall have coefficient of slip resistance conforming to ANSI A137.1.
- .5 Provide coves, corners, reveals, surf caps, inners and outers as required to complete the work.

2.2 Ceramic Tile

- .1 CT1: Ceramic Wall Tile (Washroom): Daltile Arctic White 190 glossy 51 x 204 mm.
- .2 CT2: Ceramic Wall Tile (Washroom): Daltile Sea Breeze 1174 glossy 51 x 204 mm.
- .3 CT3: Ceramic Wall Tile (Washroom): Daltile Mustard 1012 glossy 51 x 204 mm.
- .4 CT4: Ceramic Wall Tile (Washroom): Daltile Ocean Blue 1049 glossy 51 x 204 mm.
- .5 PCT1: Ceramic floor Tile (Washroom): Daltile Harmonist Celestia HM30 Matte
- .6 PCT2: Ceramic floor Tile (Vestibule): Daltile Volume 1.0 Stereo Grey Matte 1305 x 619 mm.

## 2.3 Mortar, Adhesives and Grout Material

- .1 Primer: Low VOC, low viscosity primer as recommended by manufacturer to suit substrate and site conditions; provide proof of bonding ability of setting systems where manufacturer recommends that a primer is not necessary to installation.
- .2 Surface Preparation Materials:
  - .1 Portland Cement Mortar: Scratch and bond coat, levelling bed containing the following:
    - .1 Portland Cement: Meeting or exceeding requirements of CSA A3000, Type GU.
    - .2 Hydrated Lime: Meeting or exceeding requirements of ASTM C207, Type N.
    - .3 Sand: Meeting or exceeding requirements of ASTM C144, passing 16 mesh.
    - .4 Water: Potable.
  - .2 Self Levelling and Smoothing Underlayment: Cementitious and self levelling smoothing underlayment meeting or exceeding requirements of ANSI A108.1, Type 2.
- .3 Wall Tile Systems:
  - .1 Thin Set Interior Installation: Dry set mortar meeting or exceeding requirements of ANSI A118.1 formulated for thin set applications, factory sanded mortar consisting of Portland cement, sand and additives requiring only addition of potable water for installation complete with bond enhancing latex additive.
- .4 Floor Tile Systems:
  - .1 Thin Set Interior Installation: Latex-Portland cement mortar meeting or exceeding requirements of ANSI A118.1, rated for floor traffic load bearing performance indicated above.
- .5 Adhesive Systems:
  - .1 Epoxy Adhesive: Thin set adhesive system using 100% solids epoxy resin and epoxy hardener meeting or exceeding requirements of ANSI A108.1; stain proof, chemical resistant and having high temperature resistance and water cleanable.
  - .2 Organic Adhesive: Thin set wall tile adhesive system using non-flammable, water resistant, latex adhesives for interior use meeting or exceeding requirements of ANSI A108.1, Type 1.
- .6 Tile Grout Systems:
  - .1 Unsanded Portland Cement Grout: factory blended dry-set stain resistant, latex modified Portland cement meeting or exceeding requirements of ANSI A118.6, specifically formulated for joints less than or equal to 3 mm in width.
  - .2 Polymer Modified Grout: factory blended stain resistant polymer modified Portland cement meeting or exceeding requirements of ANSI A118.7, specifically formulated for joints greater than 3 mm in width.
  - .3 Epoxy Grout: Water cleanable, chemical resistant, factory blended modified Portland cement compound with 100% epoxy adhesives and hardeners meeting or exceeding requirements of ANSI A118.3.
  - .4 Grout colours to be selected by the Consultant from full range of manufacturer's standards.

## 2.4 Patching and Levelling Compound

- .1 Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and levelling concrete floors, capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish and having not less than the following physical properties:
  - .1 Compressive strength: 25 MPa.



- .2 Tensile strength: 7 MPa.
- .3 Flexural strength: 7 MPa.
- .4 Density: 1.9
- .5 Products containing gypsum are not acceptable.

- .2 Levelling Compound: Laticrete 3701 latex or 226 Mapecem mortar mixed with Planicrete 50.

## 2.5 Floor Sealer and Protective Coating

- .1 To tile and grout manufacturer's recommendations.

## 2.6 Accessories

- .1 Reducers, edge trim, and transition strips: Schluter Systems purpose made aluminum.
- .2 CT Edge Protection: Schluter RONDEC, size to suit tile thickness. Satin anodized aluminum. Trim to come with all connectors or end caps required for a complete and finished installation. As a minimum, provide edge protection at the following locations:
  - .1 Top of PC Base;
  - .2 Top of CT wall tile;
  - .3 All outside corners of wall tile or porcelain ceramic tile base.
- .3 Sealant: as specified in Section 07 92 00.

## 2.7 Mixes

- .1 Mix premanufactured mortars and grouts in accordance with referenced standards, and mortar and grout manufacturer's written instructions; mix site mixed materials as follows:
  - .1 Scratch Coat (by volume): Mix 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC detail.

## PART 3 EXECUTION

### 3.1 Surface Conditions

- .1 Surfaces on which tile is to be applied, shall be thoroughly cleaned down.
- .2 Verify that concrete substrates have been allowed to cure for a minimum of 28 days in accordance with TTMAC requirements.
- .3 Verify that substrates for bonding tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and are within starting flatness tolerances as specified in Section 03 30 00 and are ready for application of levelling materials specified in this Section.
- .4 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of Work, and similar items located in or behind tile have been completed before installing tile.
- .5 Drywall surfaces on which wall and floor tile is to be applied, shall be free from dust, excess plaster and shall be plain and true without any irregularities. 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 in wet areas:
  - .2 Tile installed with chemical resistant mortars and grouts
  - .3 Tile 300 mm or larger in any direction
  - .4 Tile with raised or textured backs
  - .5 All porcelain tiles with more than 20% of the tile backs covered with firing release dust back buttered so that 100% of the back is covered with adhesive mortar rated for C627, Extra Heavy Duty rating.
- .7 Install prefabricated edge strips and control at locations indicated or where exposed edge of floor tile meets different flooring materials and exposed substrates.
- .8 Protect exposed edges of floor tile with properly sized transition strips, use sloped reducer strips where uneven transitions between 6 mm and 13 mm occur.
- .9 Control and Movement Joints: Install control joints and expansion joints in tile work in accordance with TTMAC Detail 301MJ; keep control and expansion joints free of bonding materials and as follows:
- .1 Cut tiles to establish line of joints; sawn joints after installation of tiles will not be acceptable.
  - .2 Locate joints in tile surfaces directly above joints in concrete substrates.
  - .3 Provide floor control joints over structural control joints.
  - .4 Install prefabricated joint profiles in accordance with manufacturer's written instructions, set with top surface of joint profile slightly below top surface of tile.
  - .5 Prepare joints and apply sealants in accordance with requirements of Section 07 92 00.
  - .6 Keep control and movement joints free from setting materials.
  - .7 Form an open joint for sealant in tile wherever a change in backing material occurs, at all vertical interior corners, around penetrating pipes and fixtures, and where tile abuts other materials or fixtures.
  - .8 Install control joints where indicated or at not less than the flowing spacings:

Environment	Minimum	Maximum	Joint Width (minimum)
Interior/Shaded	4800 mm	6100 mm	6 mm

### 3.3 Grouting

- .1 Grouting: Install grout in accordance with manufacturer's written instructions, the requirements of TTMAC, and as follows:
- .1 Allow proper setting time before application of grout.
  - .2 Pre-seal or wax tiles requiring protection from grout staining.
  - .3 Force grout into joints to a smooth, dense finish.
  - .4 Remove excess grout in accordance with manufacturer's written instructions and polish tile with clean cloths.

- .2 Grout all tile using specified grout in strict accordance with manufacturers written instructions all to give a flush, hard joint.
- .3 Joints in tile shall be filled solid and flush with grout.
- .4 Prepare joints and mix grout in accordance with manufacturer's printed instructions. Force maximum amount of grout into joints, avoiding air traps or voids.
- .5 Remove all excess grout by washing diagonally across the joints. Check for voids, air pockets and gaps and fill same. Remove all discoloured grout and replace with new.
- .6 Cure all joints.

3.4 Floor Sealer and Protective Coatings

- .1 Apply in accordance with manufacturer's instructions.

3.5 Cleaning and Protection

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Cleaning: Clean tile surfaces so they are free of foreign matter using manufacturer recommended cleaning products and methods after completion of placement and grouting and as follows:
  - .1 Remove grout residue from tile as soon as possible.
  - .2 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation; protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.
  - .3 Flush surface with clean water before and after cleaning.
- .3 Protection: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies as follows:
  - .1 Protect finished areas from traffic until setting materials have sufficiently cured in accordance with TTMAC requirements.
  - .2 Protect floor areas from traffic after grouting is completed in accordance with manufacturer's written instructions.
  - .3 Prevent foot and wheel traffic from floors for a minimum of 24 hours after completion of grouting.
  - .4 Provide protective covering until Substantial Performance of the Work.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 09 21 16 Gypsum Board
- .2 Section 09 53 00 Acoustical Suspension

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM C423-23 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - .2 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .3 ASTM E1264-22 Standard Classification for Acoustical Ceiling Products
  - .4 ASTM E1414/E1414M-21a Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
  - .5 ASTM E1477-98a(2022) Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 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.
- .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 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
  - .1 Surface Burning Characteristics: As follows, tested per ASTM E84 and complying with ASTM E1264 Classification.
  - .2 Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory
- .2 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.

1.8

Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .3 Protect on site stored or installed absorptive material from moisture damage.

1.9 Waste Management and Disposal

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

1.10 Extra Materials

- .1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units amounting to 5% of gross ceiling area for each pattern and type required for project.
- .3 Ensure extra materials are from same production run as installed materials.

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Acoustic units for suspended ceiling system: to ASTM E1264
- .2 Panel Type 1:
  - .1 Surface Texture: Medium Texture
  - .2 Composition: Mineral Fiber
  - .3 Colour: White
  - .4 Size: 610 x 610 x 19 mm
  - .5 Edge Profile: Square Lay-in
  - .6 Noise Reduction Coefficient (NRC) ASTM C 423 Classified w/ UL label on product carton: 0.70
  - .7 Ceiling Attenuation Class (CAC): ASTM E1414/E1414M; Classified with UL label on product carton: 35, 40
  - .8 Flame Spread: ASTM E 1264; Class A
  - .9 Light Reflectance (LR) White Panel: ASTM E 1477; 0.82
  - .10 Dimensional Stability: HumiGuard Plus
  - .11 Recycle Content: Up to 56% total recycled content. (Total recycled content: pre-consumer, post-consumer and post-industrial)
  - .12 Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
  - .13 Life Cycle Assessment: Third Party Certified Environmental Product Declaration (EPD)
  - .14 Indoor Air Quality Certified to SCS-105 v4.2-2023
  - .15 USDA Certified Biobased Product
  - .16 Basis of Design: SCHOOL ZONE FINE FISSURED, item number 1713, as manufactured by Armstrong World Industries, Inc.
- .3 Alternate manufacturer: Products as manufactured by the following are acceptable, subject to Consultants approval of style, finish, performance characteristics and texture:
  - .1 CGC
  - .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



## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 12 23 Structural Steel
- .2 Section 09 21 16 Gypsum Board
- .3 Section 09 51 13 Acoustic Panel Ceilings
- .4 Division 23 Mechanical
- .5 Division 26 Electrical

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A307-21 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
  - .2 ASTM A641/A641M-19 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .3 ASTM A653 / A653M – 23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .4 ASTM A1011/A1011M-23 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  - .5 ASTM C635/C635M-22 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings.
  - .6 ASTM C636/C636M-19 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  - .7 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .8 ASTM E119-22 Standard Test Methods for Fire Tests of Building Construction and Materials
  - .9 ASTM E1264-22 Standard Classification for Acoustical Ceiling Products

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.
- .3 Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- .4 Submit one representative model of each type of ceiling suspension system.
  - .1 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

### 1.5 Design Requirements

- .1 Determine the superimposed loads that will be applied to suspension systems by components of

the building other than the ceiling and ensure that adequate hangers are installed to support the additional loads in conjunction with the normal loads of the system.

- .2 Design supplemental suspension members and hangers where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers at required spacing to support standard suspension system members:
  - .1 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- .3 Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of L/360 to ASTM C635 deflection test.

#### 1.6 Performance Requirements

- .1 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
  - .1 Surface Burning Characteristics: Tested per ASTM E84 and complying with ASTM E1264 Classification.
- .2 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.

#### 1.7 Quality Assurance

- .1 Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- .2 Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.
- .3 Where required, provide fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .4 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and as described in Section 09 51 13.

#### 1.8 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

#### 1.9 Waste Management and Disposal

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

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 Components: All main beams and cross tees, base metal and end detail shall be commercial quality hot-dipped galvanized steel as per ASTM C635. Main beams and cross tees shall be

double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

- .2 Face width: 22 mm
- .3 Edge Moldings and Trim: Hemmed angle moulding to match main beams and cross tees.
- .4 Structural Classification: Intermediate Duty System, ASTM C635.
- .5 Colour: White and match the actual colour of the specified ceiling tile.
- .6 Standard of Acceptance:
  - .1 Armstrong Prelude XL
- .7 Attachment Devices: Size for five times design load indicated in ASTM C635, Table 1, Direct Hung unless otherwise indicated or required.
- .8 Threaded Rod: to ASTM A397. Galvanized or zinc plated.
- .9 Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three times design load, but not less than 2.06 mm thick.
- .10 Channel Framing and Fittings: Strut type metal framing and components to ASTM A1011 or ASTM A653. Unistrut P1000SL or equivalent. Galvanized.

### PART 3 EXECUTION

#### 3.1 Manufacturer's Instructions

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

#### 3.2 Examination

- .1 Do not proceed with installation until all wet work such as concrete, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

#### 3.3 Preparation

- .1 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- .2 Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
  - .1 Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

### 3.4 Installation

- .1 Install suspension system and panels in compliance with ASTM C636; CISCA Seismic Guidelines and in accordance with the manufacturer's installation instructions.
- .2 Install wall moldings at intersection of suspended ceiling and vertical surfaces.
- .3 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.
- .4 Secure hangers to overhead structure using attachment methods as indicated by manufacturer. Do not suspend ceiling systems from building services including plumbing lines, conduit, cable trays or duct work.
- .5 Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to: piping, ductwork, conduit and equipment. Provide trapeze or other supplementary support members at obstructions to allow typical hanger spacing. Brace assemblies must be configured and/or located in order to avoid obstructions in addition to maintaining the required brace assembly spacing.
- .6 Install hangers spaced at maximum 1219 mm centres and within 152 mm from ends of main tees. Install hanger wires plumb and straight.
- .7 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width.
- .8 Ensure suspension system is coordinated with location of related components.
- .9 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles, and speakers.
- .10 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 610 mm around perimeter of fixture.
- .11 Interlock cross member to main runner to provide rigid assembly.
- .12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .13 Install access splines to provide ceiling access.
- .14 Finished ceiling system to be square with adjoining walls and level within 1:1000

### 3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Touch up scratches, abrasions, voids and other defects in painted surfaces.

End of Section

## **PART 1 GENERAL**

### **1.1 General**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Sections**

- .1 Section 09 21 16 Gypsum Board

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM C423-23 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - .2 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 Underwriters laboratories of Canada (ULC)
  - .1 CAN/ULC S102-2018 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 published technical information for each product indicated.
- .3 Shop Drawings: Submit reflected ceiling plans drawn to scale prescribed by Consultant.
  - .1 Include coordinated penetrations and ceiling-mounted items
  - .2 Include any necessary details or drawings from the manufacturer regarding recommended installation.
  - .3 Include photometrics.
- .4 Samples
  - .1 Submit manufacturer's sample of modular ceiling element.
- .5 Submit manufacturers standard colour range
- .6 Submit operating and maintenance instructions for suspended modular ceilings, for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00-Closeout Submittals.

### **1.5 Quality Assurance**

- .1 Single-Source Responsibility: Provide panels and method of attachment by a single manufacturer.
- .2 Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers

### **1.6 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 the modular ceiling panels in an interior location and keep in cartons prior to installation to avoid damage.
- .4 Exercise care in moving and opening cartons to prevent damage to the panel face.
- .5 Handle panels carefully to avoid damaging units in any way.

#### 1.7 Project Conditions

- .1 All wet work must be complete and dry prior to installation. Installation shall be carried out where the temperature is between 5 ° C and 32 ° 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 one year from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.

### PART 2 PRODUCTS

#### 2.1 Manufacturer

- .1 Acoufelt, 650 N. Opdyke Road, Suite A, Auburn Hills, MI 48326 USA 1-800-966-8557, [www.acoufelt.com](http://www.acoufelt.com),

#### 2.2 Product

- .1 Acoufelt Beam Ceiling Baffles

#### 2.3 Panel Units

- .1 Panels:
  - .1 Beam Ceiling Baffle Size: 50 mm wide, 300 mm high. Lengths vary as indicated on plans.
  - .2 Surface Texture: Smooth texture
  - .3 Composition: PET plastic (up to 60% recycled) + Metal brackets
  - .4 Colour: 8 colours as indicated on Contract Drawings.
  - .5 Fire Rating: ASTM E84 and CAN ULC S102: Class A.
  - .6 Sound absorption: Sound Absorption: ASTM C423: 0A for raw material.
  - .7 Provide all necessary end caps and joiner brackets for a complete installation.
  - .8 Units shall be CSA approved.

#### 2.4 Accessories

- .1 Mounting methods: Threaded rod to Unistrut (provide all necessary accessories)

### **PART 3 EXECUTION**

#### **3.1 Examination**

- .1 Field verify each wall area and establish layout of panels. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation. Panel substructure shall be level and plumb. Panel substructure shall be structurally sound as determined by that subcontractor's engineer. Panel substructure shall be free of defects detrimental to work and erected in accordance with established building tolerances.
- .2 Coordinate panel layout with mechanical, electrical and sprinkler fixtures as required.
- .3 Coordinate delivery of such items to project site.

#### **3.2 Installation**

- .1 Installation shall be by an approved and certified electrician.
- .2 Install panels in accordance with the manufacturer's instructions and in compliance with the authorities having jurisdiction.
- .3 Erect panels level and plumb, in proper alignment in relation to substructure framing and established lines.
- .4 Panel anchorage shall be structurally sound and per engineering recommendations.
- .5 Locate and place wall panels' level, plumb, and at indicated alignment with adjacent work.
- .6 Do not locate the panels in the direct sunlight or sagging from heat and colour fade may occur.

#### **3.3 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Replace damaged and broken panels.

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 09 21 16 Gypsum Board

### 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 E662-21ae1 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  - .4 ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .5 ASTM F1700-20 Standard Specification for Solid Vinyl Floor Tile
  - .6 ASTM F1869-23 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .7 ASTM F1913-19 Standard Specification for Vinyl Sheet Floor Covering Without Backing
  - .8 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102.2-2018 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- .3 DIN 51130 Testing of floor coverings - Determination of the anti-slip property - Workrooms and fields of activities with slip danger - Walking method - Ramp test
- .4 American Concrete Institute (ACI)
  - .1 ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
- .5 Danish Standards (DS)
  - .1 DS/EN 660-2 Resilient floor coverings - Determination of wear resistance - Part 2: Frick-Taber test

### 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.

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## PART 2 PRODUCTS

### 2.1 Resilient Sheet Vinyl Safety Flooring

- .1 Vinyl sheet safety flooring shall meet requirements of ASTM F1913.
- .2 Manufacturer: Polyflor
- .3 RSF-1
  - .1 Heavy-duty homogeneous vinyl flooring with tonal chip decoration
  - .2 2.00 mm gauge
  - .3 PUR Finish.
  - .4 Colour: "Sailcloth"
- .4 RSF-2
  - .1 Heavy-duty homogeneous vinyl flooring with tonal chip decoration
  - .2 2.00 mm gauge
  - .3 PUR Finish.
  - .4 Colour: "Mint Crisp"
- .5 RSF-1
  - .1 Heavy-duty homogeneous vinyl flooring with tonal chip decoration
  - .2 2.00 mm gauge
  - .3 PUR Finish.
  - .4 Colour: "Deep Space"
- .6 Performance Standards
  - .1 Slip Resistance: ASTM D2047 SCOF  $\geq 0.6$
  - .2 Abrasion Resistance DS/EN 660-2 Group T
  - .3 Binder Content: ISO 10581 (EN 649) Conforms
  - .4 General Performance:
    - .1 ASTM F1913 Conforms
    - .2 ASTM F1700 Class I, Type A
  - .5 Reaction to Fire
    - .1 ASTM E662  $< 450$
    - .2 ASTM E648 Class 1
    - .3 CAN/ULC S102.2 FSV  $< 300$ ; SDV  $< 500$

### 2.2 Wall Base Materials

- .1 Resilient Base: To ASTM F1861, 100 mm high thermoplastic rubber, not less than 3.0 mm thickness with preformed internal and external corners. Base at resilient tile shall have standard toe.
  - .1 R1: Johnsonite DuraCove DC Rubber Wall Base .
    - .1 Colour: TG6 MINK WG
  - .2 R2: Johnsonite DuraCove DC Rubber Wall Base.
    - .1 Colour: 40 BLACK
  - .3 R3 Johnsonite DuraCove DC Rubber Wall Base.
    - .1 Colour: 92 BLUE LAGOON

### 2.3 Adhesives

- .1 Provide high-performance epoxy flooring adhesive 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 Provide transition/reducing strips tapered to meet abutting materials.
- .3 Provide threshold of thickness and width as shown on the drawings.
- .4 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.
- .5 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 with ASTM F1869 and Bond Tests as described in manufacturer's installation guidelines to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not exceed 80%. MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.
- .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.

### **3.4      Rubber Base Installation**

- .1 Lay out base to keep number of joints to a minimum. Locate joints at maximum available spacing or at internal or pre moulded corners.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using a 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use pre-moulded end pieces at flush door frames.
- .7 Cope internal corners. Use pre moulded corner units for right angle external corners. Use formed straight base materials for external corners of other angles, minimum 300 mm each leg.
- .8 Provide rubber base at all locations specified, regardless of floor finish.

### **3.5      Installation of Accessories**

- .1 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.
- .2 Apply metal edge strips, after flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

### **3.6      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 09 65 16.23 Vinyl Sheet Flooring

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E648-19ae1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  - .2 ASTM E1155M-14 Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric)
  - .3 ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .4 ASTM 1316-18(2023) Standard Test Method for Measuring the Transmissivity of Transparent Parts
  - .5 ASTM F1869-23 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .6 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
  - .7 ASTM F2772-24 Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Before any rubber flooring materials are delivered to the job site, submit to the Consultant a complete list of all materials proposed to be furnished and installed under this Section of the Work, stating manufacturer's name and catalogue number for each item, and product samples in colours specified.
- .3 Submit two copies of the manufacturer's current recommended method of installation for each item.
- .4 Submit Manufacturer's current printed data sheets on specified products.
- .5 Shop Drawings: Showing installation details and locations of borders, patterns, game lines, locations of floor inserts and seams.
- .6 Manufacturer Certifications:
  - .1 Provide certification that accurately identifies the Original Equipment Manufacturer (OEM) of flooring furnished for this project including manufacturer's name, address and factory location.
    - .1 Suppliers of Private-Label flooring for this project must identify themselves as such and fully disclose the OEM information listed above.

- .2 All "manufacturer" requirements in these specifications must be complied with by the OEM, including warranties, certifications, qualifications, product data, test results, environmental requirements, performance data, etc.
- .2 Provide ISO 9001 certification for the OEM of the specified products.
- .3 Provide ISO 14001 certification for the OEM of the specified products.
- .4 Provide ISO 50001 certification for the OEM of the specified products.
- .7 Samples: submit duplicate 100 x 100 mm samples of full range of manufacturer's specified products and colours.
- .8 Submit shop drawings illustrating layouts, details, dimensions and other data.
- .9 Samples:
  - .1 Colour samples: Wood visual samples Minimum 610 x 915 mm to show that the appearance of wood plank pattern complies with these specifications
- .10 Laboratory Test Results:
  - .1 Provide certification of testing per ASTM F2772 and the product being furnished complies with the ASTM Indoor Sport Floor Classification specified for this Project. Third-party certification required; sales literature is not sufficient.
- .11 Submit maintenance data for athletic rubber tile flooring for Operation and Maintenance Manual specified under Section 01 78 00.

#### 1.5 Quality Assurance

- .1 Manufacturer must be certified ISO 9001 and ISO 14001 and ISO 50001.
- .2 Manufacturer must have minimum 10 years experience in the manufacturing of prefabricated rubber athletic flooring.
- .3 Installer must have performed installations of the same scale in the last five years.
- .4 Installer to be recognized and approved by the rubber athletic flooring manufacturer.
- .5 Fire Test Characteristics: As determined by testing identical products according to ASTM E648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.
- .6 Safety and Performance Properties: Comply with ASTM F2772 Performance Level Class 2 for force reduction, ball bounce, vertical deformation and surface friction.
- .7 Mock Up: Mock up is to be installed following the same procedures and utilizing the same specified materials that will be used for the actual project. Mock-up size: minimum 3.0 square meters.

#### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Materials must be delivered in Manufacturer's original, unopened and undamaged containers with identification labels intact.

- .3 Store material upright on a clean, dry, flat surface protected from all possible damage and protect from exposure to harmful weather conditions.
- .4 Store flooring and installation materials in protected dry spaces, with ambient temperatures maintained within range recommended by manufacturer, but not less than 13 deg C nor more than 29 deg C.

#### 1.7 Project Conditions

- .1 Product Installation:
  - .1 Maintain temperatures during installation within range recommended by manufacturer, but not less than 18 deg C in spaces to receive flooring 48 hours prior, during and 48 hours after installation.
  - .2 After installation, maintain temperatures within range recommended by manufacturer, but not less than 13 deg C or more than 29 deg C.
  - .3 Prohibit traffic during flooring installation and for 48 hours after flooring installation.
  - .4 Refer to the adhesive technical data sheet for appropriate time for traffic after installation.
- .2 Moisture vapour emission content of the concrete slab must not exceed the tolerance of the adhesive used when tested using the anhydrous calcium chloride test as per ASTM F1869.
- .3 Perform an alkalinity test and moisture test before commencing. Moisture content must not exceed the capacity of the specified adhesive (verify using the anhydrous calcium chloride test as per ASTM F1869 and pH level should be in the range of 7 to 8.5).
- .4 Install flooring only after other finishing work, including painting and overhead work, has been completed.

#### 1.8 Maintenance Materials

- .1 Provide extra stock materials for use in facility operation and maintenance. Provide amount of approximately 2% of the total floor surface, of each type, colour and dye lot.

#### 1.9 Coordination

- .1 Coordinate layout and installation of flooring with other gymnasium equipment.

#### 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 fifteen 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 Sheet Vinyl Sport Impact Flooring

- .1 Basis-of-Design Manufacture: Subject to compliance with requirements, provide Gerflor RECREATION 60 Multi-purpose flooring installed with Gerflor's full-spread adhesive.



- .2 Product Description: ASTM Class 2 Foam-backed sheet vinyl flooring designed for fully adhered multi-purpose applications.
  - .1 Overall Thickness: Not less than 6.0 mm.
  - .2 Wear-Layer Thickness: Not less than 1.5 mm.
  - .3 Backing: closed cell foam with reinforced fiberglass grid.
  - .4 Seaming Method: Heat welded.
  - .5 Adhesive Method:
    - .1 Full-spread adhesive coverage to completely adhere flooring to substrate.
    - .2 Complete adhesive coverage to eliminate the possibility of gaps or space between the slab and flooring material where moisture could accumulate and create an environment conducive to mold growth.
    - .3 Flooring to be fully adhered to the concrete slab in all locations eliminating the possibility of waves or wrinkles forming caused by the floor shifting, moving or by rolling loads displacing it.
    - .4 Moisture Resistance: 100 percent relative humidity (RH) when tested according to ASTM F2170, or 25-pounds moisture vapor emission rate when tested according to ASTM F1869.
  - .6 Traffic-Surface Texture: Wood visual shall have wood grain embossed texture for a genuine wood appearance.
  - .7 Colour: 6062 Canadian Maple.
    - .1 Wood pattern shall accurately simulate the true visual appearance of natural wood strip flooring.
      - .1 Pattern shall replicate random-length stock by simulating non-uniform board lengths.
      - .2 Wood pattern shall not include a dark line simulating edges or ends of individual boards.
      - .3 Surface texture shall simulate realistic wood grain and not be raised or "pebbled" embossing.
  - .8 Bacteriostatic and Fungicidal Treatment: Manufacturer's factory-applied permanent treatment throughout the flooring material which can improve indoor air quality and reduce asthma and allergy risks associated with bacterial and mold growth.
  - .9 Applied Finish: Manufacturer's, factory-applied, permanent and UV-cured.
    - .1 No-Wax finish: Published product literature identifying factory applied finish as, "No-Wax-Just clean and rinse"
    - .2 Basis-of-Design Product: PUR Protect.
  - .10 Roll Size:
    - .1 Roll Width: Rolls to be a minimum width of 1.5 m wide.
    - .2 Roll Length: Wood visual rolls to be a minimum length of 26.4 m to minimize the number of end-seams.
- .3 Performance Criteria:
  - .1 ASTM F2772 Indoor Sport Floor Standard:
    - .1 Provide certification of compliance for the four ASTM F2772 Indoor Sport Floor Standard performance categories:
      - .1 Shock Absorption/Force Reduction:
        - .1 Class C2 (22% to 33%). Pass
      - .2 Ball Bounce:
        - .1 Minimum 90%: Pass
      - .3 Surface effect/Coefficient of Friction:
        - .1 Between 80-110: Pass
      - .4 Vertical deformation:
        - .1 Maximum 3.5mm: Pass
    - .2 Sound Insulation: EN ISO 717; 19 dB.

- .3 Fire Performance: ASTM E648; Greater than 0.45 W/cm2, Class 1.
- .4 Surface Maintenance Requirements: No-wax surface requiring only cleaning and rinsing.
- .5 Slab Moisture Design Tolerance Maximum relative humidity (RH) of 95% when tested according to ASTM F2170.

## 2.2 Accessories

- .1 Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation.
  - .1 Basis-of-Design Product: as recommended by floor4ing manufacturer and compatible with adhesive
  - .2 Slab moisture tolerance: Same slab moisture tolerance as the adhesive.
- .2 Primers shall be waterproof, best quality formulated for the application of the rubber floor coverings over subfloor as indicated on the drawings and Room Finish Schedule. Primers to be type and brand recommended and certified by the manufacturer of the products for use with his materials and used in strict accordance with the manufacturer's directions.
- .3 Adhesives: Water-resistant type recommended by athletic flooring manufacturer for substrate and conditions indicated.
  - .1 Basis-of-Design Product: Gerflor Gerfix Spray Adhesive.
    - .1 Moisture Resistance Limit: 95% relative humidity (RH) when tested according to ASTM F2170
    - .2 Coverage Type: Full-spread application for 100% coverage.
- .4 Heat Welding Rod: As supplied by indoor resilient flooring manufacturer. Colour shall blend with resilient flooring colour.
- .5 Game-Line and Marker Paint: Complete system including primer, compatible with flooring and recommended by flooring and paint manufacturers.
- .6 Reducer strips: manufacturer's standard reducer strips, 38 mm wide tapered from 9.5 mm to 0 mm.
- .7 Resilient Base: As specified in Section 09 65 16.23

## PART 3 EXECUTION

### 3.1 Examination

- .1 Verify the Following:
  - .1 The area in which the indoor resilient flooring will be installed is dry, weather-tight and in compliance with specified requirements.
  - .2 Permanent heat, lighting and ventilation systems are installed and operable.
  - .3 Other work, including overhead work, that could cause damage, dirt, dust or otherwise interrupt installation has been completed or suspended.
  - .4 No foreign materials or objects are present on the substrate and it is clean and ready for preparation and installation.
  - .5 Tests to verify that the moisture evaporative rate or substrate relative humidity is within the specified ranges.
  - .6 The concrete slab surface pH level is within the specified range.

- .7 The concrete slab surface deviation is no greater than 3.2 mm within 3.0 m when measured according to ASTM E1155.

### 3.2 Preparation

- .1 Prepare substrates according to manufacturer's written recommendations to ensure proper adhesion of resilient flooring system.
- .2 Concrete Substrates: Prepare according to ASTM F710.
  - .1 Verify that substrates are dry and free of sealers, curing compounds and other additives. Remove coatings and other substances that are incompatible with adhesives using mechanical methods recommended by manufacturer.
  - .2 Alkalinity Testing: Perform pH testing according to ASTM F710. Proceed with installation only if pH readings are between 7.0 and 8.5.
- .3 Moisture Testing: Perform ASTM F2170 relative humidity test and proceed with installation only after substrates have maximum relative humidity (RH) of 95%.
- .4 Use trowelable concrete based patching compound with the same moisture vapor tolerance as the adhesive to fill depressions, holes, cracks, grooves or other irregularities in substrate.
- .5 Place flooring and installation materials into spaces where they will be installed at least 48 hours before installation. Install flooring materials only after they have reached the same temperature as space where they are to be installed.
- .6 Sand the surface of the concrete slab.
- .7 Sweep and then vacuum substrates immediately before installation. After cleaning, examine substrate for moisture, alkaline salts, grit, dust or other contamination. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 Installation

- .1 General:
  - .1 Comply with resilient flooring manufacturer's installation instructions.
  - .2 Take necessary precautions to minimize noise, odors, dust and inconvenience during installation.
  - .3 Fit flooring neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
  - .4 Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- .2 Lay out flooring as follows:
  - .1 Minimize number of seams and place them inconspicuous areas.
  - .2 Locate seams as shown on approved shop drawings.
- .3 Adhered Flooring: Attach products to substrates using full-spread adhesive applied to substrate to comply with adhesive and flooring manufacturer instructions.
  - .1 Vinyl Sheet Flooring Seams: Finish seams to produce surfaces flush with adjoining flooring surfaces. Comply with ASTM F1516. Rout joints and use heat welding rod to permanently and seamlessly fuse sections together.

**3.4     Game Lines**

- .1 Lay out game lines for the sports activities indicated .
- .2 Mask flooring at game lines and apply paint of colour directed by the Consultant to produce clean, sharp and distinct edges.

**3.5     Cleaning**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Perform the following operations after completing resilient flooring installation:
  - .1 Remove marks and blemishes from flooring surfaces.
  - .2 Sweep and then vacuum flooring.
  - .3 Damp-mop flooring to remove soiling.
- .3 Protect flooring from abrasions, indentations, and other damage from subsequent operations and placement of equipment, during remainder of construction period.
- .4 Immediately prior to Substantial Performance. Remove protection, clean, dry or damp mop floors.

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 65 16.23 Vinyl Sheet Flooring.

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D2859-16(2021) Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
  - .2 ASTM E662-21ae1 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  - .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 F1869-22 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .6 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-4.129-93 Carpet for Commercial Use
  - .2 CAN/CGSB-4-GP-156 Direct Glue-Down Carpet, Guide to Selection and Installation
- .3 Carpet and Rug Institute (CRI)
  - .1 CRI 104-2002 Standard for Installation of Commercial Carpet
  - .2 CRI Indoor Air Quality Carpet Testing Program
- .4 American Association of Textile Chemists and Colorists (AATCC)
  - .1 AATCC 16-E Color Fastness to Lightfastness
  - .2 AATCC -134 under 3.5KV; Electrostatic Propensity of Carpet
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102.2 -2018 Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples: Submit duplicate 610 mm square pieces of full line of each type of carpet tile specified for selection of colours by the Consultant.
- .3 Submit carpet layout with a complete list of all materials proposed to Consultant for review prior to start of work.
- .4 Submit manufacturer's current recommended method of installation for each item.

- .5 Provide maintenance data for carpet tile for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00- Closeout Submittals.

1.5 Quality Assurance

- .1 Flooring contractor shall be approved by the material manufacturer and shall have completed a minimum of three projects of similar scope.

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 Use all means necessary to protect carpet materials before, 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.

1.7 Project Conditions

- .1 The temperature of the job site must stay within 15 °C and 25 °C throughout the installation and for 2-3 days beforehand.

1.8 Maintenance Materials

- .1 Submit in accordance with Section 01 78 00.
- .2 Provide extra materials as described below. Extra materials to be packaged with protective covering for storage. Identify extra materials with labels describing contents.
- .3 Extra Stock: Provide full size units equal to one carton of each type, colour and pattern required. Store on site as directed.
- .4 Maintenance materials to be from the same product run as installation materials.

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 Manufacturers

- .1 Carpet tile meeting the specified requirements and manufactured by one of the following may be acceptable, subject to approval by the Consultant of material colour range and patterns:

- .1 Interface Flooring Systems (Canada) Inc.
- .2 Mannington Commercial
- .3 The Mohawk Group
- .4 Patcraft Commercial Carpet and Commercial Flooring
- .5 Tandus Flooring
- .6 Shaw Contract Group

## 2.2 Materials

- .1 Carpet Tile: (CPT1)
  - .1 Basis of specification and standard of acceptance:
    - .1 Shaw Contract Local Tile 5t523 "Vibrant Tejate"
- .2 Carpet Tile: (CPT2)
  - .1 Basis of specification and standard of acceptance:
    - .1 Interface Luminescent 13111 "Titanium Iris"
    - .2 Installation: Ashlar Installation
- .3 Accessories:
  - .1 Trim & Accessories: Finercraft Plastic Products Inc.
  - .2 Rubber Base: as specified in Section 09 65 16.23
  - .3 Carpet Protection: Non-staining, heavy duty Kraft paper or 6 mil thick polyethylene film.
- .4 Leveling and Patching Compounds: Portland cement-based formulation provided by or recommended by carpet tile manufacturer. Do not use gypsum based compounds.
- .5 Adhesive: Pressure Sensitive Adhesive or as recommended by manufacturer.
- .6 All products shall meet the flame spread and smoke developed criteria under ULC 102.2.

## PART 3 EXECUTION

### 3.1 Inspection

- .1 The labels on each carton shall indicate product style, pattern, colour, run number and dye lot. Confirm that the style, pattern and colour match the specifications for each area of installation. Do not mix run numbers or dye lots on the same area.

### 3.2 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 Confirm that carpet tile may be installed in accordance with the original design and the manufacturer's recommendations.
- .3 In the event of discrepancy, immediately notify the Consultant.
- .4 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- .5 Concrete Subfloors: Verify that concrete slabs comply with the following:

- .1 Prepare concrete subfloors in accordance with ASTM F710.
- .2 Concrete floors must be thoroughly cured (minimum 90 days) prior to tile installation.
- .3 Remove coatings, including curing compounds, existing floor covering adhesive residues, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.
- .4 Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.
- .5 Test the moisture emission and alkalinity levels of the concrete as per manufacturer's instructions and referenced standards.
- .6 Use leveling and patching compounds recommended by flooring manufacturer for filling cracks, holes and depressions in the substrate. Surface shall be smooth, level and at proper elevation. Remove ridges, roughness and protrusions from concrete surfaces by grinding.

### 3.3 Installation

- .1 Install all carpet tiles in strict accordance with the manufacturer's recommendations and written installation instructions and CRI 104, Section 14, "Carpet Modules".
- .2 Do not lay carpet tiles until all trades, except painter, have completed their work and just prior to completion of the building.
- .3 Install carpet tile using a minimum number of pieces of carpet tile.
- .4 Fill all cavities, cracks, joints and all other surface imperfections in concrete substrate with latex fill or other approved subfloor filler in order to produce a smooth, flat, hard surface for receipt of carpet tile. Scrape off all ridges, droppings, scale and other projections. Clean floor with an industrial vacuum cleaner. Remove all substance and materials affecting adhesive bond.
- .5 Install carpet tile pattern parallel to walls and borders
- .6 Dry fit (without adhesive) tiles along the entire length of vertical and horizontal centre lines. Make necessary adjustments prior to commencing installation.
- .7 Provide full coverage spread of specified release adhesive. Protect all elements and baseboards with plastic or other material before spraying. Apply adhesive in accordance to manufacturer's recommendations.
- .8 Lay tiles in the step or pyramid pattern in accordance to manufacturer's recommendations.
- .9 Tiles adjacent to fixtures, architectural elements and walls shall be cut. Follow the manufacturer's guidelines. Where tiles terminate at doorways, or where tiles of different type or colour butt together the joint shall centre on the door. Provide and install reducer strips where carpet tiles terminate against a concrete floor where no applied architectural floor finish is required. Reducer strip shall be installed below centre of door where a door occurs.
- .10 Lay tiles with all joints square and tightly butted together. Start installation from centre of rooms to ensure equal maximum size edge tiles. Pattern and direction of tile shall be as directed by the Consultant.



.11 Lay tiles at full depth of closets, toe spaces, and recesses. Cut and fit tiles tightly against openings, breaks, frames, fixtures, columns and other vertical surfaces. Apply adhesive to provide watertight joint around all cut areas.

.12 Roll carpet tile for complete contact of carpet tile with adhesive and substrate.

.13 Resilient base shall be installed under Section 09 65 19.

### 3.4 Cleaning

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

.2 Perform cleaning operations immediately after installing carpet.

.3 Inspect the entire installation, paying close attention to joint and any tiles that have been cut.

.4 Remove yarns that protrude from carpet surface

.5 Remove surplus adhesive from carpet tiles as the work progresses.

.6 Vacuum carpet using commercial machine with rotating brush.

.7 Protect installed carpet to comply with CRI 104, Section 16 protection of indoor installations. Protect carpet and carpet tile against damage from construction

.8 Immediately prior to Substantial Performance, remove protection and vacuum the floor with a pile lifter.

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 91 23 Interior Painting

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM F793/F793M-20 Standard Classification of Wall Coverings by Use Characteristics
  - .2 ASTM F1141/F1141M-20 Standard Specification for Wall Coverings
  - .3 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 265 (2019) Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls
  - .2 NFPA 286 (2019) Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
- .3 The Ontario Building Code.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit complete printed data for each type of product. Include material specifications, weight and fire certification.
- .3 Samples: Submit duplicate samples of specified wallcovering materials, minimum 400 x 400 mm square.
- .4 Provide maintenance data for vinyl wall coverings for incorporation into Operating and Maintenance Manuals specified in Section 01 78 00- Closeout Submittals.

### 1.5 Quality Assurance

- .1 Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.

### 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 Environmental Limitations: Do not install coverings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient

temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- .2 Lighting: Do not install covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
- .3 Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by covering manufacturer for full drying or curing.

#### 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.

### PART 2 PRODUCTS

#### 2.1 Materials

- .1 To ASTM F793 and ASTM F1141.
- .2 All wall coverings shall be commercial grade. High traffic areas shall use a heavy weight wall covering of approximately 23 ounces per square yard.
- .3 All wall coverings will have a graffiti resistant coating
- .4 Flame spread rating in accordance with NFPA 265
- .5 Basis of Design Product:
  - .1 WC-1: Versa Wall Covering , Pattern: Ocean Drive : Colour: Carlyle A191-321

#### 2.2 Adhesives:

- .1 Adhesive: Mildew-resistant, nonstaining, adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall covering manufacturer.

### PART 3 EXECUTION

#### 3.1 Manufacturer's Instructions

- .1 Install wallcoverings in accordance with manufacturer's printed recommendations.

#### 3.2 Examination

- .1 Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

**3.3      Preparation**

- .1 Comply with manufacturer's written instructions for surface preparation.
- .2 Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- .3 Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.
- .4 Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
  - .1 Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
  - .2 Sizing shall be applied after walls have been primed according to manufacturer's recommendation
- .5 Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

**3.4      Installation**

- .1 All corners (interior and exterior) shall be wrapped 100 to 150 mm.
- .2 Wall covering shall be applied prior to items such as chair rail, baseboard, and trim.
- .3 Apply wallcovering in accordance with manufacturer's instructions.

**3.5      Cleaning**

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 06 20 00 Finish Carpentry
- .3 Section 07 92 00 Joint Sealants
- .4 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-24 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 Underwriter 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 duplicate full size sample of each type acoustical unit.
- .3 Submit shop drawings showing layout and anchorage details.
- .4 Submit full range of manufacturer's colours and fabrics for selection by the Consultant.

### 1.5 Environmental Requirements

- .1 Commence installation after building enclosed and dust generating activities are completed.
- .2 Permit wet work to dry prior to commencement of installation.
- .3 Maintain uniform minimum temperature of 15 ° C and relative humidity of 20- 40% prior to, during and after installation.

### 1.6 Extra Materials

- .1 Provide extra materials of acoustic units and adhesive in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units for maintenance use amounting to 2% of gross wall area for each pattern and type required for project.
- .3 Provide sufficient adhesive to install extra material provided.

- .4 Extra materials to be from same production run as installed materials.
- .5 Clearly identify each package of acoustical units including colour and type, and each container of adhesive.
- .6 Store where directed by Owner

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 Wall Panels

- .1 High Impact Extreme Acoustic Panel: Acoustic core material: 14 mm thick with high impact control component.
- .2 Basis of Design and Standard of Acceptance: Acoufelt Fracture Two Tone.
  - .1 Size as indicated on drawings.
  - .2 Extruded trim: To manufacturer's standard. Reinforce corners.
  - .3 Metal support clips: continuous roll formed galvanized steel to acoustic unit supplier's standard.
  - .4 Extruded mounting: Mount panels using mechanical fastening only (includes slide and engage z-clip, wall clips and/or track).
  - .5 Fabric covering: Guilford FR 701 100% polyester fabric, chosen from the manufacturers full range of colours.
    - .1 Flamespread to ASTM E84, Class 1 and ULC 102.2
    - .2 Fabric finishes shall be stretch applied over the panel face, bonded to the panel edges and returned a minimum of 25mm on the back of the panel.
    - .3 The finish shall be flat and wrinkle free and fully tailored at corners with no exposed darting.
- .3 Adhesive: type recommended by acoustic unit manufacturer.
- .4 Screws: to CSA B111, non-corrosive finish, type recommended by acoustic unit manufacturer.
- .5 Colour:
  - .1 (AP-1): Acoufelt Fracture Two Tone, Raindrop TTRAI "Piano Black/Currant"
  - .2 (AP-2): Acoufelt Fracture Two Tone, Raindrop TTRAI "Piano Black/Shiraz"

2.2 Accessories

- .1 Acoustic Wall Panels Installation shall be by use of slide and engage clips ("Z" clips), either into a DWC-7 anti-rattle wall clip, or into continuous wall track. Panel clips (DPC-3) and wall clips (DWC-7 or continuous wall track)) shall be a minimum 1.00 mm satin-coat steel with wall clips

mechanically mounted to the back of the panels. All fasteners (wall anchors, screws, etc.) are to be supplied by the installing contractor.

### PART 3 EXECUTION

#### 3.1 Manufacturer's Instructions

- .1 Install all acoustic treatment in accordance with manufacturer's recommendations.

#### 3.2 Examination

- .1 Do not proceed with installation until all wet Work such as and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.
- .2 Ensure substrate surface is straight to tolerance of plus or minus 3 mm over 3000 mm.

#### 3.3 Preparation

- .1 Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

#### 3.4 Installation

- .1 Install acoustic units to clean, dry and firm substrate using adhesive.
- .2 Install acoustic units plumb and aligned. Arrange units symmetrical on each wall. Cut units to be at least 50 % of unit width.
- .3 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.
- .4 Keep acoustic installation and all components clean. Remove blemishes immediately.

#### 3.5 Protection

- .1 Use polyethylene to protect finished acoustical wall treatment from damage.
- .2 Remove and replace damaged materials prior to Substantial Performance

#### 3.6 Cleaning

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

End of Section

## **PART 1 GENERAL**

### **1.1 General**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Sections**

- .1 Section 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 MPI Standard GPS-1-12 and GPS-2-12 MPI Green Performance Standard for Painting and Coatings.
- .4 Society for Protective Coatings (SSPC)
  - .1 Systems and Specifications, SSPC Painting Manual 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 Steel Doors, Frames and Metal Fabrications:
  - .1 EXT 5.1D – Alkyd G5 semi-gloss finish over alkyd primer.
- .2 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

**Project:** 24015  
**Description:** Mill Courtland Community Centre Addition  
216 Mill Street, Kitchener, ON

**EXTERIOR PAINTING**  
**Section 09 91 13**

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scuffing newly applied paint.

End of Section



## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 05 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
- .10 Section 09 96 46 Intumescent Coatings

### 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 MPI Standard GPS-1-12 and GPS-2-12 MPI Green Performance Standard for Painting and Coatings.
- .4 Society for Protective Coatings (SSPC)
  - .1 Systems and Specifications, SSPC Painting Manual 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 Colour Schedule:
  - .1 PT-1: BJM SEMOLINA "2155-40"
  - .2 PT-2: BJM KENDALL CHARCOAL "HC-166"
  - .3 PT-3: BJM GENTLE VIOLET "2170-20"
  - .4 PT-4: BJM GENTLEMAN'S GRAY 2062-20
  - .5 PT-5: BJM SLATE TEAL "2058-20"
  - .6 PT-6: BJM WINTER SNOW "OC-63"
  - .7 PT-7: BJM HORIZON
  - .8 PT-8: BJM JET BLACK "2120-10"
- .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 Structural Steel:

- .1 INT 5.1X Latex G5 semi-gloss finish (over quick dry shop primer).

### .2 Metal Fabrications:

- .1 INT 5.3A Latex G5 semi-gloss finish

### .3 Galvanized Metal: interior doors, frames, railings, misc. steel, pipes, and ducts.

- .1 INT 5.3A Latex G5 semi-gloss finish

### .4 Concrete Masonry:

- .1 INT 4.2D High performance architectural latex G5 semi-gloss finish.

### .5 Interior Wood Doors

- .1 INT 6.3A High performance architectural latex G5 semi-gloss finish.

### .6 Electrical Equipment Backboards:

- .1 INT 6.4P Fire retardant, pigmented coating. Low odour/low VOC. Semi-gloss (UL/ULC rated).

### .7 Gypsum Board: Walls:

- .1 INT 9.2A Latex G3 eggshell finish over latex sealer.

### .8 Gypsum Board: Ceilings and Bulkheads:

- .1 INT 9.2A Latex G2 velvet finish over latex sealer.

- .9 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, 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 05 41 00 Structural Metal Stud Framing
- .2 Section 06 10 00 Rough Carpentry.
- .3 Section 07 42 30 Solid Phenolic Wall Panels

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Manufacturer's descriptive literature and specifications.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 Submit catalogue sheets [and][full size templates].
  - .3 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.
  - .4 Submit drawn-to-scale details for individually fabricated or incised lettering indicating word and letter spacing.
  - .5 Artwork for graphics will be provided by the Owner.
- .4 Samples:
  - .1 Submit duplicate 300 x 300 mm samples of each powder coat finish selected.

### 1.4 Quality Assurance

- .1 Manufacturer to have a minimum of 10 years experience in manufacturing signs of type similar to those required.
- .2 All exterior building signs to be manufactured by one manufacturer.

### 1.5 Coordination

- .1 Coordinate installation of signage with Related Sections to ensure that adequate structural support and backing has been provided.

### 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 Manufacturer**

- .1 Provide graphic signage as detailed on drawings complete with all necessary mounting hardware and accessories for a complete installation as manufactured by a qualified sign manufacturer acceptable to the Consultant with a minimum of ten years experience in the fabrication and installation of exterior building signage.

### **2.2 Materials**

- .1 Furnish materials and hardware necessary to install cut metal letters and graphics shown on drawings and herein specified.
- .2 Stainless Steel – 304 Alloy
- .3 Fasteners: supply and install complete signage package including all necessary hardware, fasteners and accessories necessary for a complete installation..

### **2.3 Finishes**

- .1 Fabricated Stainless Steel
  - .1 Brushed finish
- .2 Powder Coat Finish: Prismatic CPowders or equivalent, custom colours to match City of Kitchener Corporate standards.

### **2.4 Sign Graphics**

- .1 Sign graphics: well defined, arranged for balanced appearance, and properly word and letter spaced in accordance with the City of Kitchener Graphic standards.

### **2.5 Fabrication**

- .1 Letters and graphics shall be fabricated of stainless steel. Form letters by heliarc welding process. Characters should have smooth flat faces, sharp corners, precisely formed lines and profiles, free from pits, scale, and other defects.
- .2 Letter style, font, size and depth shall be as directed by the Owner.
- .3 Mounting and hardware shall be as recommended by manufacturer for signage as indicated. Provide mounting templates designating stud locations for mounting on specified exterior wall surfaces as indicated on Contract Drawings.
- .4 Powder coat finish where specified and in accordance with coating manufacture's written instructions.

## **PART 3 EXECUTION**

### **3.1 Manufacturer's Instructions**

- .1 Install signage in accordance with manufacturer's instructions and reviewed shop drawings.

3.2 Verification

- .1 Verify that support framing and backing has been provided sufficient to support all exterior building signage.

3.3 Installation

- .1 Install signs level, plumb, and at the height indicated with sign surfaces free from distortion or other defects in appearance.

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 10 28 10 Toilet and Bath Accessories

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .2 CSA Group (CSA)
  - .1 CSA/ASC B651:23 Accessible Design for the Built Environment.
- .3 American National Standards Association (ANSI)
  - .1 ANSI/
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies
- .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 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 toilet compartments and urinal screens 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 Toilet Partitions must be delivered to the job site in the manufacturers' original packages and marked to correspond with the approved shop drawings.
- .4 Protect finished surfaces during shipment and installation. Do not remove until immediately prior to Substantial Performance.

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 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 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 Hadrian Manufacturing Inc.

2.2 Floor to Ceiling Toilet Partitions

- .1 Basis of Design Product: Hadrian Elite Max.
  - .1 Style: Floor to ceiling.
- .2 Urinal Screens: To match panels in construction and finish.
  - .1 Basis of Design Product: Hadrian Urinal Screen.
    - .1 Wall hung.

2.3 Materials

- .1 Construction: Doors, Panels and Pilasters shall be constructed of two sheets of panel flatness zinc-coated steel, Galvanneal ASTM A653 GR33, laminated under pressure to a honeycomb core for sound deadening and rigidity. Formed edges to be welded together and inter-locked under tension with a roll-formed oval crown locking bar, mitred, welded and ground smooth at the corners. Honeycomb to have a maximum 25mm cell size.
- .2 Doors: Shall be 25 mm thick with cover sheets not less than 22-gauge (0.8 mm). Door heights are 2336mm.
- .3 Panels: Shall be 25 mm thick with cover sheets not less than 22-gauge (0.8 mm).
- .4 Pilasters: Shall be 32 mm thick with cover sheets not less than 20-gauge (0.9mm). Pilaster tops

shall be reinforced with a 20-gauge channel to create extra strength and twist-free rigidity.

- .5 Headrail: Shall be 25 mm by 41mm extruded anodized aluminum with double-ridge anti-grip design. Wall thickness to be 1.5mm and shall be securely attached to wall and pilasters with manufacturer's fittings in such a way as to make a strong and rigid installation. All joints in headrails shall be made at pilaster.

## 2.4 Hardware

- .1 Hardware and Fittings: All panel-to-pilaster, panel-to-wall and pilaster-to-wall connections shall be made with full height continuous channels. All door hardware shall be #4 brushed castings, standard. Fasteners shall be 12 x 1-3/4" and 12 x 5/8" TR-27 6-lobe security screws. Doors shall be equipped with a gravity type hinge mounted on the lower pilaster hinge bracket. Door hinges shall be wrap-around style and adjustable to permit the door to rest at any position when not latched. Each door to be fitted with a combined coat hook and bumper and a concealed latch, with face mortised flush with edge strip of door. Standard and Barrier-free doors shall include stainless steel, #4 brushed indicator slide latch to activate latch without fingertip grip application. Standard and barrier-free latches shall have a turn slot designed to allow emergency access from exterior. The combined full length extruded aluminum door stop and keeper shall have a 6.4 mm wide continuous rubber bumper locked in place the length of the stop. To cover the sightline gap at door hinge side, full length extruded aluminum filler channel shall be provided. The "no sightline" aluminum continuous stop and hinge filler shall be #4 brushed to complement door and pilaster finish. Threaded upper hinge pin shall have a metal core and self-lubricating nylon sleeve to ensure smooth, quiet operation. Pilaster and panel pedestals to be 304 #4 brushed stainless steel.

## 2.5 Urinal Screens

- .1 Screens shall be constructed of two sheets of panel atness zinc-coated galvanneal steel, ASTM A653 GR33, laminated under pressure to a honeycomb core for sound deadening and rigidity. Formed edges to be welded together and inter-locked under tension with a roll-formed oval crown locking bar, mitred, welded and ground smooth at the corners. Honeycomb to have a maximum 25mm cell size.
- .2 Screens shall be 25 mm thick with cover sheets not less than 22-gauge (0.8mm). Screens shall be 610mm deep by 1219 mm high and anchored into the wall approximately 305mm off the floor.
- .3 Screens shall be fastened to the wall with double-ear brackets that are chrome plated zinc die cast. Floor mounted with pilaster and door to ceiling mounted with post to be fastened to the front support with "U" brackets that are chrome plated zinc die cast.

## 2.6 Finish

- .1 All sheet metal to be thoroughly cleaned, phosphated and finished with a high performance powder coating, electrostatically applied and oven cured to provide a uniform, smooth protective finish.
- .2 Colour: Charcoal

## 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



## 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 06 10 00 Rough Carpentry
- .3 Section 07 21 13 Building Insulation
- .4 Section 09 21 16 Gypsum Board

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .3 ASTM E557-12(2020) Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions
  - .4 ASTM E413-22 Classification for Rating Sound Insulation
- .2 International Standards Organization
  - .1 ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
  - .2 ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
  - .3 ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
  - .4 ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
  - .5 ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.
- .3 ADA – Americans with Disabilities Act.
- .4 American National Standards Institute (ANSI)
  - .1 ANSI Z97.1 - Safety Glazing Materials Used in Buildings.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.
- .3 Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.
- .4 Setting Drawings: Show imbedded items and cutouts required in other work, including support

beam punching template.

- .5 Samples: Colour samples demonstrating full range of finishes available by Consultant. Verification samples will be available in same thickness and material indicated for the work.
- .6 Reports: Provide a complete and unedited written sound test report indicating test specimen matches product as submitted.
- .7 Operation and Maintenance Manuals specified in Section 01 78 00.

#### 1.5 Design Criteria

- .1 Laboratory acoustical performance of the operable wall shall have been tested in an independent acoustical laboratory in accordance with ASTM E90 test procedure and shall have attained an STC rating of not less than 52. A written test report by the test facility shall be available on request.
- .2 Provide finish for partition covering with maximum flame spread 20 fuel contributed, smoke developed 40, when tested to ASTM E84.

#### 1.6 Quality Assurance

- .1 Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.
- .2 Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.
- .3 Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
- .4 The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.
- .5 Indoor Air Quality: Operable partition, movable wall manufacturer's non-wood products must meet the SCS Indoor Advantage™ Gold Certification or equivalent. This approval guarantees conformance to indoor air concentrations meeting Indoor Advantage Gold Indoor Air Quality Certified to SCS-105 v4.2-2023 Conforms to ANSI/BIFMA M7.1 and X7.1 and the CDPH/EHLB Standard Method (CA 01350) v1.2-2017 conducted in an independent third-party air quality testing laboratory.

#### 1.7 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.
- .3 Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

- .4 Deliver, store and handle materials prior to installation to prevent damage.

#### 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.

### PART 2 PRODUCTS

#### 2.1 Acceptable Manufacturer

- .1 Manufacturer: Modernfold Inc.
- .2 Product: Acousti-Seal Legacy – Paired Panel 932 manually operated paired panel partition.
- .3 Acceptable Alternate Manufacturer's: Equivalent products with all welded panels by the following manufacturer's, as approved by the Consultant may be accepted subject to review of the performance characteristics, details, materials and finishes:
  - .1 Moderco
  - .2 Panelfold
  - .3 Corflex
  - .4 Hufcor

#### 2.2 Operation

- .1 Operable wall shall be a series of flat panels hinged in pairs, manually operated, top supported with operable floor seals.
- .2 Final Closure: Hinged panel closure.

#### 2.3 Panel Construction

- .1 Nominal 76 mm thick panels in 1220 mm widths. All panel horizontal and vertical framing elements shall be fabricated from minimum 1.30 mm formed steel with overlapped and welded corners for rigidity. Top channel reinforced to support suspension system components. Frame designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
- .2 Panel Skin: Roll-formed 21-gage steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels: 52 STC
- .3 Hinges for Closure Panels, Pass Doors, and Pocket Doors shall be Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
- .4 Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance

at panel joints.

- .5 Panel Weights: 52 STC - 11 lbs./square foot

## 2.4 Panel Finishes

- .1 Panel face finish shall be:
- .1 Reinforced vinyl with woven backing weighing not less than 567 g per lineal yard.
  - .2 Top colour: Standard Len-tex vinyl Emboss LT suede B. White,
  - .3 Base colour: Standard Len-tex vinyl Emboss LT suede B. White,
- .2 Panel trim: No exposed panel trim required or allowed; seals and hardware to be of one colour.
- .1 White

## 2.5 Suspension System

- .1 Suspension system shall be Modernfold #17 suspension system all steel, with a minimum 3.0 mm roll formed steel track. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 9.6 mm diameter threaded rods. Aluminum track is not acceptable.
- .2 Exposed track soffit shall be all steel. Soffit shall be prime painted, and permit mounting to track brackets without exposed fasteners. Plywood, particle board, or aluminum soffits are not permitted. Track soffit must accommodate termination of plenum sound barrier on both sides of track.
- .3 Carriers: One all-steel trolley with steel-tired ball bearing wheels per panel (except hinged panels). Non-steel tires are not acceptable.
- .4 Suspension system shall provide automatic indexing of panels into stack area using pre-programmed switches without moving parts.
- .5 Carriers shall attach to panels with a shock absorbing mounting to prevent stress to structural, ceiling and carrier elements due to abusive handling of panels.

## 2.6 Sound Seals

- .1 Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.
- .2 Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
- .3 Horizontal Bottom Seals:
- .1 A2 - Automatic operable seals providing nominal 51 mm operating clearance with an operating range of +13mm to -38 mm which automatically drop as panels are positioned, without the need for tools or cranks.

## 2.7 Accessories

- .1 Provide manufacturer's standard stack jamb and fly panel with recessed handle.

- .2 Hardware: Equip partition with manufacturer's standard hardware. Hardware finish selected from manufacturer's standard finishes.
- .3 Hinges for Panels, Closure Panels, Pass Doors, and Pocket Doors shall be full leaf butt hinges, attached directly to the panel frame. Welded hinge anchor plates within panel shall further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragal are not acceptable.
- .4 Single Pass Door: Matching pass door same thickness and appearance as panels. ADA compliant pass door to be trimless and equipped with friction latch and flush pulls for panic operation. No threshold will be permitted.
  - .1 Hardware:
    - .1 Lever handle both sides of door.
    - .2 Automatic door closures.
    - .3 Door viewer,
- .5 Pocket Doors: Same construction, finish, and appearance as the adjacent panels.
- .6 Finished end caps.

### PART 3 EXECUTION

#### 3.1 Fabrication

- .1 Fabricate operable partitions in the factory.
- .2 Panels shall be minimum 76 mm thick. Panel skins shall be lockformed and directly welded to frames to form a unitized panel for non-racking rigidity and durability.
- .3 Panel cores shall be insulated to provide acoustical rating as specified and to provide rigid backing for skins.

#### 3.2 Examination

- .1 Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.3 Installation

- .1 General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.
- .2 Install operable partitions and accessories after other finishing operations, including painting have been completed.
- .3 Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.
- .4 Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

**3.4     Adjusting**

- .1 Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

**3.5     Demonstration**

- .1 Demonstrate proper operation and maintenance procedures to Owner's representative.

**3.6     Cleaning and Protection**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.
- .3 Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

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

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-23 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM A924/A924M-22a Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  - .3 ASTM B456-17(2022) Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
  - .4 ASTM C1036-21 Standard Specification for Flat Glass
  - .5 ASTM C1503-18 Standard Specification for Silvered Flat Glass Mirror
  - .6 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/ASC B651:23 Accessible Design for the Built Environment.
  - .2 CSA G164-18(R2023) Hot Dip Galvanizing of Irregularly Shaped Articles.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
  - .1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.
- .3 Samples:
  - .1 Submit samples when requested.
  - .2 Samples to be returned for inclusion into work.
- .4 Closeout Submittals:
  - .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### 1.5 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

1.6 Waste Management and Disposal

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

1.7 Extra Materials

- .1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.
- .2 Deliver special tools to Owner.

**PART 2** PRODUCTS

2.1 Materials

- .1 Sheet steel: to ASTM A653 with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: Type 304, with Brushed finish.
- .3 Stainless steel tubing: Type 304, commercial grade, seamless welded, minimum 1.2 mm wall thickness.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 Manufacturers

- .1 Products and components listed are minimum standard of acceptance. Alternative products by recognized manufacturers of toilet and bath accessories may be accepted subject to review by the Consultant of manufacturer's product information and specifications.
- .2 Acceptable manufacturers include:
  - .1 Bobrick
  - .2 Bradley
  - .3 Frost
  - .4 Hafele
  - .5 Richelieu
  - .6 Watrous

2.3 Components

- .1 TPD: Toilet Tissue Dispenser:
  - .1 Supplied by Owner, installed by Contractor.
- .2 GB1: Grab Bar, 38 mm diameter x 1.6 mm wall tubing of stainless steel, 76 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN. 600 mm long.
  - .1 Bobrick B-6806.99 x 24
- .3 GB: Barrier Free Toilet Grab Bars 2 (L-shaped) 760 x 760 38 mm dia. Peened finish c/w mounting kits.



- .1 Bobrick B-6898.99, 90° Angle Grab Bar.
- .4 SND: Sanitary Napkin Disposal
  - .1 Supplied by Owner, installed by Contractor.
- .5 SD: Soap Dispenser: Liquid wall mounted soap dispenser.
  - .1 Supplied by Owner, installed by Contractor.
- .6 Framed Mirror: Bobrick B-165 1830.
- .7 Hand Dryers:
  - .1 Supplied by Owner, installed by Contractor.
- .8 Frameless Mirror: as specified in Section 08 80 05
- .9 Baby Changing Station:
  - .1 Koala KB200- Horizontal Wall Mounted Changing Station. White Granite finish.
- .10 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
- .11 Collapsible Coat Hook: Bobrick B-983
- .12 Adjustable Height Adult Change Table: Max-Ability Model Pressalit Care 3000 1911 x 787 mm, capacity 200 kg. Electrically operated adjustable unit complete with transformer for plugging into electric outlet provided under Electrical Divisions.
- .13 SNV: Sanitary Napkin Vendor: Satin-finish stainless steel surface mounted vending machine.
  - .1 Supplied by Owner, installed by Contractor.
- .14 GB3: Swing Up Grab Bar: 32 mm diameter, 737 mm deep, satin stainless steel c/w mounting kits.
  - .1 Bobrick B-4998

## 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 The general contractor is to have approval of the installation locations of all washroom accessories from the City of Kitchener's GRAAC. A walkthrough with one representative from the GRACC will be conducted prior to the installation of washroom accessories.
- .2 Install toilet and bath accessories in accordance with the Ontario Building Code, CSA B651 and manufacturer's instructions.
- .3 Install and secure accessories rigidly in place as follows:
  - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
  - .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
  - .3 Solid masonry or concrete: use bolt with lead expansion sleeve set into drilled hole.
- .4 Install grab bars on built-in anchors provided by manufacturer.
- .5 Use tamper proof screws/bolts for fasteners.
- .6 Fill units with necessary supplies shortly before final acceptance of building.
- .7 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.
- .8 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-22a 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 Provide all fastenings, anchorage and accessories as required to complete the work and as recommended by the manufacturer.
- .6 Fastenings shall be concealed or theft-proof type where possible. Exposed fastenings shall be neatly executed and shall be of the same material and finish as the base metal on which they occur.

### 2.2 Products

- .1 **Bike Rack:** Maglin MBR350-4-3. Surface mount, 4 loops. E-Coat rustproofing and powder coated finish in colour selected by the Consultant. Complete with mounting hardware.
- .2 **Basketball Backstops:** Sport Systems Canada IG Series basketball backstop compete with all necessary hardware and accessories.
  - .1 Ground sleeve: BB-BFD4 GRSLV
  - .2 Pole: BF04 – 4 1/2" O.D. galvanized pole with 48" gooseneck galvanized to CSA and ASTM standards
  - .3 Backboard: 1750 – Cast aluminum fan-shaped backboard.
  - .4 Rim: B-IG-01B 240SG – Double rim with mesh
- .3 **Parking Signs:** Heavy-duty, 2.0 mm thick aluminum signs and sign-posts to Ontario Traffic Manual Book 5- Regulatory Signs and Municipal standards. Reflective Aluminum (RA) engineer grade reflective sign face designed to provide increased visibility in low-light conditions with UV-resistant inks to prevent fading during long-term outdoor use. Supplied with top and bottom center holes for post or fence mounting and galvanized steel post. Symbols and markings as indicated.
  - .1 Fabricate posts from steel conforming to ASTM A36/A36M or ASTM A499 and having a minimum yield strength of 207 MPa 30 ksi and a minimum tensile strength of 345 MPa 50 ksi. Galvanize posts after punching in accordance with ASTM A123/A123M.
  - .2 Hardware: Bolts, nuts, post clips, lock and flat washers must be either aluminum alloy or commercial quality stainless steel, hot-dip galvanized or cadmium plated after fabrication. Bolts/nuts must be tamper resistant design. Provide fiber washers of commercial quality.
  - .3 Signs specified herein and where shown on drawings are to be included in Contact price and are not part of any cash allowance.
- .4 **Wall Padding**
  - .1 Wall Padding specified as manufactured by Apple Athletics, 225 Hughes Road, Orillia, ON, L3V 2M2, Tel: 705-325-6455, Toll Free: 1-800-461-8952.
  - .2 Removable Wall Padding mounted on Velcro Strips: Apple Athletics, Class A safety guard

- wall passing (610 x 1830 x 50 mm) Velcro 2 sides. Velcro strips installed for attaching shall be provided at the top and the bottom of each pad location. Total area covered= 1830mm x 3660mm.
- .3 Removable stage padding mounted on Velcro strips installed for attaching shall be provided at top and bottom of each pad location for full width of stage.
  - .4 Final location of Velcro strips to be confirmed on site by Consultant and Owner prior to installation.
  - .5 Colour to be selected from manufacturer's complete range.
  - .6 Allow access holes for electrical wall outlets and cover with a removable strip secured with a velcro strip.
- .5 **Wall Mounted Play**
- .1 Wall mounted play boards as supplied by Canadian Learning Supply
  - .2 2 each HABA Interactive Learning & Sensory Walls – Quarter Circle (mirrored).
    - .1 12.8 mm thick birch wood construction with colourful painted details and clear finish.
    - .2 Wall-mounting hardware included
    - .3 698 mm H x 648 mm W
  - .3 1 each HABA Interactive Learning & Sensory Walls – Curve Design
    - .1 12.8 thick birch wood construction with colourful painted details and clear finish.
    - .2 Wall-mounting hardware included
    - .3 698 mm H x 648 mm W

### PART 3 EXECUTION

#### 3.1 Installation - General

- .1 Install manufactured items in accordance with manufacturer's printed instructions and recommendations.

#### 3.2 Installation - Parking Signage

- .1 Signposts consist of a base post and signpost. Drive steel sign base posts with a suitable driving head. Attach signposts to base posts. Replace any base posts damaged during driving or otherwise at no additional cost to the Owner. Embed steel sign base posts in concrete.
- .2 Locate and erect all signs in accordance with the drawings, municipal standards and codes. Vertically mount signs at right angles to the direction of, and facing, the traffic that they are intended to serve. Mounted signs must present a smooth flat surface varying no more than 10 mm from a 1.2 m straightedge placed in any position on the face of the sign after erection. Mount signs on traffic signal posts with strap or clamp type sign supports.

#### 3.3 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 CSA Group (CSA)
  - .1 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Provide manufacturer's product literature, technical specifications and other data prior to actual field installation work.
- .3 Provide shop drawings of manufacturer's recommended installation and foundation requirements prior to actual field installation work.

### 1.5 Quality Assurance

- .1 Manufacturer of soccer goals shall be certified to CSA W47.1

### 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 Manufacturer

- .1 Manufacturers and product selections named are provided to establish the minimum standard.
  - .1 Beacon Athletics  
901 Deming Way, Ste 101

Madison, WI 53717  
Phone: (800) 747-5985  
Fax (608) 836-0724  
Website: [www.beaconathletics.com](http://www.beaconathletics.com)

## 2.2 Products

### .1 Barrier Net System

- .1 Basis of Design: Beacon Athletics Combo Barrier Net System.
  - .1 Model: BNL-1560
  - .2 Size: 15'H x 60'L
- .2 Design Criteria
  - .1 Poles: 102 mm OD Powder coated Aluminum Poles with Ground Sleeves
    - .1 Pole spacing not to exceed 6.1 m on center
  - .2 Netting: Upper 2440 mm shall be 102 mm square mesh net, Lower 3660 mm shall be 38 mm square mesh net
  - .3 Hardware:
    - .1 Provide all hardware necessary to raise, lower & tension the netting from the ground
    - .2 Premium Harken Lifting Blocks

## PART 3 EXECUTION

### 3.1 Installation

- .1 All athletic field equipment shall be installed in accordance with manufacturer's written directions, and as indicated on the drawings.
- .2 Check for plumbness.

### 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 03 20 00 Concrete Reinforcing
- .2 Section 03 30 00 Cast-in-Place Concrete
- .3 Section 31 23 10 Excavating, Trenching and Backfilling

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM D2321-20 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Information to include unit dimensions and capacity, materials and colour options.
- .3 Shop Drawings: Detailed product data, including components, materials and finish/colour options.
- .4 Installation Data: Manufacturer's special installation requirements including special procedures, site location details requiring special attention.
- .5 Submit operating and maintenance instructions for In-Ground Waste Collection systems for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00-Closeout Submittals.
  - .1 Include description of system operation, adjusting and testing requirements.
  - .2 Identify system maintenance requirements, servicing cycles, lubrication requirements and spare parts listings.

### **1.5 Shipping, Handling and Storage**

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Delivery and Acceptance Requirements: Deliver materials in original packaging clearly labelled with project information, and other pertinent information clearly identified.
- .3 Storage and Handling Requirements:
  - .1 Handle containers 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 Manufacturer

- .1 Molok North America

### 2.2 Product Description

- .1 Molok Model: M-5000 complete with all signage, fittings and accessories as necessary for a complete installation.
  - .1 5000 L capacity
  - .2 Hinged lid.
  - .3 Manufacturer standard lifting liner.
  - .4 Colours as selected by Consultant.

## PART 3 EXECUTION

### 3.1 Examination

- .1 Verify actual site dimensions and conditions prior to commencing work. Ensure that the ground slope is no more than 5%.
- .2 Ensure the area is clear of overhead obstructions (powerlines, trees, etc.), and clear of fire hydrants, transformers, and other utility boxes.
- .3 Ensure that there are no underground services and utilities under the proposed locations.
- .4 Refer to a geotechnical report if available for soil and groundwater conditions. If the report indicates a high water table, contact the manufacturer for an engineered solution.
- .5 Report conditions contrary to contract requirements that would prevent installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
- .6 Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

### 3.2 Excavation

- .1 Ensure that site area is clear of all above and below grade obstructions.
- .2 Excavate trench 2135mm wide by 1676mm deep (measured from highest finished grade). Length of trench is dependent on the proposed number of containers and the truck approach angle.

### 3.3 Installation

- .1 Install in-ground waste collection system in accordance with manufacturer's printed instructions and reviewed shop drawings.

### 3.4 Protection

- .1 Protect ground sleeve liner and garbage container from other site works until completion of project.

3.5 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

### 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, manually Operated Solar Shades as manufactured by Solarfective Products Limited or approved equivalent.
- .2 Basis of Design: The Legrand Shading Systems Solarfective Teleshade (TS)
- .3 Subject to compliance with the contract documents, acceptable equivalent products of the following manufacturers may be used upon approval:
  - .1 Elite Window Fashions
  - .2 Lighting Harvesting Shading Solutions
  - .3 Mechoshade Systems Inc.
  - .4 Nysan Solar Control
  - .5 Sun Glow Window Covering Products of Canada
  - .6 SunProject Inc.

#### 2.2 Hardware – Manually Controlled Shades

- .1 Chain Operated with infinite positioning. Left or right hand operation and banding as applicable to project conditions.
  - .1 Drive assembly:
    - .1 Must allow fingertip control and include a built-in shock absorber system to prevent chain breakage under normal operating conditions.
    - .2 Factory set for size and travel of shades.
    - .3 Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.
    - .4 Drive Chain: No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have passed a 40kg load test. Chain may be positioned at either, or both ends of the shade without disassembly of the shade unit.
      - .1 Supply and install child safe chain retainers.
    - .5 Supply and install counter balancing mechanism designed to offset the weight of the shade and give fingertip control.

#### 2.3 Assembly

- .1 Supply and install fully factory assembled shade units consisting of 2 shade brackets, shade tube,

extruded aluminum fascia, hembar and fabric as specified.

- .2 Factory modify housings where necessary to bypass columns and other obstructions.
- .3 End Brackets: 2 piece molded ABS construction with nylon drive sprocket. Bracket colour coordinated with fascia colour.
- .4 Shade tube; Minimum 1.52 mm thick extruded aluminum with 3 equally spaced continuous stiffening fins, non-sag design, maximum deflection under full load of fabric  $L/700$ .
- .5 Fascia: One piece extruded aluminum 1.7 mm thickness complete with three continuous screw flutes. Anodized. Colour as selected by the Consultant. Extruded aluminum snap lock fascia which continuously fits on the end and center brackets as a one-piece section.
- .6 Hembar: extruded aluminum with matching plastic end finials.

#### 2.4 Shade Mounting System

- .1 Extruded aluminum bracket designed to accept preassembled shade system.
  - .1 Brackets shall be used to facilitate the alignment with shade opening.
- .2 Modular Construction: shades must be removable as a complete modular unit without any component disassembly required.

#### 2.5 Aluminum Finish

- .1 Exposed aluminum: Baked enamel, colour to be selected by the Consultant.
- .2 Unexposed aluminum: mill finish.

#### 2.6 Shade Fabric

- .1 Sun control fabric: dimensionally stable shade fabric.
  - .1 Acceptable Products: 3% open area:
    - .1 Phifer Sheerweave, Style 4600.
    - .2 Colour: to be selected by the Consultant.
- .2 Performance: fabric shall hang flat, without buckling or distortion. Edge, where trimmed, shall hang true and straight. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than + 3 mm in either direction due to warp distortion, or weave design.
- .3 Fabric shall be certified by an independent laboratory to pass the small scale vertical burn requirements test ULC S109 and NFPA 701.

#### 2.7 Fabrication

- .1 Finished assemblies shall be square, true to size and free from distortion, twist or other defects that could affect their strength, operation or appearance.
- .2 Factory applied finish shall be uniform, smooth and without blemishes.
- .3 The fabric shall be colour fast, retain its shape, not be affected by moisture or heat, and shall be

non-flammable. Cut fabric to eliminate glare and reflection from shining surfaces while maintaining exterior view. The top of the fabric shall be retained in the recessed spline of the shade roller and the bottom of the fabric shall be retained by the hem bar.

### **PART 3 EXECUTION**

#### **3.1 Installation**

- .1 Install shading devices in accordance with manufacturer's instructions.
- .2 Take field measurements prior to fabrication to ensure fit.
- .3 Fabric shall be premeasured and manufactured off-site.
- .4 Install square, plumb, true to line, adequately anchored, maintaining uniform clearances, accurate alignment levels and parallel with the window plane. Fabric shall not travel more than 3 mm in either direction within channels after installation.
- .5 Adjust operable parts for correct function.
- .6 Secure with non-corrosive fasteners, concealed in final assembly.
- .7 Adjust to provide for operation without binding.
- .8 Refinish damaged or defective work so that no variation in surface appearance is discernable.

#### **3.2 Demonstration**

- .1 Prior to acceptance of system, arrange for demonstration of equipment with authorized representatives of the Owner, to be performed by representative of shade manufacturer to assure proper function, operation and explanation.
- .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 06 40 00 Architectural Woodwork

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM D3574-17 Standard Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams
  - .2 ASTM D4157-13(2022) Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)
  - .3 ASTM G154-23 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples: Submit samples of upholstery fabric, minimum 200 x 200 mm
- .3 Submit maintenance instructions for upholstery, for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00-Closeout Submittals.

### **1.5 Quality Assurance**

- .1 Regulatory Requirements:
  - .1 Upholstered furniture foam components must meet or exceed ASTM D3574 Standard Test Method for Flexible Cellular Materials.
  - .2 All components must meet or exceed all applicable national standards for furniture safety and durability, including but not limited to the following:
    - .1 ANSI/BIFMA X5.1, X5.5 and X5.7.

### **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 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 General: All materials, construction and finishing shall be of the highest quality to produce movable furniture that is equal or superior to the industry standard.
- .2 Adhesives, General: Do not use adhesives that contain urea formaldehyde.
  - .1 VOC Limits for Installation Adhesives and Glues: Contact Adhesive: 250 g/L.
- .3 Upholstery Fabrics: To ASTM D4771.
  - .1 Manufacturer: Maharam
  - .2 Collection: Arcade
  - .3 Colour: Medley ALTA Stain Resistant finish
  - .4 Content: 71% Solution-Dyed Acrylic, 29% Solution-Dyed Polyester
  - .5 Finish: PFAS-Free Water Repellent
  - .6 Backing: None
  - .7 Width: 137cm
  - .8 Repeat: 45cm V, 71cm H
  - .9 Abrasion: ASTM D4157, 80,000 double rubs Wyzenbeek
  - .10 Flammability: AS/NZS 3837 Unadhered
  - .11 ISO 5660 Unadhered
  - .12 Lightfastness: ASTM G154,

### 2.2 Upholstered Seating

- .1 Seats: Tight/monolithic construction; no loose, semi-attached or attached cushions.
  - .1 Seat: 50 mm 22035CFR hybrid foam base, 125 mm 18024CFR hybrid foam top layer, 13mm 21050CFR hybrid foam front and side layers.
  - .2 Back: 50 mm 22035CFR hybrid foam base, 25 mm 18024CFR hybrid foam top and side layers.
  - .3 Hybrid foam: 50% non-petroleum based Polyols, 50% petroleum-based Polyols.  
Non-petroleum based content shall be derived from a renewable resource such as soy.
- .2 Fabrication:
  - .1 Seat and back are foamed and upholstered individually.
  - .2 All seams shall be reinforced, utilizing heavy duty, commercial quality thread of fiber compatible with upholstery fiber compositions.
  - .3 All horizontal planes shall be parallel and level for full extent, and at 90 degrees with vertical planes for full extent of all intersections.
  - .4 Foam shall be cut to crown at seams so that a consistent level at all horizontal and vertical planes is maintained upon foam compression with use.

PART 3 EXECUTION

3.1 Installation

- .1 Install upholstery at built in benches as detailed.

3.2 Protection

- .1 Protect upholstery until date of Substantial Performance.

3.3 Cleaning

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

End of Section

## **Division 20 Common Requirements for Mechanical**

- 20 00 01 Mechanical Specification Index
  - Common Contract Requirements for Mechanical**
  - 20 02 51 Mechanical Contract Requirements
    - Common Work Results for Mechanical**
    - 20 05 11 Mechanical Work Requirements
    - 20 05 21 Demolition and Renovation
    - 20 05 31 Expansion Fittings and Loops
    - 20 05 34 Bases, Hangers and Supports
    - 20 05 49 Vibration Control Measures
    - 20 05 53 Identification of Mechanical Services
    - Testing, Adjusting, and Balancing**
    - 20 06 11 Testing, Adjusting, and Balancing (TAB) of Mechanical Systems

## **Division 22 Plumbing**

- 22 07 19 **Plumbing Insulation**
  - Plumbing Piping Insulation
  - Facility Water Distribution**
  - 22 11 16 Domestic Water Piping – Copper
  - 22 11 31 Potable Water Auxiliary Equipment
  - Facility Sanitary Sewerage**
  - 22 13 17 Sanitary Waste and Vent Piping – Plastic
  - Facility Storm Drainage**
  - 22 14 16 Storm Drainage Piping - Plastic
  - Electric Domestic Water Heaters**
  - 22 33 33 Electric Domestic Water Heaters and Trim
  - Plumbing Auxiliary Equipment**
  - 22 36 13 Plumbing Auxiliary Equipment
  - Fire Extinguishers**
  - 22 37 13 Portable Fire Extinguishers
  - Plumbing Fixtures Combined With Drawing Schedule**
  - 22 44 13 Plumbing Fixtures Combined With Drawing Schedule

## **Division 23 Heating, Ventilating, and Air Conditioning (HVAC)**

- Operation and Maintenance of HVAC Systems**
- 23 01 31 HVAC System Cleaning
- HVAC Insulation**
- 23 07 13 Duct Insulation

	<b>Facility Fuel Piping</b>
23 11 23	Facility Natural-Gas & Propane Piping
	<b>HVAC Ducts and Casings</b>
23 31 13	Metal Ducts
	<b>Air Duct Accessories</b>
23 33 13	Duct Accessories
23 33 13.13	Volume-Control Dampers
23 33 16	Fire Dampers
23 33 18	Operating Dampers
23 33 46	Flexible Ducts
23 33 53	Duct Liners
	<b>HVAC Fans</b>
23 34 23	Packaged Exhausters
	<b>Air Terminal Units</b>
23 36 16	Variable-Air Volume Units
	<b>Air Outlets and Inlets</b>
23 37 13	Diffusers, Registers, and Grilles
23 37 23	Louvres and Vents for Intake and Exhaust
	<b>Packaged Outdoor HVAC Equipment</b>
23 74 45	Packaged Air Source Rooftop HVAC Units with Back-Up Gas Heat
	<b>Humidity Control Equipment</b>
23 84 13	Electric Humidifiers

## **Division 25 Integrated Automation**

	<b>Control Systems</b>
25 40 11	Building Automation System

END OF SECTION

**Part 1 General**

**1.1 GENERAL PROVISIONS**

- .1 This section covers items common to all sections of Mechanical Division.
- .2 Conform to Division 1 General Conditions.
- .3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.
- .4 Unless specifically indicated, all materials and equipment provided under this contract shall be new and shall be manufactured in the project year.

**1.2 INTENT**

- .1 Mention herein or indication on Drawings of articles, materials, operations or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for mechanical work.
- .2 Where used, words "Section" and "Division" shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.
- .3 Where used, word "supply" shall mean furnishing to site in location required or directed complete with accessory parts.
- .4 Where used, word "install" shall mean secured in place and connected up for operation as noted or directed.
- .5 Where used, word "provide" shall mean supply and install as each is described above.

**1.3 TENDERS AND BONDING**

- .1 Complete Supplemental Tender Form including list of equipment and materials to be used on this project and forming part of tender documents.
- .2 Submit Supplemental Tender Form as noted.
- .3 Submit tender based on specified described equipment or Alternates listed.
- .4 State in Tender, names of all Subcontractors proposed for work under this Division.

**1.4 REGULATIONS, PERMITS, AND FEES**

- .1 All materials and quality of work shall meet all current and latest Provincial, Municipal and Fire Marshall requirements, regulations, codes, and by-laws in force in the area of the project.
- .2 Each contractor shall give all necessary notices, obtain all necessary permits, and pay all fees in order that the work shown or specified may be carried out. Each contractor shall furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.

- .3 In the event that changes or alterations are required on completed work by authorized inspectors, these changes shall be made at the contractor's expense.
- .4 Special equipment which does not have a standard CSA label shall be inspected by the local electrical authority having jurisdiction and the Approval Certificate shall be submitted to the Consultant as soon as possible. All costs and fees for inspections shall be borne by this contractor.
- .5 Submit a copy of all final certificates in the maintenance manuals.

## **1.5 DRAWINGS**

- .1 Mechanical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of piping, conduits and ducts to accommodate structural conditions. Location of pipes, ducts, conduits and other equipment may be altered by Consultant without extra charge provided change is made before installation and does not necessitate major additional material.
- .2 As work progresses and before installing piping, ductwork, heating units, registers, diffusers, fixtures and any other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fittings.
- .3 Mechanical Drawings indicate general location and route of pipes, ducts and conduits which are to be installed. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Follow building lines, conceal piping, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.
- .4 Install piping and ductwork to clear structural members and any fireproofing. Locate mechanical work to permit installation of specified insulation. Do not remove or damage structural fireproofing. Leave space to permit fireproofing and insulation to be inspected and repaired.
- .5 Before commencing work, check and verify all sizes, locations, grade and invert elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.
- .6 Locate all mechanical and electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.
- .7 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install piping and other work so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.
- .8 Relocate equipment and/or material installed but not co-ordinated with work of other Sections and/or installed incorrectly as directed, without extra charge.
- .9 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

**1.6 INTERFERENCE AND COORDINATION DRAWINGS**

- .1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.
- .2 Prepare drawings to indicate co-ordination 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.
- .3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.
- .4 Upon consultant's request submit copies of interference drawings to consultant.
- .5 Due to the nature of the building and the complexity of the building systems provide the following:
  - .1 Interference drawings, showing coordination of architectural, structural, mechanical and electrical systems for the consultant's review prior to fabrication.
  - .2 Detailed layout drawings, clearly showing fasteners and hangers.
- .6 Provide CAD drawings (minimum release AutoCAD 2007) in addition to hard copies.

**1.7 QUALITY ASSURANCE**

- .1 Perform work in accordance with applicable provisions of local Plumbing Code, Gas Ordinances, and adoptions thereof for all mechanical systems. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
- .2 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Consultant in writing of such differences.

**1.8 ALTERNATES AND SUBSTITUTIONS**

- .1 Throughout Mechanical Division are lists of "Alternate Equipment" manufacturers acceptable to Consultant if their product meets characteristics of specified described equipment. Submitted Bids shall be based on the supply of named articles and or products as specified in the Bid Documents.
- .2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs including all costs for revisions to electrical contract to suit Alternate used. Prices are not required in Tender for Alternates listed except where specifically noted as "Separate Price". Complete the Supplementary Tender Form.

- .3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" nor "equal" specified product unit is proposed and does not fit space allotted in Consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Should electrical characteristics for "alternate" or "equal" equipment differ from equipment specified it shall be the responsibility of the equipment manufacturer to pay all costs associated with the revisions to the electrical contract. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.
- .4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.
- .5 If pipe or item, of size or weight indicated, is unobtainable, supply next larger size or heavier weight without additional charge.

## 1.9 EXAMINATION

- .1 Site Inspection
  - .1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.
  - .2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- .2 Drawings:
  - .1 Mechanical Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  - .2 Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing, Mechanical, and Fire Protection Drawings.
  - .3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- .3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.



**1.10 SEQUENCING SCHEDULING AND COORDINATION**

- .1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Consultant. Should conditions arise where certain changes would be advisable, secure Consultant's approval of these changes before proceeding with work.
- .2 Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Consultant. Each Contractor shall refer to all sections of the specification for their responsibilities with other trades. Changes required in work specified in Mechanical Division caused by neglect to do so shall be made at no cost to Owner.
- .3 Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.
- .4 Furnish and install inserts and supports required by Mechanical Division unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Mechanical Division.
- .5 Be responsible for required excavation, backfilling, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
  - .1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
  - .2 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
  - .3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .6 Adjust locations of pipes, ducts, equipment, fixtures, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.
  - .1 Make offsets, transitions, and changes in direction of pipes, ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
  - .2 Furnish and install traps, air vents, sanitary vents, pull boxes, etc, as required to effect these offsets, transitions, and changes in direction.

- .7 Slots and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

**1.11 CONTRACT BREAKDOWN**

- .1 Provide breakdown of contract exclusive of HST to acceptance of consultants prior to first draw submission.
- .2 Provide labour and material cost for each item.
- .3 Breakdown shall indicate total contract amount.
- .4 Contract breakdown shall be as follows as a minimum.
- Mobilization and shop drawings (max. \$2000.00)
- Demolition
- Above grade rough-in plumbing and drainage
- Plumbing Fixtures
- Specialty Piping
- HVAC Units
- Humidifiers
- VAV Boxes
- Gas Piping
- Piping Insulation
- Ductwork
- Duct Insulation
- Grilles & Diffusers
- Fire Stopping
- Building Automation Systems
- Testing Adjusting and Balancing
- HVAC system commissioning
- Mechanical contractor closeout requirements (min. of 3% but not less than \$5,000.00)
- .5 Progress claims, when submitted are to be itemized against each item of the contract breakdown, this shall be done in table form showing contract amount, work complete to date, previous draw, amount this draw and balance.

**1.12 COMMISSIONING CONTRACT BREAKDOWN**

- .1 This contractor shall work with the HVAC system commissioning contractor as specified elsewhere. The following commissioning breakdown shall be indicated on the contract breakdown draw.

**1.13 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Furnish complete catalog data for manufactured items of equipment to be used in the Work to Consultant for review within 30 days after award of Contract.
- .2 Provide a complete list of shop drawings to be submitted prior to first submission.

- .3 Before submitting to the Consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the Contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it 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 drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.
- .4 If material or equipment is not as specified or submittal is not complete, it will be rejected by Consultant.
- .5 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.
- .6 **Submit all shop drawings for the project as a package. Partial submittals will not be accepted.**
- .7 Catalog data or shop drawings for equipment, which are noted as being reviewed by Consultant or his Engineer shall not supersede Contract Documents.
- .8 Review comments of Consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless Consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.
- .9 Check work described by catalog data with Contract Documents for deviations and errors.
- .10 Shop drawings and product data shall show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances. e.g. access door swing spaces.
- .11 Shop drawings and product data shall be 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 as to current model production.
  - .5 Certification of compliance to applicable codes.
- .12 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.
- .13 Shop drawings shall be submitted electronically as per the following directions:
  - .1 Electronic Submissions:
    - .1 Electronically submitted shop drawings shall be prepared as follows:
      - .1 Use latest software to generate PDF files of submission sheets.
      - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.

- .3 PDF format shall be of sufficient resolution to clearly show the finest detail.
- .4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
- .5 Submissions shall contain multiple files according to section names as they appear in Specification.
- .6 File names shall include consultant project number and description of shop drawing section submitted.
- .7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.
- .8 On the shop drawing use an "electronic mark" to indicate what is being provided.
- .9 **Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.**
- .2 Email submissions shall include subject line to clearly identify the consultants project number and the description of the shop drawings submitted.
- .3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.
- .4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.
- .5 On site provide one copy of the "reviewed" shop drawings in a binder as noted above.
- .6 Contractor to print copies of "reviewed" shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

#### 1.14 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for incorporation into manual as in submittals' requirements.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Consultant before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for each system including environmental controls.
  - .2 Description of each system and its controls.
  - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

- .4 Operation instruction for each system and each component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Valves schedule and flow diagram.
- .7 Colour coding chart.
- .8 Spare parts equipment list.
- .9 Manufacturers standard or extended warranty information.
- .4 Maintenance data shall 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.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified elsewhere.
  - .4 Testing, adjusting and balancing reports as specified in Testing, Adjusting and Balancing Section.
- .6 Miscellaneous data to include:
  - .1 Letter of contractors warranty and guarantee.
  - .2 Index sheet.
  - .3 Tabbed format for each section.
  - .4 Manufacturers approved shop drawings.
  - .5 Spare parts list and source.
  - .6 List of Manufacturers and suppliers address for each piece of equipment.
- .7 Approvals:
  - .1 Submit 1 copy of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant.
  - .2 Make changes as required and re-submit as directed by Consultant.
  - .3 Provide two (2) copies of final operation maintenance manuals, as well as a PDF file of the entire approved manual on a USB stick. Only one USB stick is to be provided containing both the approved manual and Record drawings.
- .8 Additional data:
  - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

**1.15 RECORD DRAWINGS**

- .1 Site records:
  - .1 Contractor shall provide 2 sets of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection at all times.
- .2 Record drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of record drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 3 mm (1/8") high as follows: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  - .3 TAB to be performed using record drawings.
    - .1 Submit hard copy to Consultant for approval. When returned, make corrections as directed.
    - .2 Once approved, submit completed reproducible paper record drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.
- .3 The contractor will include in his tender a lump sum of \$900.00 for DEI & Associates Inc. to CAD the Record drawings. The CAD drawings files will be provided to the owner as part of the maintenance manuals.

**1.16 WARRANTIES**

- .1 In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
- .2 Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.
- .3 If mechanical sub-contractor with offices located more than 80 km (50 miles) from Project site is used, provide service/warranty work agreement for warranty period with local mechanical sub-contractor approved by Consultant. Include copy of service/warranty agreement in warranty section of Operation & Maintenance Manual.
- .4 Warranty period shall start from date of substantial completion.

**1.17 SUBSTANTIAL PERFORMANCE**

- .1 Complete the following to the satisfaction of the consultant prior to request for submission of substantial performance.
  - .1 Record Drawings.
  - .2 Maintenance Manuals
  - .3 System Start up
  - .4 TAB Reports
  - .5 HVAC System Commissioning
  - .6 Instructions to Owners
  - .7 Final Certificates (required prior to consultant's release of conformance letter).
    - .1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)
    - .2 Mandatory TSSA Gas Pressure Test (CSA B149.1)
    - .3 Backflow Test Certificate (for all testable devices)

**1.18 OCCUPANCY REQUIREMENTS**

- .1 The contractor shall provide the following documentation to the consultant prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:
  - .1 Final Certificates (required prior to consultant's release of conformance letter).
    - .1 Potable Water Test (Refer to domestic water piping – Copper section – Part 3)
    - .2 Mandatory TSSA Gas Pressure Test (CSA B149.1)
    - .3 Backflow Test Certificate (for all testable devices)

**1.19 REVISION TO CONTRACT**

- .1 Provide the following:
  - .1 Itemized list of material with associated costs.
  - .2 Labour rate and itemized list of labour for each item.
  - .3 Copy of manufacturers/suppliers invoice if requested.

**1.20 DELIVERY, STORAGE, AND HANDLING**

- .1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials.
- .2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

**1.21 PHASING OF WORK**

- .1 This work for this project shall be constructed in phases. Refer to the architectural drawings for phasing information and details. Misinterpretation of the drawings with respect to the extent of the phasing of the work shall not relieve the contractor of the work required to complete the entire contract.
- .2 Provide all necessary services or temporary services to suit phasing of construction with respect to all mechanical services and fire protection.
- .3 Life safety systems in the building are to remain fully operational in occupied areas for building staff and occupants during renovations.
- .4 Provide all necessary tests and certificates at completion of each phase to suit requirements of local authorities and consultants for occupancy of completed areas.

**1.22 TSSA INSPECTION**

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.

**1.23 CONFINED SPACES**

- .1 Certain areas of the building may be defined as a "Confined Space". Any personnel working in these areas must have confined space training, appropriate equipment and undertake all work in conformance with appropriate codes and standards.
- .2 Refer to building documentation for any spaces deemed "Confined Space".

**1.24 ENERGY EFFICIENCY**

- .1 The mechanical systems of this building must achieve the energy efficiency levels by conforming to ANSI/ASHRAE/IESNA 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings" and Chapter 2 of Division 3 of SB-10 prescriptive method from the Ontario Building Code.
- .2 All equipment, products, and installations must conform to the Codes and Standards.

**END OF SECTION**



**Part 1            General**

**1.1            TESTS**

- .1 Give 48 hours written notice of date for tests.
- .2 Insulate or conceal work only after testing and approval by Consultant.
- .3 Conduct tests in presence of Consultant.
- .4 Bear costs including retesting and making good.
- .5 Piping:
  - .1 General: maintain test pressure without loss for 4 h unless otherwise specified.
  - .2 Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
  - .3 Test natural gas systems to CSA-B149.1-00, TSSA requirements and requirements of authorities having jurisdiction.
  - .4 Test fuel oil systems to CSA B139 1976, CSA B139S1-1982 and authorities having jurisdiction.
  - .5 Test drainage, waste and vent piping to Ontario Building Code and authorities having jurisdiction.
  - .6 Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 860 kPa (124.8 psi), whichever is greater.
  - .7 Test fire systems in accordance with authorities having jurisdiction and as specified elsewhere.
- .6 Equipment: test as specified in relevant sections.
- .7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

**1.2            SYSTEM START UP**

- .1 Provide adjusting testing and start up of all equipment prior to testing and balancing (TAB) specified elsewhere.
- .2 Provide consultant with written notice verifying all equipment operation and installation is complete.
- .3 Start up shall be in presence of the following: owner or representative, contractor, building automation systems (BAS) contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.
- .4 Simulate system start up and shut down and verify operation of each piece of equipment.
- .5 Arrange with all parties and provide 72 hours notice for start up procedure.
- .6 Arrange with building automation systems contractor to sequence all components and ensure system operation.

### 1.3 COMMISSIONING

- .1 Coordinate and direct each step of the commissioning process, and recommend acceptance or non-acceptance to the Owner/Owner's Representative.
- .2 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to consultant and Owner/Owner's Representative.
- .3 The Commissioning Process is detailed in *ASHRAE Guideline 1-1996 HVAC Commissioning Process*. The commissioning plan may be modified to reflect the actual construction schedule and design.
- .4 Provide a pre-functional test of all HVAC mechanical system and sub-system elements, including control devices, shall be checked for the following:
  - .1 Verify that each element has been properly installed, properly identified, and that all connections (including electrical) have been made correctly.
  - .2 Verify that each element has been checked for proper lubrication, drive rotation, belt tension, control sequence, flow direction, or other conditions which may cause damage or reduce system performance.
  - .3 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.
  - .4 Controls calibration to be completed in accordance with the specification.
  - .5 The TAB shall be done in accordance with the specifications.
- .5 A functional performance testing shall be done during two separate periods – one during the cooling season and one during the heating season. The first (cooling) testing period shall occur as soon after completion of installation as practical. The heating testing period shall occur as soon as weather conditions make it practical to test warm-up, zone heating and economizer functions. These tests ensure that all equipment and systems operate in accordance with design intent. The tests are dynamic tests, and test the systems through all possible modes of operation.
- .6 Reports:
  - .1 The contractor shall be responsible for recording, documenting, and maintaining detailed inspection and testing data on the test documentation reports. The data record shall be comprehensive and concise.
  - .2 All data must be recorded as soon as possible during the course of the inspection and testing.
  - .3 All documentation shall have the date, time, and names of persons participating in the inspection and testing.
  - .4 All test instruments shall be documented for valid calibration.
  - .5 The recording work sheets, inspection check lists, and Performance Testing plans must all be approved by the Engineer and the owner's representative prior to the start of the testing.
  - .6 Include all commissioning documentation in the maintenance manuals.

- .7 Mechanical System Execution:
- .1 Operate equipment and systems shall be tested in the presence of the owner's representative and the consultant to demonstrate compliance with specified requirements. To minimize the time of Commissioning Team members, testing shall be done in four seasonal single blocks of time insofar as possible.
  - .2 Notify the consultant, in writing, fourteen (14) days prior to tests scheduled under requirements of this Section.
  - .3 Testing shall be conducted under specified design operating conditions as recommended or approved by the consultant.
  - .4 All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by any inter-ties of other major systems.
  - .5 All special testing materials and equipment shall be provided by the appropriate contractor.
  - .6 Provide three copies of all test reports and records to the consultant.
- .8 The verification testing procedures shall address all operating characteristics of all new and existing mechanical equipment and systems, including:
- |                                 |                       |
|---------------------------------|-----------------------|
| Equipment Checklist             | System Checklist      |
| Boiler(s)                       | Boiler(s)             |
| Rooftop Heating/Cooling Unit(s) | Humidifiers           |
| Fan Coil Units                  | Air Handling Units    |
| Exhaust Fans                    | Heat Recovery Unit(s) |
| Air Handling Unit(s)            | Pumps                 |
| Heat Recovery Unit(s)           |                       |
| Pumps                           |                       |
| Humidifiers                     |                       |
| Controllers/Valves/Dampers      |                       |
| Relays/Sensors/Transducers      |                       |

#### 1.4 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTION

- .1 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.
- .2 Mechanical contractor to schedule and coordinate the demonstration all on the same day, starting at a pre-approved time and continuing consequently until complete.
- .3 Where specified elsewhere in Mechanical Division, qualified manufacturers' representatives who are knowledgeable about the project to provide demonstrations and instructions.
- .4 Use operation and maintenance manual, record drawings, audio visual aids, etc. as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Where deemed necessary, Consultants may record these demonstrations on video tape for future reference.

## 1.5 DEFICIENCIES

- .1 During the course of construction, the consultants will monitor construction and provide written reports of work progress, discussions, and instruction to correct work.
- .2 Instruction to correct work shall be done within the work period before the next review.
- .3 The contractor shall not conceal any work until inspected.
- .4 The contractor shall expedite 100% complete rough-in work and have inspected prior to concealing services and equipment especially above ceiling.
- .5 Upon completion of the project the consultant will do a final review. Upon receiving the final inspection report, the contractor must correct and sign back the inspection report indicating the deficiencies are completed. A re-inspection will only be done once consultant receives this in writing.

## 1.6 EQUIPMENT INSTALLATIONS

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to floor drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

## 1.7 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install mechanical equipment at following heights unless indicated otherwise.

.1	Standard water closets	350 (14") to top of bowl
.2	Barrier-free water closets	400 (16") to top of bowl
.3	Barrier-free water closets	450 (18") to top of seat lid
.4	Wall hung lavatory	787 (31") to rim
.5	Barrier-free wall hung lavatory	840 (33") max to top of rim 737 (29") min underside of rim front
.6	Urinals (Adult)	± 600 (24)
.7	Hose bibbs	+/- 600 (24")
.8	Shower heads	2.0 m (6' – 6") to bottom of head
.9	Barrier-free drinking fountains	840 mm (33") to rim Not less than 686 (27") under unit
.10	Fire extinguisher	1350 (4' – 0") to hanger
.11	Fire extinguisher cabinets	1500 (5' – 0") to top of cabinet
.12	Thermostats: Barrier Free (operable)	1200 mm (47.25")
	Non Barrier Free	1500 mm (59")

Also follow direction of architectural drawings and where discrepancies occur clarify prior to rough-in.

**1.8 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply anchor bolts and templates for installation by other divisions.

**1.9 PROTECTION OF OPENINGS**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**1.10 ELECTRICAL**

- .1 Electrical work to conform to Electrical Division including the following:
  - .1 Supplier and installer responsibility and related mechanical responsibility is indicated in Equipment Schedule on mechanical and/or electrical drawings
  - .2 Control wiring and conduit is specified in Electrical Division except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division. Refer to Electrical Division for quality of materials and workmanship.
  - .3 Electrically operated equipment shall be C.S.A. approved label. Special Inspection Label of Provincial Authority having jurisdiction will be accepted in lieu of C.S.A. approval. Each motor shall have an approved starter. Starter will be supplied and installed by Electrical Division unless otherwise indicated.
  - .4 **All starters for mechanical equipment to be provided by this contractor. Wired by Electrical Division.**

**1.11 MOTORS**

- .1 Provide high efficiency motors for mechanical equipment as specified.
- .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .3 Motors under 373 W, (1/2 hp): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, voltage as indicated.
- .4 Motors 373 W, (1/2 hp) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (72°F), 3 phase, voltage as indicated.

**1.12 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 specified.
- .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 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment plates to allow for centre line adjustment.
- .7 Provide sheave changes as required for final air balancing.

### **1.13 GUARDS**

- .1 Provide guards for unprotected devices.
- .2 Guards for belt drives:
  - .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.2 mm (18 gauge) thick sheet metal tops and bottoms.
  - .3 40 mm (1 1/2") diameter 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 (16 gauge) 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, 20 mm (3/4") mesh.
  - .2 Net free area of guard: not less than 80% of fan openings.
  - .3 Securely fasten in place.
  - .4 Removable for servicing.
- .7 Duct Openings in Floor
  - .1 Provide reinforced expanded mesh grating, style 3 (3 lbs/sq.ft.) cover on accessible unprotected duct openings over 300 mm (12") wide and as indicated. This includes all ductwork terminating in air handling units and plenums.
  - .2 Securely Fasten in place.
  - .3 Removable for servicing.

**1.14 ROOF MOUNTED DUCT SUPPORT**

- .1 Provide zero penetration duct support on roof where indicated.
- .2 Base shall be made of high density polypropylene with UV protection.
- .3 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.
- .4 Provide shop drawings as specified. Install to manufacturers recommendations.
- .5 Acceptable materials:
  - .1 Portable pipe hanger
  - .2 Bigfoot systems
  - .3 Miro rooftop support
  - .4 Trikon Systems

**1.15 ROOF MOUNTED PIPE SUPPORT**

- .1 Provide zero penetration pipe support on roof where indicated.
- .2 Base shall be made of high density polypropylene with UV protection. Maximum loading shall be 50 lb/sq.ft.
- .3 Frames shall be galvanized. All fastenings, rods, nuts, washers, hangers, etc. shall be stainless steel.
- .4 Provide shop drawings as specified. Install to manufacturers recommendations.
- .5 Acceptable material:
  - .1 Portable pipe hanger
  - .2 Bigfoot systems
  - .3 Miro rooftop supports

**1.16 SLEEVES**

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated. Grout sleeves in place.
- .2 Schedule 40 steel pipe.
- .3 Sleeves with annular fin continuously welded at midpoint:
  - .1 Through foundation walls.
  - .2 Where sleeve extends above finished floor.
  - .3 Through fire rated walls and floors.
- .4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.

- .6 Fill voids around pipes:
  - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
  - .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
  - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
  - .4 Fill future-use sleeves with lime plaster or other easily removable filler.
  - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.
- .7 Provide minimum 20 gauge duct sleeves where ducts pass through masonry concrete or fire rated assemblies. Maintain minimum 25 mm clearance all around or to the requirements of the authority having jurisdiction. Seal at wall as indicated.

#### **1.17 FIRE STOPPING**

- .1 This contractor shall work with all other contractors on the project in providing one common method of fire stopping all penetrations made in fire rated assemblies.
- .2 Approved fire stopping and smoke seal material in all fire separations and fire ratings within annular space between pipes, ducts, insulation and adjacent fire separation and/or fire rating.
- .3 Do not use cementious or rigid seals around penetrations for pipe, ductwork, or other mechanical items.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.
- .5 Provide materials and systems capable of maintaining effective barrier against flame, smoke and gases. Ensure continuity and integrity of fire separation.
- .6 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.
- .7 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation. Provide "fire wrap" blanket around services penetrating fire walls. Extent of blanket must correspond to ULC recommendations.
- .8 The fire stopping materials are not to shrink, slump or sag and to be free of asbestos, halogens and volatile solvents.
- .9 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.
- .10 Fire stop materials are to be capable of receiving finish materials in those areas which are exposed and scheduled to receive finishes. Exposed surfaces are to be acceptable to consultant prior to application of finish.
- .11 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.
- .12 Install material and components in accordance with ULC certification, manufacturer's instructions and local authority.



- .13 Submit product literature and installation material on fire stopping in shop drawing and product data manual. Maintain copies of these on site for viewing by installers and consultant.
- .14 Manufacturer of product shall provide certification of installation. Submit letter to the consultant.
- .15 Acceptable Manufacturer:  
Minnesota Mining and Manufacturing
- .16 Acceptable Alternate Manufacturers to approval of local authority:
  - .1 Fryesleeve Industries Inc.
  - .2 General Electric Pensil Firestop Systems
  - .3 International Protective Coatings Corp.
  - .4 Rectorseal Corporation (Metacaulk)
  - .5 Proset Systems
  - .6 3M
  - .7 AD Systems
  - .8 Hilti
- .17 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of substantial completion.

#### **1.18 ESCUTCHEONS**

- .1 On pipes and ductwork passing through walls, partitions, floors and ceilings in exposed finished areas and on water and drain pipes inside millwork and cabinets.
- .2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.
- .3 Outside diameter to cover opening or sleeve.
- .4 Inside diameter to fit around finished pipe.

#### **1.19 PAINTING**

- .1 Refer to Section Interior Painting and specified elsewhere.
- .2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Apply two coats of paint to exposed piping service in mechanical room, base colour as specified in Mechanical Identification Section.
- .4 Prime and touch up marred finished paintwork to match original.
- .5 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

**1.20 SPARE PARTS**

- .1 Furnish spare parts in accordance with general requirements and 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 set of belts for each type or each size of machinery.
  - .6 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide list of equipment in maintenance manuals indicating corresponding spare parts required. List of spare parts to be signed off by receiving personnel.

**1.21 SPECIAL TOOLS**

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Maintenance Materials Special Tools and Spare Parts.

**1.22 ACCESS DOORS**

- .1 Provide access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 x 600 mm (24" x 24") for body entry and 300 x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
  - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
  - .2 Remaining areas: use prime coated steel.
  - .3 Fire rated areas: provide ULC listed access doors
- .4 Installation:
  - .1 Locate so that concealed items are accessible.
  - .2 Locate so that hand or body entry (as applicable) is achieved.
- .5 Acceptable materials:
  - .1 Le Hage
  - .2 Zurn
  - .3 Acudor
  - .4 Nailor Industries Inc.

**1.23 DIELECTRIC COUPLINGS**

- .1 General:
  - .1 To be compatible with and to suit pressure rating of piping system.
  - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes NPS 50 mm (2") and under: isolating unions.
- .3 Pipes NPS 65 mm (2 1/2") and over: isolating flanges.

**1.24 DRAIN VALVES**

- .1 Locate at low points and at section isolating valves unless otherwise specified.
- .2 Minimum NPS 20 mm (3/4") unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.
- .3 Drain valves on potable water systems shall be complete with vacuum breaker.

**1.25 REPAIRS, CUTTING, AND RESTORATION**

- .1 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
- .2 Each Section of this Division shall bear expense of cutting, patching, and repairing to install their work and/or replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
- .3 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .4 All patching, painting and making good of the existing walls, floors, ceilings, partitions and roof will be at the expense of this Contractor, but performed by the Contractor specializing in the type of work involved unless otherwise noted.

**1.26 EXISTING SYSTEMS**

- .1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.
- .2 Be responsible for damage to existing plant by this work.

**1.27 CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units prior to turn over to owner.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

**1.28 DISCONNECTION AND REMOVAL**

- .1 Disconnect and/or remove equipment, piping, ductwork, etc. as indicated.
- .2 Cap and conceal all redundant and obsolete connections.
- .3 Provide a list of equipment to be removed to the owner, for his acceptance of same.  
Remove all equipment from site, which the owner does not retain.
- .4 Store equipment to be retained by owner on site where directed by consultant.

**1.29 OWNER SUPPLIED EQUIPMENT**

- .1 Connect to equipment supplied by the owner and make operable.

**1.30 DEMOLITION**

- .1 **The general requirements are indicated on the drawings and on the outline specification in Division 1.**
- .2 **The general execution of the demolition is to be carried out in a clean and efficient manner.**
- .3 **Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.**
- .4 All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.
- .5 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.
- .6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.
- .7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.
- .8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.

**1.31 LOCATION OF EXISTING UNDERGROUND SERVICES**

- .1 This contractor shall locate existing services prior to starting any work in the affected area.
- .2 This contractor shall use a video camera for the existing storm and/or sanitary drainage at the indicated connection point to confirm location, size and invert of the existing piping.

**1.32 EXISTING CONCRETE SLAB X-RAY/SCANNING**

- .1 This contractor shall retain the services of a qualified company to provide and X-Ray and/or scan of the existing buried services in wall and/or floors prior to starting any work in the affected area.
- .2 Failure to locate existing piping, conduit rebar etc., shall not relieve this contractor of repair of same prior to installing his service.
- .3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

**1.1 TSSA INSPECTION**

- .1 Prior to final completion of the project, this contractor shall make application, arrange, and pay for a TSSA inspection of all piping systems and equipment installations, including, but not limited to medical gasses, refrigeration, fuel piping, compressed air, heating plant, cooling plant, and associated equipment installed under the contract.
- .2 Provide a copy of the TSSA report in the maintenance manuals for each system.

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL PROVISIONS**

- .1 Conform to the General Provisions of General Requirements Section.
- .2 This project is one of a retrofit nature in part, and which will require some demolition.
- .3 Allow for all remedial work in areas indicated on the drawings and as generally defined in the relevant sections of the specifications.

**1.2 RELATED WORK SPECIFIED ELSEWHERE**

- .1 Electrical Division.

**1.3 SCOPE OF WORK**

- .1 The scope of work is essentially the selected disconnection and/or removal of services and/or equipment, piping ductwork etc. as indicated or required to complete the work.

**Part 2 Products**

**2.1 GENERAL**

- .1 This Division is to liaise with the Owners or Consultant for equipment being removed that may be suitable for reuse to that specified or handed over to the owner.
- .2 This Division to take full responsibility for any special tools or equipment required to disassemble or remove material from building.

**Part 3 Execution**

**3.1 GENERAL**

- .1 The general requirements are indicated on the drawings and on the outline specification in Division 1.
- .2 The general execution of the demolition is to be carried out in a clean and efficient manner.
- .3 Demolition of existing ceiling, walls etc., to facilitate removal of existing services or equipment or installation of new to be kept to a minimum and then restored to match existing.
- .4 All openings or holes created by removal of existing mechanical systems which are not being reused are to be patched with the same material surrounding surfaces.
- .5 All new holes and openings to facilitate mechanical systems are to be patched to match surrounding surfaces.
- .6 Protect all existing furnishings materials and equipment. Any damage occurring as a result of the work of this Division shall be repaired or replaced at the expense of this Division.

- .7 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Owners in an expedient manner with minimum disruption to the facility and systems downtime.
- .8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .9 Where the location of any services has been shown on the plans, such information is not guaranteed. It is this Division's responsibility to verify locations, invert elevations, etc., immediately after moving on site. Should for any reason the information obtained necessitates changes in procedure or design, advise the Consultant at once. If verification of existing conditions is not done at the outset and any problems arise, the responsibility for same is entirely this Division's.
- .10 Disconnect and/or remove equipment piping, ductwork, etc. as indicated.
- .11 Cap and conceal all redundant and obsolete connections.
- .12 Provide a list of equipment to be removed to the owner, for his acceptance of same. Remove all equipment from site which the owner does not retain.
- .13 Maintain equipment to be retained by owner on site where directed by consultant.
- .14 Demolition of all parts of the work must be completed within the confines of the work area and in such a way as the dust produced and risk to injury of will not adversely affect the building users.
- .15 Demolished areas of the existing building will remain in their current use in some cases. Demolition in these areas must be kept to the minimum required to complete the work.
- .16 Demolition shall take place within areas isolated from all other areas with appropriate hoarding, scaffolding, netting, fencing or other means of security between building users and the work.
- .17 Co-ordinate making safe electrical devices, capping plumbing and removal of fixtures prior to commencement of demolition.
- .18 All piping and equipment to be removed and/or abandoned shall be drained prior to capping and/or abandoning. Disposal of all liquids shall be to the approval of authority of having jurisdiction and/or provincial regulations.

### **3.2 EXISTING SYSTEM DRAINAGE**

- .1 Drain all existing piping and drainage systems including all related equipment as required to facilitate system renovations.
- .2 Disposal of existing system shall be to the requirements of the local and/or provincial regulations.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American Society for Testing and Materials
  - .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A105/A105M, Specification for Carbon Steel Forgings for Piping Applications.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate for each item as applicable:
  - .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.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit maintenance data in accordance with general requirements.
- .2 Data to include:
  - .1 Servicing requirements, including any special requirements, stuffing box packing, lubrication and recommended procedures.

**Part 2 Products**

- .1 Application: to suit motion.
- .2 Minimum length in accordance with manufacturer's recommendations to suit offset.
- .3 Inner hose: stainless steel corrugated.
- .4 Braided wire mesh stainless steel outer jacket.
- .5 Diameter and type of end connection: as indicated.
- .6 Operating conditions:
  - .1 Working pressure: 1034 kPa (150 psi).
  - .2 Working temperature: 250°C (482°F).
  - .3 To match system requirements.



**2.2 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 INSTALLATION**

- .1 Install expansion joints with cold setting, as indicated as instructed by Consultant. Make record of cold settings.
- .2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
- .3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

**3.2 APPLICATION**

- .1 Provide on all vibration isolated equipment.
- .2 Provide where requested by equipment manufacturers installation manuals.
- .3 Install in accordance with manufacturer's recommendations.
- .4 Provide expansion compensators (exp.) on radiation heating element exceeding 3.6 M (12' – 0") in length. Provide one expansion compensators on each length of return piping in cabinet.

**3.3 THERMAL EXPANSION**

- .1 Provide in long runs of heating mains exceeding 100 ft. in length.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .3 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture Selection, Application, and Installation.

**1.2 DESIGN REQUIREMENTS**

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.
- .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 all 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 to be in accordance with MSS SP-58.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Submit shop drawings and product data for following items:
  - .1 All bases, hangers and supports.
  - .2 Connections to equipment and structure.
  - .3 Structural assemblies.

**1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2 Products**

**2.1 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

**2.2 PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: to ANSI & ULC requirements
  - .2 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: Suspension from upper flange of I-Beam or joist.
  - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
    - .1 Rod: 10 mm (3/8") UL listed
  - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed & FM approved.
- .3 Upper attachment structural: Suspension from upper flange of I-Beam.
  - .1 Cold piping NPS 50 mm (2") maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
  - .2 Cold piping NPS 65 mm (2 1/2") or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nuts.
- .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 (1/4") minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate ULC listed. Note: Rapidex and Siporex are not considered concrete. Should one of these systems be encountered, piping/ductwork and/or equipment shall be supported from adjacent walls or from supplemental steel provided by this contractor attached to the adjacent walls/structure.
- .5 Shop and field-fabricated assemblies.
  - .1 Trapeze hanger assemblies: ASME B31.1.
  - .2 Steel brackets: ASME B31.1.
- .6 Hanger rods: threaded rod material to MSS SP-58.
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.

- .7 Pipe attachments: material to MSS SP-58.
  - .1 Attachments for steel piping: carbon steel.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for all piping.
  - .4 Oversize pipe hangers and supports to accommodate thermal insulation.  
Provide 1.5 mm (16 gauge) saddles.
- .8 Adjustable clevis: material to MSS SP-58 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.

### **2.3 RISER CLAMPS**

- .1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS-SP-58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

### **2.4 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>2</sup> (13.12 lbs/ft<sup>2</sup>) density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m (10') span.
- .2 Insulated hot piping:
  - .1 Curved plate 300 mm (12") long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm (12") and over, carbon steel to comply with MSS SP-58.

### **2.5 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of miscellaneous metals, specified herein. Submit calculations with shop drawings.

### **2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

### **2.7 ROOF MOUNTED EQUIPMENT**

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated.
- .2 Provide all necessary continuous pressure treated wood blocking and 24 gauge metal liner on all exposed wood as required to install roof curb level.

**2.8 MANUFACTURER**

- .1 Acceptable materials:
  - .1 Grinnell
  - .2 Anvil
  - .3 Myatt
  - .4 Taylor

**Part 3 Execution**

**3.1 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, elsewhere 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 be 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 at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

**3.2 HANGER SPACING**

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 15 mm (1/2"): every 1.8 m (6').
- .4 Copper piping: up to NPS 15 mm (1/2"): every 1.5 m (5').
- .5 **Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.**

- .6 Within 300 mm (12") of each elbow and:

Maximum Pipe Size: NPS	Spacing Steel	Maximum Spacing Copper
up to 32 mm (1 1/4")	2.1 m (7')	1.8 m (6')
40 mm (1 1/2")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2 1/2")	3.6 m (12')	3.0 m (10')
80 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3 1/2")	3.9 m (13')	3.3 m (11')
100 mm (4")	4.2 m (14')	3.6 m (12')
125 mm (5")	4.8 m (16')	
150 mm (6")	5.1 m (17')	
200 mm (8")	5.7 m (19')	
250 mm (10")	6.6 m (22')	
300 mm (12")	6.9 m (23')	

- .7 Pipework greater than NPS 300 mm (12"): to MSS SP-69.

### 3.3 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.
- .4 Do "NOT" support piping, ductwork and equipment from roof deck, on bottom chord of floor and/or roof joist and/or from OWSJ bridging. Provide structural member between joist.

### 3.4 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4mm (5/32") from vertical.
- .2 Where horizontal pipe movement is less than 15 mm (1/2"), offset pipe hanger and support so that rod hanger is vertical in the hot position.

### 3.5 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.

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Provide separate shop drawings for each isolated system complete with performance and product data.

**Part 2 Products**

**2.1 GENERAL**

- .1 Size and shape of bases type and performance of vibration isolation to be as indicated.
- .2 To be of the same manufacturer for all isolation.
- .3 Acceptable materials:
  - .1 Korfund
  - .2 Vibro-Acoustics
  - .3 Vibron

**2.2 ROOF CURB ISOLATION RAIL**

- .1 General: complete factory assembled without need for sub-base.
- .2 Lower member: continuous extruded aluminum channel.
- .3 Upper member: continuous extruded aluminum channel to provide continuous support for equipment, complete with all-directional neoprene rubber bushings 6 mm (1/4") thick to resist wind [and seismic] forces.
- .4 Springs: steel, adjustable, removable, selected for 25 mm (1") maximum static deflection plus 50% additional travel to solid, cadmium plated, sized and positioned to ensure uniform deflection.
- .5 High frequency isolation: 6 mm (1/4") minimum thick [continuous gasket on top and bottom of complete assembly] [or] [pads on top and bottom of each spring]. Material: closed cell neoprene.
- .6 Weatherproofing: continuous flexible counterflashing to curb and providing access to springs. Material: [aluminum] [neoprene].
- .7 Hardware: cadmium plated or galvanized.



**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:
  - .1 Up to NPS 100 mm (4"): first 3 points of support. NPS 125 mm (5") to NPS 200 mm (8"): first 4 points of support. NPS 250 mm (10") and Over: first 6 points of support.
  - .2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

**3.2 SITE VISIT**

- .1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Consultant.
- .2 Provide Consultant with notice 24 h in advance of visit.
- .3 Make adjustments and corrections in accordance with written report.

**3.3 TESTING**

- .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Testing Adjusting and Balancing Section.
- .2 Vibration measurements shall be taken for equipment-listed below:
- .3 Provide Consultant with notice 48 h in advance of commencement of tests.
- .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations including sound curves.
- .5 Submit complete report of test results including sound curves.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 Canadian Standards Association (CSA).
  - .1 Natural Gas and Propane Installation Code CSA B149.1.
- .4 National Fire Protection Association
  - .1 NFPA 13, Installation of Sprinkler Systems.
  - .2 NFPA 14, Standpipe and Systems.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with General Requirements.
- .2 Product data to include paint colour chips, all other products specified in this section.

**1.3 PRODUCT LITERATURE**

- .1 Submit product literature in accordance with General Requirements.
- .2 Product literature to include nameplates, labels, tags, lists of proposed legends.

**Part 2 Products**

**2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic lamicoid nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be 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 (1/8") thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

Size	No. of Sizes mm (")	Height of Line mm (")	Letters mm (")
1	10 x 50 (3/8" x 2")	1 (3/64")	3 (1/8")
2	15 x 75 (1/2" x 3")	1 (3/64")	6 (1/4")
3	15 x 75 (1/2" x 3")	2 (5/64")	3 (1/8")
4	20 x 100 (3/4" x 4")	1 (3/64")	10 (3/8")
5	20 x 100 (3/4" x 4")	2 (6/64")	6 (1/4")
6	20 x 200 (3/4" x 8")	1 (3/64")	10 (3/8")
7	25 x 125 (1" x 5")	1 (3/64")	15 (1/2")
8	25 x 125 (1" x 5")	2 (5/64")	10 (3/8")
9	32 x 200 (1¼" x 8")	1 (3/64")	20 (3/4")
  - .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.
  - .3 Roof top equipment: use size #9.
  - .4 Equipment above ceiling: use size #1 riveted to ceiling suspension system.

## 2.3 FIRE DAMPER/FIRE STOP FLAP NAMEPLATES

- .1 Colours:
  - .1 Black letters, yellow background.
- .2 Construction:
  - .1 Self adhesive 50 mm x 25 mm, matte finish, with round corners.
- .3 Locations:
  - .1 Install on adjacent ceiling grid. Where fire stop flap is installed in gypsum ceiling install on diffuser/grille frame. Where fire damper is installed above gypsum ceiling install on adjacent wall.

## **2.4 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.
- .4 Upon completion of this project all references to room names and numbering shall be to the Owner's requirements which may or may 'NOT' be the numbering system used on the drawings. Each contractor shall verify the proper numbering scheme to be used prior to project completion.
- .5 All equipment shall be identified in sequence from the existing equipment and "NOT" duplicate numbering of equipment.

## **2.5 PIPING SYSTEMS GOVERNED BY CODE**

- .1 Identification:
  - .1 Natural and propane gas: To CSA B149.1-00 and authority having jurisdiction and as indicated elsewhere.
  - .2 Sprinklers: To NFPA 13.
  - .3 Standpipe and hose systems: To NFPA 14.

## **2.6 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 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .3 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.
  - .2 Outside diameter of pipe or insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.
  - .3 Use double-headed arrows where flow is reversible.
- .4 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm (3/4") and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C (300°F) and intermittent temperature of 200°C (395°F).

.6 Colours and Legends:

- .1 Where not listed, obtain direction from Consultant.
- .2 Colours for legends, arrows: To following table:  

Background colour:	Legend:	Arrows:
Yellow	White	Black
Green	White	Black
Red	White	Black

.7 Pictograms:

- .1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.8 Background colour marking and legends for piping systems:

CONTENTS	BACKGROUND COLOUR MARKING	
	MARKING	LEGEND
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HW recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Natural gas	Yellow	NATURAL GAS
Gas regulator vents		to Codes
Conduit for low voltage		
Control wiring	White	CONTROL WIRING___VOLTS

2.7 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm (2") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.8 VALVES, CONTROLLERS

- .1 Brass tags with 15 mm (1/2") 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.
- .3 Provide adhesive coloured tab (max. size 15 mm) indication on ceiling to locate valves/equipment above. Same applies to grid. Colour to be approved by consultant.

**2.9 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.
- .3 Provide equipment identification and/or indication on ceiling to locate devices/equipment above ceiling. Install identification on grid. Colours to be approved by consultant.

**2.10 LANGUAGE**

- .1 Identification to be in English.

**Part 3 Execution**

**3.1 TIMING**

- .1 Provide identification only after all painting specified has been completed.

**3.2 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.

**3.3 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 in any way.

**3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels not more than 1.7 m (5'-8") 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, other confined spaces, at entry and exit points, and at each access opening.

- .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, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification to be 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.

### **3.5 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. Where existing numbering system is installed start new numbering system at 100.

**END OF SECTION**

**Part 1 General**

**1.1 CONTRACT REQUIREMENTS**

- .1 TAB contractor will work for the owner from the cash allowance in the Mechanical Allowances section.
- .2 This contractor must co-ordinate their work with that of the TAB contractor.
- .3 Prequalified TAB contractors are to submit quotes to the engineers on or before the tender closing time specified in Division 1.
- .4 Should the Engineer's Office not receive the quotes it will be the successful mechanical contractor's responsibility to obtain the quotations.
- .5 If required, the successful mechanical contractor shall:
  - .1 Provide copies of specified drawings and addendums to the NEBB certified Testing and Balancing contractors listed below.
  - .2 Obtain quotations for Testing and Balancing services.
  - .3 Submit quotations to the engineer's office for review.
- .6 The Engineer's Office will issue required instruction for the initiation of Testing and Balancing agency's work.

**1.2 GENERAL**

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section including all air handling systems and equipment, all plumbing systems and equipment and all temperature controls system, building automation systems and equipment.
- .2 This contractor must co-ordinate their work with that of the TAB contractor.

**1.3 QUALIFICATIONS OF TAB AGENCIES**

- .1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Consultant within 30 days of start of work.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 Only the following NEBB (National Environmental Balancing Bureau) TAB contractors may quote:
  - .1 Air Audit Inc.  
110 Turnbull Court, Unit 11  
Cambridge, Ontario  
N1T 1K6  
(519) 740-0871



- .2 Air Velocities Control Ltd.  
100 Premium Way  
Mississauga, Ontario  
L5B 1A2  
(905) 279-4433
- .3 Flowset Balancing Ltd.  
431 Willis Dr.  
Oakville, Ontario  
L6L 4V6  
(416) 410-9793
- .4 Air Adjustments & Balancing Inc.  
P.O. Box 176,  
Schomberg, Ontario  
L0G 1T0  
(416) 254-3004

#### **1.4 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 (95% design) and low (75% of design) loads using actual or simulated loads. TAB contractor to perform equipment evaluation upon start up and once during each season in the first year of operation.
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions. Confirm all equipment interlocks and functions of associated systems.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and temperatures. Refer to BAS for system operating functions.

#### **1.5 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

#### **1.6 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as 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. Co-ordinate with other trades to ensure all systems are interlocked as indicated elsewhere prior to TAB.

#### **1.7 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

- .2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.
- .4 During construction indicate all tolerances of piping, ductwork etc conforms to specifications.

#### **1.8 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in the Mechanical Division.

#### **1.9 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

#### **1.10 START OF TAB**

- .1 Notify Consultant in writing 3 days prior to start of TAB.
- .2 Start TAB only when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weather-stripping, sealing, caulking.
  - .3 All pressure, leakage, other tests specified elsewhere in the Mechanical Division.
  - .4 All provisions for TAB installed and operational.
  - .5 Start-up, verification for proper, normal and safe operation of all 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 All 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.
- .7 Control valves are properly piped.
- .8 Coils and radiation are properly piped.
- .9 BAS in operation.

#### **1.11 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 10%, minus 5%.
  - .2 Hydronic systems: plus or minus 10%.

#### **1.12 ACCURACY TOLERANCES**

- .1 Measured values to be accurate to within plus or minus 2% of actual values.

#### **1.13 INSTRUMENTS**

- .1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

#### **1.14 SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
  - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.

#### **1.15 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Consultant, 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.

#### **1.16 TAB REPORT**

- .1 Format to be in accordance with NEBB, AABC, or SMACNA.
- .2 The following additional information shall be provided for all air systems:
  - .1 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE occupied ventilation requirements.

- .2 Minimum damper position (MAD/Economizer) and the corresponding BAS signal and the voltage to the actuator to meet the full ASHRAE unoccupied ventilation requirements.
- .3 Static pressure reading for each HVAC/AHU unit with VAV/VVT boxes open to 80% of design airflow and bypass damper closed to 0%. Provide reading at normal MAD/economizer damper position, dampers fully closed and dampers fully open.
- .3 TAB report to show all results in SI or imperial units as indicated on plans and to include:
  - .1 Project as-built drawings.
  - .2 System schematics.

#### **1.17 VERIFICATION**

- .1 All reported results subject to verification by Consultant.
- .2 Provide manpower and instrumentation to verify up to 30% of all reported results.
- .3 Number and location of verified results to be at discretion of Consultant.
- .4 Bear costs to repeat TAB as required to satisfaction of Consultant.

#### **1.18 SETTINGS**

- .1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings. Replace all ceiling tile etc.
- .2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

#### **1.19 COMPLETION OF TAB**

- .1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

#### **1.20 AIR SYSTEMS**

- .1 Standard: TAB to be to most stringent of TAB standards of NEBB, AABC, SMACNA, ASHRAE.
- .2 Do TAB of all systems, equipment, components, controls specified in the Mechanical Division including but not limited to following:
  - .1 Air handling systems and equipment
  - .2 Duct testing to SMACNA standards.
- .3 Qualifications: personnel performing TAB to be current member in good standing of NEBB.
- .4 Quality assurance: Perform TAB under direction of qualified supervisor.

- .5 Measurements: to include, but not limited to, following 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, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of each damper, filter, coil, humidifier, fan, and other equipment causing changes in conditions.
  - .2 At each controller, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, grille, register or diffuser.

#### **1.21 DUCT LEAKAGE TESTING**

- .1 Co-ordinate leakage testing with the sheet metal contractor. TAB contractor will be responsible for all duct testing.
- .2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual and as indicated.

#### **1.22 DOMESTIC HWC SYSTEMS**

- .1 Meet all requirements as specified for hydronic systems.
- .2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device.
- .3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

#### **1.23 OTHER SYSTEMS**

- .1 Plumbing systems:
  - .1 TAB procedures:
- .2 Recirculating Systems pump flows, pressures

#### **1.24 OTHER TAB REQUIREMENTS**

- .1 General requirements applicable to all work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
- .2 Quality assurance: as for air systems specified this section.

- .3 Building pressure conditions:
  - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions **[during [winter] [summer] design conditions]** [at all times].
  - .2 TAB procedures:

<u>Positive</u>	<u>Negative</u>
Corridors	Washrooms
Corridors	
- .4 Zone pressure differences:
  - .1 Adjust HVAC systems, equipment, controls to establish air pressure differentials, with all systems in all possible combinations of normal operating modes.
- .5 Provide duct testing as specified.
- .6 Provide AHU testing as specified.
- .7 Provide plenum testing as specified.
- .8 Changing of air handling equipment sheave and belts as required for specified air flow sheaves and belts supplied by unit manufacturer. Retest equipment after sheave change.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
  - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 CGSB 51-GP-52Ma, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .3 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulating Pipes, Vessels and Round Ducts.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM)
  - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .2 ASTM C 921, Practice for Determining the Properties Jacketing Materials for Thermal Insulation.
  - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

**1.3 INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

**1.4 QUALIFICATIONS**

- .1 Installer to be 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 of TIAC.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

**1.6 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.

**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 as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.
- .4 Materials:
  - .1 All materials must be supplied by the same manufacturer.
  - .2 Acceptable Materials:
    - .1 Fibreglass Canada
    - .2 Knauf
    - .3 Manson
    - .4 Pittsburgh Corning



**2.3 INSULATION SECUREMENT**

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm (2") wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.

**2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 To ASTM C553.
  - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449M.

**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 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: white.
  - .3 Minimum service temperatures: -20°C (-4°F).
  - .4 Maximum service temperature: 65°C (150°F).
  - .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.

**2.8 CAULKING FOR JACKETS**

- .1 Caulking: Silicone clear caulking.

**Part 3 Execution**

**3.1 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

**3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers' instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

**3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: At expansion joints, valves, 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: As per adjacent insulation.

**3.4 INSTALLATION OF ELASTOMERIC INSULATION**

- .1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

**3.5 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 Install insulator and jackets to applicable TIAC codes.
- .3 Insulate ends of capped piping with type and thickness indicated for capped service.

- .4 Thickness of insulation to be as listed in following table.
- .1 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
- .2 All storm piping including all vertical and horizontal piping shall be insulated.

Application	Type	Pipe sizes through (NPS) and insulation thickness mm (")				
		to	32 (1¼")	50 (2")	105 (4")	200 (8")
		25 (1")	40 (1½")	80 (3")	150 (6")	& over
Domestic Water Piping	A-1	25 (1")	25 (1")	40 (1½")	40 (1½")	40 (1½")
Storm Piping	A-1/A-5	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Roof Drain sumps	A-2/A-5	25 (1")	25 (1")	25 (1")	25 (1")	25 (1")
Trap Primer Piping	A-1	15 (½")	15 (½")	25 (1")		

- .5 Finishes: Conform to the following table:

Application	Piping	Valves & Fittings
Exposed indoors	PVC	PVC
Exposed in mech. rooms	PVC	PVC
Concealed indoors	N/A	PVC

- .6 Connection: To appropriate TIAC code.
- .7 Finish attachments: SS bands, @ 150 mm (6") oc. seals: closed.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
- .3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .5 ANSI B16.24, Cast Copper Alloy, Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
- .6 ASTM B88M, Specification for Seamless Copper Water Tube (Metric).
- .7 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .8 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- .9 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .10 **ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.**
- .11 **ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.**
- .12 **ASTM F1545, Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges.**
- .13 **CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.**
- .14 **MSS-SP-67, Butterfly Valves.**

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawing data in accordance with general requirements.

**1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2 Products**

**2.1 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
  - .2 Buried or embedded: 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 and 300: to ANSI B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 Tee drill NPS 25 mm (1") and larger.
- .6 **NPS 80 mm (3") and larger: roll grooved to CSA B242.**

**2.3 JOINTS**

- .1 Solder: 95/5.
- .2 Teflon tape: for threaded joints.
- .3 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F1545, complete with thermoplastic liner.
- .4 Tee drill fittings shall be brazed with silver solder, 45% Ag - 15% Cu or copper phosphorous, 95% Cu, 5% P and non-corrosive flux.

**2.4 VALVES**

- .1 All valves shall be of commercial grade and of same manufacturer, Lead-Free.
- .2 Acceptable materials:
  - Milwaukee
  - Crane
  - Kitz

**2.5 BALL VALVES**

- .1 All valves shall be of commercial grade and of same manufacturer.
- .2 NPS 80 mm (3") and under, soldered:
  - .1 To ANSI B16.18, Class 150.
  - .2 Bronze body, full port stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- .3 Assemble all piping using fittings manufactured to ANSI standards.
- .4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- .5 Install CWS piping below and away from HWS and HWC and all other hot piping so as to maintain temperature of cold water as low as possible.
- .6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.
- .7 Bent tubing is not acceptable.

**3.2 VALVES**

- .1 Isolate equipment, fixtures and branches with ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on record drawings on completion.

**3.3 PRESSURE TESTS**

- .1 Conform to requirements of general requirements.
- .2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa (125 psi).

**3.4 FLUSHING AND DISINFECTING**

- .1 Maintain testable RP backflow preventor between municipal water and new plumbing system.
- .2 Ensure a minimum of 90% of plumbing fixtures are installed.
- .3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear with backflow protection.
- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves and operate fixtures to ensure thorough flushing.
- .6 When flushing has been complete to satisfaction of Consultant introduce a strong solution of Chlorine into water system and ensure that it is distributed throughout entire system.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine injection to be close to point of filling water main or at building water service and to occur simultaneously.

- .9 Confirm adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- .10 Upon 10 ppm confirmation and 24 hr elapsed time flush line to remove chlorine solution.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or reoccur during this period, repeat disinfecting procedure. Specialist contractor shall submit certified copy of test results.
- .13 Take water samples at remote fixtures and service connections.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .4 PDI-WH201, Water Hammer Arresters.
- .5 CAN/CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
- .6 **ANSI/AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.**
- .7 **ANSI/AWWA C701, Cold Water Meters-Turbine Type, for Customer Service.**
- .8 **ANSI/AWWA C702, Cold Water Meters-Compound Type.**
- .9 **CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.**

**1.2 SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials.
- .3 For product data, indicate dimensions, construction details and materials for all items specified herein.

**1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.
- .2 Data to include:
  - .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.

**Part 2 Products**

**2.1 INTERIOR WALL HYDRANTS (RECESSED, ENCASED)**

- .1 Encased narrow wall with integral vacuum breaker, NPS 20 mm 3/4 hose outlet, removable operating key. Stainless steel box and finish.
- .2 Acceptable materials:
  - .1 Zurn ZN1350
  - .2 Mifab
  - .3 Ancon



**2.2 INTERIOR HOSE BIBB**

- .1 20 mm (3/4") diameter brass construction, 200 psi, 180°F pressure and temperature limits, complete with hose connection, and wheel handle straight/angle pattern to suit.
- .2 Provide vacuum breaker complete with hose connection.
- .3 Acceptable manufacturers:
  - .1 Exposed on wall; Watts BD series
  - .2 Surface mounted (piping in wall); Watts SC-3 series
  - .3 Delta
  - .4 Waltec
  - .5 Wilkins
  - .6 Emco

**2.3 WATER HAMMER ARRESTORS**

- .1 Copper construction, bellows type: to PDI-WH 201.
- .2 Acceptable material:
  - .1 Zurn Z-1700
  - .2 Mifab MWH-100
  - .3 Ancon No. 15

**2.4 BACK FLOW PREVENTORS**

- .1 The backflow preventor shall prevent backflow by either backpressure or backsiphonage from a cross-connection between potable water lines and substances that are objectionable.
- .2 To CAN/CSA-B64.
- .3 Application: as indicated.
- .4 Reduced pressure principle type up to 50 mm (2") (RP):  
Rated to 180°F and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat ring and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be SILICONE. The first and second check shall be orientated at a 45° angle up-wards and accessible for maintenance without removing the relief valve. Supplied with an air gap adapter.
  - .1 Acceptable materials:
    - .1 Watts 009 ½" - 2"
    - .2 Wilkins 975 XL ½" - 2"
    - .3 Conbraco 40-200 Series

- .5 Double check valve assembly (DCVA):  
The double check type backflow preventer shall be ASSE 1015 approved, and supplied with full port ball valves. The main body and access covers shall be bronze (ASTM B584), the seat rings and all internal polymers shall be NSF® Listed Noryl™ and the seat disc elastomers shall be silicone. The first and second checks shall be accessible for maintenance without removing the device from the line.

- .1 Acceptable materials:
- .1 Watts 007 ½" - 2"
  - .2 Wilkins 950XL ¾" - 2"
  - .3 Conbraco 40-100 Series

## **2.5 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.
- .1 Acceptable materials:
- .1 Watts BD series
  - .2 Emco
  - .3 Chicago
  - .4 Zurn

## **2.6 STRAINERS**

- .1 860 kPa (125 psi), Y type with 20 mm (3/4") mesh, bronze or stainless steel removable screen.
- .2 NPS 50 mm (2") and under, bronze body, screwed ends, with brass cap.
- .1 Acceptable materials:
- .1 Watts Series 777SI
  - .2 Crane/Powers
  - .3 Colton 125 YTB
  - .4 Wilkins S Series
- .3 NPS 65 mm (2½") and over, cast iron body, flanged ends, with bolted cap.
- .1 Acceptable materials:
- .1 Watts 77F-D (77F-D-FDA for water service)
  - .2 Crane/Powers
  - .3 Colton 125 YTB
  - .4 Wilkins FS Series

## **2.7 WATER FILTERS**

- .1 Five (5) micron filter assembly for taste/odour and dirt/rust.
- .2 The unit shall be constructed of molded transparent plastic housing and a bottom pressure relief for cartridge change.

- .3 Install as per manufacturer's recommendations
- .4 Supply a spare set of cartridges.
- .5 Acceptable material:

- .1 Aqua Puro AP11B

## **2.8 SOLENOID VALVES**

- .1 Two (2) way normally closed all bronze construction.
- .2 Voltage shall be suitable for controlling function.
- .3 Acceptable material:

- .1 Asco

## **2.9 OWNER SUPPLIED EQUIPMENT**

- .1 The mechanical contractor shall supply and install all water, gas, condensate and sanitary piping to the owner supplied equipment. Connection to equipment shall be by this contractor.
- .2 Provide flexible riser stops to all sinks and ball valves to all other equipment.
- .3 Provide backflow preventors on equipment required by the local plumbing inspector.
- .4 Provide flexible gas piping to all gas equipment.
- .5 All equipment in store equipment schedule will be supplied and set in place by Mechanical Contractor unless otherwise noted.
- .6 Coordinate all rough-ins and connection with the supplier on site.
- .7 Owner supplied equipment includes existing relocated equipment.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

### **3.2 WATER HAMMER ARRESTORS**

- .1 Install on branch supplies to each fixture or group of fixtures and where indicated.

### **3.3 BACK FLOW PREVENTORS**

- .1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Pipe discharge to terminate over nearest drain and or service sink.
- .3 Provide test results in manual and leave tag with test results on device.

**3.4 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Install at bottom of all risers, at low points to drain systems, and as indicated.

**3.5 STRAINERS**

- .1 Install with sufficient room to remove basket.
- .2 Strainer size to match pipe size.

**3.6 COMMISSIONING**

- .1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.
- .2 Timing: commission only after start-up deficiencies rectified.
- .3 Access doors: verify size and location relative to items to be services.
- .4 Adjust to suit site conditions, including, but not necessarily limited to, following:
  - .1 Non-freeze wall, ground hydrants:
    - .1 Verify complete drainage.
    - .2 Verify operation of vacuum breaker.
  - .2 Water hammer arrestors:
    - .1 Verify accessibility.
  - .3 Backflow preventors, vacuum breakers:
    - .1 Verify installation of correct type to suit application.
    - .2 Adjust as necessary to ensure proper operation.
    - .3 Verify visibility of discharge.
  - .4 Pressure regulators:
    - .1 Adjust settings to suit installed locations, required flow rates.
  - .5 Hose bibbs, sediment faucets:
    - .1 Verify operation.
  - .6 Water make-up assembly:
    - .1 Verify operation.
  - .7 Water meters:
    - .1 Verify operation.
  - .8 Pipeline strainers:
    - .1 Verify accessibility of basket.
    - .2 Clean out during commissioning until system clean.
- .5 Commissioning reports:
  - .1 Record all results on approved report forms.
  - .2 Include signature of tester and supervisor.
  - .3 To be countersigned by Consultant.

- .6 Verification:
  - .1 Notify Consultant 48 h before commencing tests.
  - .2 All tests and procedures to be witnessed by Consultant.
  - .3 All reported results subject to verification by consultant.
- .7 Training:
  - .1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
- .8 Demonstrations:
  - .1 Demonstrate full compliance with Design Criteria.
  - .2 Demonstrations also to show completeness of O&M personnel training.

### **3.7 WARRANTY**

- .1 Warranty Start Date:
  - .1 Warranty period starts as of the date of Ready for Takeover.
  - .2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.
- .2 Warranty Duration:
  - .1 One (1) year warranty period applies.
- .3 Warranty Coverage:
  - .1 Applies to parts and labour.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .3 ASTM D2564, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.
- .5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.
- .6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

**Part 2 Products**

**2.1 PIPING AND FITTINGS**

- .1 Buried sanitary, and vent piping to:
  - .1 80 mm (3") and smaller: ABS drain waste and vent pipe to CAN/CSA-B181.1.
  - .2 100 mm (4") and larger: SDR-35 PVC drain waste and vent pipe to CAN/CSA-B181.2.
  - .3 Vent piping: any size, PVC-DWV plastic drain and sewer pipe and fittings CAN/CSA-B181.2.
- .2 Above grade sanitary and vent piping:
  - .1 80 mm (3") and smaller: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
  - .2 100 mm (4") and larger: IPEX: PVC-XFR drain waste and vent pipe to CAN/CSA-B181.2.
  - .3 Vent piping: any size, IPEX: PVC-XFR plastic drain and sewer pipe and fittings CAN/CSA-B181.2.
- .3 Use plastic XFR – DWV in pipe chase for urinal piping to 1.5 M (5' –0") above finished floor.
- .4 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

**2.2 JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

**2.3 EXPANSION**

- .1 Provide solvent welded expansion joints as required by manufacturer's recommendations.

**2.4 VENT FLASHINGS**

- .1 Thaler Stack Jack spun aluminum complete with insulation, cap, and rubber gasket.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction. Install in accordance with manufacturer's instructions.
- .2 Installation of underground pipe
  - .1 Provide all excavation, bedding, backfill, and compaction.
  - .2 Install materials in accordance with Manufacturer's instructions.
  - .3 Use jacks to make-up gasketed joints.
  - .4 Stabilize unstable trench bottoms.
  - .5 Bed pipe true to line and grade with continuous support from firm base.
    - .1 Bedding depth - 100 mm to 150 mm (4" to 6").
    - .2 Material and compaction to meet ASTM standard noted above.
  - .6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.
  - .7 Trench width at top of pipe -
    - .1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.
    - .2 Maximum - Outside diameter of pipe plus 600 mm (24").
  - .8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
  - .9 Do not use back hoe or power equipment to assemble pipe.
  - .10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.
  - .3 Every 15 m (50 ft) of horizontal run.
  - .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts

- .4 Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gases pass freely to atmosphere with no pressure or syphon condition on water seal.
- .5 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
  - .1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.
  - .2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.
- .6 Install solvent welded expansion joints as per manufacturer's recommendation. Care is to taken to accommodate ambient temperatures at time of install.
- .7 **Vent entire waste system to atmosphere.**
  - .1 **Discharge 350 mm (14") above roof. Join lines together in fewest practicable number before projecting above roof.**
  - .2 **Set back vent lines so they will not pierce roof near an edge or valley.**
- .8 **Flash pipes passing through roof with Thaler insulated Stack Jack flashing.**
  - .1 **Flashing base shall be at least 600 mm (24") square.**
- .9 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

END OF SECTION



**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM D2235, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .3 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .4 CAN/CSA-B181.1, ABS Drain, Waste and Vent Pipe and Pipe Fittings.
- .5 CAN/CSA-B181.2, PVC and CPVC Drain, Waste and Vent Pipe and Pipe Fittings.
- .6 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

**Part 2 Products**

**2.1 PIPING AND FITTINGS**

- .1 Buried storm piping to:
  - .1 80 mm (3") and smaller: ABS drain pipe to CAN/CSA-B181.1.
  - .2 100 mm (4") and larger: SDR-35 PVC drain pipe to CAN/CSA-B181.2.
- .2 Above grade storm piping:
  - .1 80 mm (3") and smaller: IPEX: PVC-XFR fire rated drain storm pipe to CAN/CSA-B181.1.
  - .2 100 mm (4") and larger: IPEX: PVC-XFR storm pipe to CAN/CSA-B181.2.
- .3 Where piping pierces a fire separation an approved fire stop system to the approval of authority having jurisdiction shall be used.

**2.2 JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Installation of underground pipe
  - .1 Provide all excavation, bedding, backfill, and compaction.
  - .2 Install materials in accordance with Manufacturer's instructions.
  - .3 Use jacks to make-up gasketed joints.

- .4 Stabilize unstable trench bottoms.
- .5 Bed pipe true to line and grade with continuous support from firm base.
  - .1 Bedding depth - 100 mm to 150 mm (4" to 6").
  - .2 Material and compaction to meet ASTM standard noted above.
- .6 Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.
- .7 Trench width at top of pipe -
  - .1 Minimum 450 mm (18") or diameter of pipe plus 300 mm (12"), whichever is greater.
  - .2 Maximum - Outside diameter of pipe plus 600 mm (24").
- .8 Piping and joints shall be clean and installed according to manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
- .9 Do not use back hoe or power equipment to assemble pipe.
- .10 Initial backfill shall be 300 mm (12") above top of pipe with material specified in referenced ASTM standard.
- .3 Place Cleanouts
  - .1 Where shown on Drawings and near bottom of each stack and riser.
  - .2 At every 90 degree change of direction for horizontal lines.
  - .3 Every 15 m (50 ft) of horizontal run.
  - .4 Extend clean out to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts
- .4 Before piping is covered, conduct tests in presence of Consultant and correct leaks or defective work. Conduct test prior to placing floor slab but after backfill is placed.
  - .1 Fill waste and vent system a minimum of 1.8 m (6 ft) above finished floor with water and show no leaks for 2 hours.
  - .2 Conduct ball test in presence of consultant to ensure proper grade and clear of obstructions.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
- .3 CAN/CSA C22.2 No. 110, Construction and Test of Electric Storage Tank Water Heaters.
- .4 CAN/CSA-C191, CSA Standards on Performance of Electric Storage Tank Water Heaters for Domestic Hot Water.
- .5 CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

**1.2            SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.
  - .2 Wiring and schematic diagrams.
  - .3 Dimensions and recommended installation.
  - .4 Pump performance and efficiency curves.

**1.3            CLOSEOUT SUBMITTALS**

- .1 Provide maintenance and engineering data for incorporation into manual specified in general requirements
- .2 Data to include:
  - .1 Manufacturer's name, type, model year, capacity, and serial number.
  - .2 Details of operation, servicing, and maintenance.
  - .3 Recommended spare parts list with names and addresses.

**Part 2            Products**

**2.1            ELECTRIC WATER HEATER**

- .1 To CAN/CSA C22.2 No. 110, CAN/CSA-C191 [and CAN/CSA-C309 for glass-lined storage tanks], with immersion type elements as indicated.
- .2 Tank: as indicated, glass lined steel, 50 mm (2") thick mineral wool or fibreglass insulation, enamelled steel jacket, integral hi-limit safety shut-off switch and top connections.

.3 Acceptable Manufacturers:

- .1 A.O. Smith
- .2 Rudd
- .3 Bradford White

## **2.2 WATER HEATER TRIM AND INSTRUMENTATION**

- .1 Drain valve: NPS 25 mm (1") with hose end.
- .2 Thermometer: 100 mm (4") dial type with red pointer and thermowell filled with conductive paste.
- .3 Thermowell filled with conductive paste for control valve temperature sensor.
- .4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .5 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

## **Part 3 Execution**

### **3.1 WATER HEATER**

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Provide structural steel for horizontal (vertical) mounted tanks.
- .3 Provide insulation between tank and supports.
- .4 Provide neutralizing cartridge on each vent drain.

### **3.2 FIELD QUALITY CONTROL**

- .1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.
- .2 Check power supply.
- .3 Check starter protective devices.
- .4 Start up, check for proper and safe operation.
- .5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .6 Demonstrate equipment operation as directed by consultant.

**3.3 WARRANTY**

- .1 Warranty Start Date:
  - .1 Warranty period starts as of the date of Ready for Takeover.
  - .2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.
- .2 Warranty Duration:
  - .1 Electric water heater (120 gal tank type): tank, three (3) year warranty
  - .2 Electric water heaters (19 gal tank type): tank, three (3) year warranty
  - .3 Electric instantaneous point of use water heater: three (3) year manufacturer's warranty.
- .3 Warranty Coverage:
  - .1 Applies to parts and labour.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.
  - .2 Wiring and schematic diagrams.
  - .3 Dimensions and recommended installation.
  - .4 Pump performance and efficiency curves.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance and engineering data for incorporation into manual specified in general requirements
- .2 Data to include:
  - .1 Manufacturer's name, type, model year, capacity, and serial number.
  - .2 Details of operation, servicing, and maintenance.
- .3 Recommended spare parts list with names and addresses.

**Part 2 Products**

**2.1 DOMESTIC HOT WATER EXPANSION TANK**

- .1 Pre-charged 6.4 gal (3.2 gal accept volume) hydropneumatic steel expansion tank complete with internal butyl diaphragm.
- .2 Tank construction shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank must be stamped with a maximum working pressure of 150 psi and a maximum working temperature of 250°F.
- .3 Tank volume: 24 l (4.5 gallons) with 0.73 acceptance factor.
- .4 Acceptable material:
  - .1 Amtrol ST-12C
  - .2 Well-X-Trol

**Part 3 Execution**

**3.1 DOMESTIC HOT WATER EXPANSION TANK**

- .1 Adjust expansion tank pressure to suit system pressure.
- .2 Provide an expansion tank on the cold water feed to each water heater complete with lockshield type shutoff valve at inlet to tank.
- .3 Provide an expansion tank at the water entrance.

**3.2 FIELD QUALITY CONTROL**

- .1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.
- .2 Check power supply.
- .3 Check starter protective devices.
- .4 Start up, check for proper and safe operation.
- .5 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .6 Adjust flow from water-cooled bearings.
- .7 Adjust impeller shaft stuffing boxes, packing glands.
- .8 Demonstrate equipment operation as directed by consultant.
- .9 Demonstrate water softener regeneration controls.

**3.3 WARRANTY**

- .1 Warranty Start Date:
  - .1 Warranty period starts as of the date of Ready for Takeover.
  - .2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.
- .2 Warranty Duration:
  - .1 One (1) year warranty period applies.
- .3 Warranty Coverage:
  - .1 Applies to parts and labour.

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL REQUIREMENTS**

- .1 Conform to Sections of Division 1 and to General Mechanical Requirements Section.

**1.2 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Perform work in accordance with the recommendations of and the requirements of:
  - .1 Local and district bylaws and regulations.
  - .2 N.F.P.A.14 "Installation of Standpipe and Hose Systems".
  - .3 The Ontario Building Code.
  - .4 U.L.C. or Factory Mutual approval for hose, valve and extinguisher requirements.
  - .5 N.F.P.A.10 "Standard for Portable Fire Extinguishers".
  - .6 The Ontario Fire Code.

**1.3 SUBMITTALS**

- .1 Submit shop drawings and maintenance data in accordance with general requirements.

**1.4 COORDINATION**

- .1 Confirm fire extinguisher cabinet locations and quantities from both architectural and mechanical drawings and report any discrepancies to consultant prior to bid close.
- .2 Coordinate location of cabinet with other trades and provide protection against damage during construction.

**Part 2 Products**

**2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS (CLASS ABC)**

- .1 Stored pressure rechargeable type with hose and shut off nozzle, ULC labelled for A, B and C class protection as indicated. Size of extinguishers shall be as follows:
  - .1 Kitchen Type 'K' 10 lb 20BC rating
  - .2 Servery Areas Type 'K' 10 lb 20 BC rating
  - .3 Mechanical Rooms 10 lb ABC rating
  - .4 Storage Rooms 10 lb ABC rating
  - .5 Corridor/Gym/Finished Areas 5 lb ABC rating complete with cabinet
  - .6 Acceptable materials:
    - .1 Wilson & Cousins
    - .2 National



## **2.2 IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of NFPA 10.
- .2 Attach tag or label to extinguishers indicating month and year of installation and provide space for the addition of recording service dates.

## **2.3 FIRE BLANKET**

- .1 100% non-combustible fire retardant glass fibre, non-toxic, non-conductor, cleanable complete with straps.
- .2 Size: 1 m x 1 m (40" x 40").
- .3 Cabinet to be surface mounted, 400 mm x 300 mm (16" x 12").
- .4 Mount on wall in kitchen area where indicated or directed on site by consultant.
- .5 Manufacturer:
  - .1 National FB 4040 blanket, FB 6078 MC cabinet.
  - .2 Wilson & Cousins.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Provide portable fire extinguisher cabinets and mount in wall during construction. Cabinet to be surface or recessed mounted as indicated on the drawings. Install cabinets so that the door will not obstruct normal traffic when open.
- .2 Hang extinguishers in cabinets with wall mounting bracket.
- .3 Prior to installing the extinguisher cabinets, confirm the mounting height and exact location with the Consultant. Mount extinguisher so top of unit is not more than 1.5 m (5').
- .4 Install wall mounted fire extinguishers complete with wall mounting bracket where indicated and/or directed on site by consultant.
- .5 Caulk perimeter of fire extinguisher cabinets after acceptance.

### **3.2 TESTS**

- .1 Fire protection equipment shall be tested to the requirements of NFPA10, NFPA13, NFPA14 and comply with the requirements of the authorities having jurisdiction.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CAN/CSA B45S1, Supplement #1 to CAN/CSA B-45 Series Plumbing Fixtures.
- .3 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.
- .4 CAN/CSA-B125.3, Plumbing Fittings.
- .5 CAN/CSA-B651, Accessible Design for the Built Environment.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Indicate, for all 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.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data including monitoring requirements for incorporation into manual specified in general requirements.
- .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.

**1.4 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.
- .3 Equipment not installed.
  - .1 Capped with valves for future connection by others.

**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.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: Architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

**2.2 FIXTURE CARRIERS**

- .1 Provide factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.
- .2 Acceptable materials:
  - .1 Zurn
  - .2 Smith
  - .3 Ancon

**2.3 PLUMBING FIXTURES**

- .1 Refer to plumbing fixture schedule on the drawings for fixture type, manufacturer, trim, drainage supply, and accessories.

**2.4 FIXTURE PIPING**

- .1 Hot and cold water supplies to each fixture/faucet:  
Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon and chrome plated nipple.
  - .1 Acceptable materials:
    - .1 Delta 47T900 Series
    - .2 McGuire
- .2 Waste:  
Open grid strainer, or pop up as indicated, offset open grid strainer on Barrier-Free fixtures, cast brass fittings with tubular piping, chrome plated, rubber gasket compression fitting, and overflow flange.
  - .1 Acceptable materials:
    - .1 Delta 33T200 Series
    - .2 McGuire

- .3 'P' Traps:  
Cast brass P trap with cleanout on each fixture not having integral trap.  
Chrome plated in all exposed places.

- .1 Acceptable materials:

- .1 Delta 33T300 Series
  - .2 McQuire

### Part 3 Execution

#### 3.1 INSTALLATION

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified. Confirm mounting height(s) with consultant prior to rough-in.
  - .2 Wall-hung fixtures: measured from finished floor.
  - .3 Physically Barrier-Free: to comply with most stringent of either NBCC or CAN/CSA B651.
- .2 Drinking fountains:
  - .1 In accordance with CAN/CSA B45S1.

#### 3.2 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 Adjust water cooler, drinking fountain flow stream to ensure no spillage.
  - .6 Automatic flush valves for water closets and urinals: set controls to prevent unnecessary flush cycles during silent hours.
- .3 Checks:
  - .1 Water closets, urinals: flushing action.
  - .2 Aerators: operation, cleanliness.
  - .3 Vacuum breakers, backflow preventors: operation under all conditions.
  - .4 Wash fountains: operation of flow-actuating devices.
  - .5 Refrigerated water coolers: operation, temperature settings.

- .4 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.
- .5 Floor and wall mounted fixtures: caulk to floor or wall using silicone caulking to make water tight, colour to match fixture.
- .6 Counter mounted fixtures: lay fixtures into bead of caulking to ensure excess moisture does not reach the cut edge of the countertop. Clean excess caulking off outside the sink.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 National Air Duct Cleaners Association (NADCA): "Assessment, Cleaning & Restoration of HVAC Systems (ACR).
- .3 National Air Duct Cleaners Association (NADCA): "Understanding Microbial Contamination in HVAC Systems".
- .4 National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services".
- .5 National Air Duct Cleaners Association (NADCA): Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems".
- .6 Underwriters' Laboratories (UL): UL Standard 181.
- .7 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62, "Ventilation for Acceptable Indoor Air Quality".
- .8 Environmental Protection Agency (EPA): "Building Air Quality".
- .9 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards - Metal and Flexible".
- .10 North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems".

**1.2 SPECIAL PROVISIONS**

- .1 Qualification of the HVAC System Cleaning Contractor
- .2 Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
- .3 Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
- .4 Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
- .5 Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the owner. Bids shall only be considered from firms, which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

- .6 Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labour to adequately perform the specified services.
- .1 The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors should comply with applicable national safety codes and standards.
  - .2 The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.
  - .3 Contractor shall submit to the owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.
- .7 Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

### **1.3 STANDARDS**

- .1 NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
- .2 All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
- .3 NADCA Standards must be followed with no modifications or deviations being allowed.

### **1.4 DOCUMENTS**

- .1 Mechanical Drawings: The owner shall provide the HVAC system cleaning contractor with one copy of the following documents:
- .2 Project drawings and specifications.
- .3 Approved construction revisions pertaining to the HVAC system.
- .4 Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

## **Part 2 Products**

### **2.1 SCOPE OF WORK**

- .1 This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.

- .2 The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.
- .3 The HVAC system includes any interior surface of the facility's existing air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts to the air handling units (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

## **2.2 HVAC SYSTEM COMPONENT INSPECTIONS AND SITE PREPARATIONS**

- .1 HVAC System Component Inspections: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air-handling units, a representative sample of the units should be inspected.
- .2 The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented.
- .3 Damaged system components found during the inspection shall be documented and brought to the attention of the consultant.
- .4 Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- .5 Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At minimum, such personnel should have an understanding of HVAC system design, and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

## **2.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS**

- .1 Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.



- .2 Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
- .3 Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process..
- .4 Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- .5 Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.
- .6 Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
- .7 Contractor shall utilize the existing service openings already installed in the HVAC system where possible.
- .8 Other openings shall be created by this contractor where needed and they must be created so they can be sealed by this contractor in accordance with industry codes and standards.
- .9 Closures must not significantly hinder, restrict, or alter the airflow within the system.
- .10 Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
- .11 Openings must not compromise the structural integrity of the system.
- .12 Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.
- .13 Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
- .14 Rigid fiberglass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiberglass duct system closures.
- .15 All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the consultant in project report documents.

- .16 Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.
- .17 Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.
- .18 Air handling units, terminal units (VAV, Dual duct boxes, etc.), blowers and exhaust fan: The contractor shall ensure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:
- .19 Clean all air handling units (AHU) internal surfaces, components and condensate collectors and drains.
- .20 Assume that a suitable operative drainage system is in place prior to beginning wash down procedures.
- .21 Clean all coils and related components, including evaporator fins.
- .22 Duct Systems: This Contractor shall:
- .23 Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas. Provide access doors specified in duct accessories to replace openings.
- .24 Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

## **2.4 HEALTH AND SAFETY**

- .1 Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.
- .2 Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- .3 Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

## 2.5 MECHANICAL CLEANING METHODOLOGY

- .1 Source Removal Cleaning Methods:
- .2 The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
  - .1 All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
  - .2 All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.
  - .3 All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.
  - .4 All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.
- .3 Methods of Cleaning Fibrous Glass Insulated Components:
  - .1 Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.
  - .2 Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).
- .4 Damaged Fibrous Glass Material:
  - .1 Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.

- .2 Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.
- .3 Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
- .4 Replacement of damaged insulation is not covered by this specification.
- .5 Cleaning of Coils:
  - .1 Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.
- .6 Antimicrobial Agents and Coatings:
  - .1 Antimicrobial agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
  - .2 Application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
  - .3 When used, antimicrobial treatments and coatings shall be applied in strict accordance with the manufacturer's written recommendations and EPA registration listing.
  - .4 Antimicrobial coatings shall be applied according to the manufacturer's written instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces.

## 2.6 CLEANLINESS VERIFICATION

- .1 General:
  - .1 Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.
- .2 Visual Inspection:
  - .1 The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
  - .2 If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the consultant reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.

- .3 If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
- .4 NADCA vacuum test analysis shall be performed by a qualified third party experienced in testing of this nature through the HVAC commissioning contract.

.3 Verification of Coil Cleaning:

- .1 Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

**2.7 PRE-EXISTING SYSTEM DAMAGE**

- .1 Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others.

**2.8 POST-PROJECT REPORT**

- .1 At the conclusion of the project, the Contractor shall provide a report to the consultant indicating the following:
  - .1 Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
  - .2 Areas of the system found to be damaged and/or in need of repair.

**Part 3 Execution**

Not Applicable.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 Canadian General Standards Board (CGSB)
  - .1 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 CAN/ULC-S702, Mineral Fiber Thermal Insulation for Buildings.
  - .3 ASTM C612, Mineral Fiber Block and Board Thermal Insulation.
  - .4 CGSB 51-GP-52Ma-[89], Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Underwriters Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .4 American Society for Testing and Materials (ASTM).
  - .1 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .2 ASTM C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .3 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  - .4 **ASTM C 411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.**
  - .5 **ASTM C 795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.**
  - .6 **ASTM C 921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.**
- .5 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - .1 ASHRAE Standard 90.1.
- .6 Manufacturer's Trade Associations.
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

**1.3 INSTALLATION INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with general requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

**1.4 QUALIFICATIONS**

- .1 Installer to be 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 of TIAC.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

**1.6 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

**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 as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C 335.
- .3 Type C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52 Ma.
  - .3 Maximum "k" factor: to ASTM C553.

.4 Type C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma:

- .1 Mineral fibre: to ASTM C553.
- .2 Jacket: to CGSB 51-GP-52 Ma.
- .3 Maximum "k" factor: to ASTM C553.

.5 Manufacturers:

- .1 All materials must be supplied by the same manufacturer.
- .2 Acceptable Materials:
  - .1 Johns Manville
  - .2 Fibreglass Canada
  - .3 Knauf
  - .4 Manson
  - .5 Roxul

## 2.3 JACKETS

.1 Canvas:

- .1 220 g/m<sup>2</sup> (0.0451 lb/ft<sup>2</sup>) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .2 Lagging adhesive: Compatible with insulation.

.2 Self adhesive aluminum:

- .1 Aluminum skin with adhesive, minimum thickness 1.5 mm (60 mils).
- .2 Modified SBS membrane.
- .3 Ultra violet light resistance.
- .4 Multi standard colours (selected by architect).
- .5 Overlap joints minimum of 50 mm (2").
- .6 Acceptable manufacturer:
  - Foilskin (Bakor)
  - Venture Clad

## 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 C 449.

.4 ULC Listed Canvas Jacket:

- .1 220 g/m<sup>2</sup> (0.0451 lb/ft<sup>2</sup>) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.



- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.
- .6 Contact adhesive: quick-setting Duro Dyne 1A-22 or equal.
- .7 Canvas adhesive: washable.
- .8 Tie wire: 1.5 mm (16 gauge) stainless steel.
- .9 Facing: 25 mm (1") stainless steel hexagonal wire mesh stitched on one face of insulation
- .10 Fasteners: weld pins, length to suit insulation, with 40 mm (1½") diameter clips.

### Part 3 Execution

#### 3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

#### 3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers in accordance with general requirements.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: At 300 mm (12") oc. in horizontal and vertical directions, minimum two rows each side.
- .6 Provide rigid insulation for exposed ductwork.
- .7 **Use two layers with staggered joints when required nominal thickness exceeds 75 mm (3").**

#### 3.3 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thickness' conform to following table:

Application	Type	Thickness
Rectangular supply air ducts	C-1	25 mm (1")
Round supply air ducts	C-2	25 mm (1")
Supply, return and exhaust ducts exposed (visible) in space being served	none	
Outdoor air ducts (exterior ductwork)	C-1	80 mm (3")
Outdoor air intake ductwork and plenums	C-1	50 mm (2")
Interior acoustically lined ducts	none	
Breeching	C-3	50 mm (2")
Last 1.5m of Exhaust duct	C-1	25 mm (1")

- .2 Exposed round ducts 600 mm (24") 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:

<u>Application</u>	<u>Rectangular</u>	<u>Round</u>
Indoor, concealed	none	none
Indoor, exposed	Canvas	Canvas
Outdoor, exposed to Precipitation	Aluminum	Aluminum

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch.
- .3 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .5 ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
- .6 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
- .7 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- .8 ASTM B32, Specification for Solder Metal.
- .9 ASTM B75M, Specification for Seamless Copper Tube [Metric].
- .10 CSA B149.1, Natural Gas and Propane Installation Code.
- .11 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings product data in accordance with general requirements.
- .2 Indicate on manufacturers catalogue literature.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**Part 2 Products**

**2.1 GAS SERVICE**

- .1 Arrange with the local utility to have the gas service and meter revised to suit new building connected gas load.
- .2 Contractor responsible to pay all fees and charges requested by the local utility to provide the gas service and meter.
- .3 Submit all plans as requested by the local utility.
- .4 Utility supplied gas meter shall be complete with pulse signal for connection to BAS system (co-ordinate pulse representation in m<sup>3</sup> of gas used on meter specifications.
- .5 Provide approved pulse gas meter in all locations where indicated on the drawings.

## **2.2 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
  - .1 NPS 15 mm to 50 mm (1/2" to 2"), screwed.
  - .2 NPS 65 mm (2 1/2") and over, plain end.
- .2 Buried pipe: CGA approved polypropylene complete with tracer wire and marker.
- .3 Copper tube: to ASTM B75M.

## **2.3 JOINTING MATERIAL**

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: nonmetallic flat.
- .4 Soldered: to ASTM B32, tin antimony 95/5.
- .5 Screwed brass fittings: Teflon Tape.

## **2.4 FITTINGS**

- .1 Steel pipe fittings, screwed, flanged or welded:
  - .1 Malleable iron: screwed, banded, Class 150.
  - .2 Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5.
  - .3 Welding: butt-welding fittings.
  - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
  - .5 Bolts and nuts: to ANSI B18.2.1.
  - .6 Nipples: schedule 40, to ASTM A53/A53M.
- .2 Copper pipe fittings, screwed, flanged or soldered:
  - .1 Cast copper fittings: to ANSI B16.18.
- .3 Brass fittings: To ASTM B16.

## **2.5 BALL VALVES**

- .1 NPS 50 mm (2") and under:
  - .1 Body and cap: cast high tensile bronze to ASTM B62.
  - .2 Pressure rating: Class 125, 860 kPa (125 psi) steam, WP = 1.4 MPa (203 psi) WOG.
  - .3 Connections: Screwed ends to ANSI B1.20.1 and with hex. 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.

## 2.6 LUBRICATED PLUG VALVES

- .1 All sizes
  - .1 Provincial Code approved, lubricated plug type.
  - .2 Body: cast iron to ASTM A 126 Class B semi-steel.
    - .1 Rating: Class 125 psig.
  - .3 Plug: tapered, with regular pattern port – 90 from full open to fully closed.
  - .4 Ends: 50 mm (2") and smaller with hexagon shoulders, ends screwed to ANSI B1.20.1. Flanged to ANSI B16.1.
  - .5 Lubrication system, nickel-plated.
  - .6 Lubricant: to suit type, temperature and pressure of contained fluid.
  - .7 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film.
  - .8 Lubricant screw for lubrication.
  - .9 O-rings between body and plug.
  - .10 Operator: removable manual lever handle.
  - .11 Acceptable materials:
    - .1 Newman Hattersley
    - .2 Crane
    - .3 Jenkins
    - .4 Milwaukee
    - .5 Toya

## 2.7 MANUFACTURED ROOF SUPPORTS

- .1 Single piece injection moulded polypropylene support.
- .2 Type 3-20 psi extruded polystyrene UV protected base glued to the support.
- .3 Minimum base dimension of 300 x 225 (12" x 9") and be 140 mm (5.5") high.
- .4 Pull test of 1.4 KN (315 lbs) using two #14-10 screws on pipe strap.
- .5 Acceptable materials:
  - .1 Quick Block
  - .1 Erico

## 2.8 PIPING THROUGH ROOF

- .1 Provide Thaler MEF-9 or equal gas piping flashing where pipe and/or relief vent penetrates roof.

**Part 3            Execution**

**3.1               PIPING**

- .1      Install in accordance with applicable Provincial/Territorial Codes.
- .2      Install in accordance with CAN/CSA B149.
- .3      Assemble piping using fittings manufactured to ANSI standards.
- .4      Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .5      Slope piping down in direction of flow to low points.
- .6      Install drip points:
  - .1          At low points in piping system.
  - .2          At each connection to equipment.
- .7      Use eccentric reducers at pipe size change installed to provide positive drainage.
- .8      Provide clearance for access and for maintenance.
- .9      Ream pipes, clean scale and dirt, inside and out.
- .10     Install piping to minimize pipe dismantling for equipment removal.
- .11     Install regulator vents to code. Terminate in open air with Gooseneck fitting complete with stainless steel screen.
- .12     Paint gas piping with two (2) coats yellow paint. Banding of gas will not be accepted.

**3.2               PIPING ON ROOF**

- .1      Support piping as follows or as per seismic requirements (1.8 M (6' - 0") O.C.) whichever is more stringent:
  - ≤ 40 mm (1½") 2.4 M (8' - 0") O.C.
  - ≥ 50 mm (2") 3.0 M (10' - 0") O.C.
- .2      Provide support at each elbow and fitting.
- .3      Provide support at each regular and/or isolating valve.
- .4      Provide support within 600 mm (24") of each piece of equipment.

**3.3               VALVES**

- .1      Install valves with stems upright or horizontal unless otherwise approved by Consultant.
- .2      Install valves at branch take-offs to isolate each piece of equipment, and as indicated.
- .3      Provide lubricated plug type when gas line is exterior of building or 65 mm (2½") and larger.
- .4      Provide ball valve when gas line is interior of building and 50 mm (2") or smaller.

**3.4 FIELD QUALITY CONTROL**

- .1 Test system in accordance with CAN/CSA B149. Requirements of authorities having jurisdiction.
- .2 Provide copy of TSSA tag to the consultant.

**3.5 PURGING**

- .1 Purge after pressure test in accordance with CAN/CSA B149.

**3.6 GAS SERVICE**

- .1 Arrange with local gas distributor to install gas service and gas meter. Pay all fees and charges to provide the gas service and gas meter.
- .2 Install all the gas meters where indicated.

**3.7 GAS FIRED EQUIPMENT START-UP**

- .1 Start-up of all new and existing gas fired equipment shall be by this contractor to the requirements of the equipment manufacturer.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 SMACNA HVAC Duct Leakage Test Manual.
- .4 ASTM A480/A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .6 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .7 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .8 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.**
- .9 CSA B228.1, Pipe Ducts and Fittings for Residential Type Air Conditioning Systems.**

**1.2            SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section general requirements.
- .2 Indicate following:
  - .1 Sealants
  - .2 Tape
  - .3 Proprietary Joints
  - .4 Fittings

**1.3            CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.



**Part 2 Products**

**2.1 DUCTWORK**

.1 Galvanized Steel:

- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
- .2 Thickness:

Size Type	Class A Gauge	Class B Gauge	Class C Gauge
<b>Square and Rectangular</b>			
Up to 600 mm (24")	22	24	24
625 mm to 1000 mm (25" to 40")	20	22	24
1025 mm to 1800 mm (41" to 72")	18	20	22
1825 mm to 2400 mm (73" to 96")	16	18	20
2450 mm and over (97")	16	16	16
<b>Round and Oval</b>			
Up to 300 mm (12")	24	24	24
325 mm to 600 mm (13" to 24")	22	24	24
625 mm to 900 mm (25" to 36")	20	22	24
925 mm to 1200 mm (37" to 48")	18	20	22
1225 mm (49") and over	18	18	20

- .3 All ductwork between HVAC unit connections and 3.0 m (10'-0") downstream or to silencers shall be 1.4 mm (18 gauge).

**2.2 DUCT CONSTRUCTION**

.1 Round and oval:

- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm (36"): slip type with tape and sealants.
- .3 Transverse joints over 900 mm (36"): Ductmate or Exanno Nexus Duct System.

.2 Square and rectangular:

- .1 Ducts: to SMACNA.
- .2 Transverse joints, longest side: up to and including 750 mm (30"): SMACNA proprietary duct joints.

- .3 Ducts with sides over 750 mm (30") to 1200 mm (48"), transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA "E" or "G" Type connection). Weld all corners.
  - .1 Acceptable materials:
    - .1 Ductmate Canada Ltd.
    - .2 Nexus, Exanno Corp.
    - .3 WDCI
- .4 Ducts 1200 mm (48") and larger, Ductmate/35, Nexus, or WDCI (heavy) (SMACNA "J" Type connection). Weld all corners.
  - .1 Acceptable materials:
    - .1 Ductmate Canada Ltd.
    - .2 Nexus, Exanno Corp.
    - .3 WDCII.

## **2.3 FITTINGS**

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Rectangular: standard radius and or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
  - .2 Round:
    - .1 In exposed areas one-piece smooth radius, 1.5 times diameter.
    - .2 In concealed areas 3-piece adjustable, 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm (16"): with double thickness turning vanes.
  - .2 Over 400 mm (16"): with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with 45° entry on branch.
  - .2 Round main and branch: enter main duct at 45° with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Diffuser connection to main:
  - .1 90° round spin in collars with balancing damper and locking quadrant.
- .6 Transitions:
  - .1 Diverging: 20° maximum included angle.
  - .2 Converging: 30° maximum included angle.
- .7 Offsets:
  - .1 Full short radiused elbows.
- .8 Obstruction deflectors: maintain full cross-sectional area.

## 2.4 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa (" w.c.)	SMACNA Seal Class	Acceptable Leakage Classification (Rectangular)	Acceptable Leakage Classification (Round)
2500 (10")	A	4	2
1500 (6")	A	4	2
1000 (4")	A	4	2
750 (3")	A	8	4
500 (2")	B	16	8
250 (1")	B	16	8
125 (0.5")	C	16	8

- .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.
- .3 Class C: transverse joints and connections made air tight with gaskets, or sealant or combination thereof. Longitudinal seams sealed with foil tape or sealant.

## 2.5 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C (-22°F) to plus 93°C (199°F).
- .1 Acceptable materials:
- .1 Duro Dyne S-2
- .2 Foster

## 2.6 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.
- .1 Acceptable material:
- .1 Duro Dyne FT-2

## 2.7 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

## 2.8 FIRESTOPPING

- .1 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angles all around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.
- .3 All ductwork passing through partition walls shall be firestopped.

## 2.9 WATERTIGHT DUCT

- .1 Provide watertight duct for:
  - .1 Dishwasher exhaust.
  - .2 Fresh air intake.
  - .3 Minimum 3000 mm (120") from duct mounted humidifier in all directions.
  - .4 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.

## 2.10 HANGERS AND SUPPORTS

- .1 Band hangers: use on round and oval ducts only up to 500 mm (20") diameter of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 500 mm (20") diameter or longest side, to ASHRAE and SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE and SMACNA following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
>750 to 1050 (>30 to 42)	40 x 40 x 3 (1½ x 1½ x 1/8)	6 (1/4)
>1050 to 1500 (>42 to 60)	40 x 40 x 3 (1½ x 1½ x 1/8)	10 (3/8)
>1500 to 2100 (>60 x 84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8)
>2100 to 2400 (>84 x 96)	50 x 50 x 5 (2 x 2 x 1/8)	10 (3/8)
>2400 (96) and over	50 x 50 x 6 (2 x 2 x ¼)	10 (3/8)

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
    - .1 Acceptable material:
      - .1 Myatt fig. 485
  - .2 For steel joist: manufactured joist clamp or steel plate washer.
    - .1 Acceptable material:
      - .1 Grinnell fig. 61 or 60
  - .3 For steel beams: manufactured beam clamps:
    - .1 Acceptable material:
      - .1 Grinnell Fig. 60

## Part 3 Execution

### 3.1 GENERAL

- .1 The following systems shall conform to these requirements:

System	Class	Material
VAV Supply	A	Galvanized steel
HVAC Supply and Return General Exhaust	B B	Galvanized steel Galvanized steel
Individual Exhaust	C	Galvanized steel

- .2 Do work in accordance with ASHRAE and SMACNA.  
.3 Do not break continuity of insulation vapour barrier with hangers or rods.  
.4 Support risers in accordance with ASHRAE and SMACNA.  
.5 Install breakaway joints in ductwork on each side of fire separation.  
.6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.  
.7 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

### 3.2 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, SMACNA and as follows:

Duct Size	Spacing
mm (")	mm (")
to 1500 (60")	3000 (120")
over 1500 (60")	2500 (100")

- .4 Do not support ductwork over 250 mm x 250 mm (10" x 10") from roof deck.

### 3.3 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.  
.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

### 3.4 LEAKAGE TESTS

- .1 Coordinate leakage testing with TAB contractor **and commissioning agent**. TAB contractor will be responsible for all duct testing.  
.2 Duct to be tested in accordance with SMACNA HVAC Duct Leakage Test Manual.  
.3 Leakage tests to be done in sections.

- .4 Trial leakage tests to be performed as instructed to demonstrate workmanship.
- .5 Install no additional ductwork until trial test has been passed.
- .6 Test section to be minimum of 15 m (50'-0") long with not less than 3 branch takeoffs and two 90° elbows. Maximum test length and area to be determined by BAS testing equipment. Allow for twelve (12) tests.
- .7 Complete test before insulation or concealment.
- .8 Provide all necessary end caps and fittings as required for the TAB contractor. Remove same after successful completion of duct test.
- .9 Pressure test ductwork to 1½ times operating pressure (minimum pressure 500 Pa (2" wc) all systems).

### **3.5 CLEANING**

- .1 Keep ducts clear from dust and debris
- .2 Keep duct liner clean from dust, debris, and moisture.
- .3 At completion of project vacuum ducts if dirt or dust is present.
- .4 Where new systems connect into existing systems the existing systems shall be cleaned and vacuumed prior to reconnection.
- .5 Ensure all systems are clean prior to start up.

### **3.6 ROOF MOUNTED DUCT SUPPORT**

- .1 Provide zero penetration duct support on roof where indicated.
- .2 Base shall be made of high density polypropylene with UV protection.
- .3 Frames shall be galvanized. All fastenings, rods, nuts, washers, etc. shall be stainless steel.
- .4 Provide shop drawings as specified. Install to manufacturers recommendations.
- .5 Acceptable materials:
  - .1 Portable pipe hanger
  - .2 Bigfoot systems
  - .3 Trikon Systems

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .4 ANSI/NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 CSA B228.1, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Flexible connections.
  - .2 Duct access doors.
  - .3 Turning vanes.
  - .4 Instrument test ports.

**1.3 CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**Part 2 Products**

**2.1 GENERAL**

- .1 Manufacture in accordance with CSA B228.1.

**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 -40°C (-40°F) to plus 90°C (194°F), density of 1.3 kg/m.

## 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 (25 gauge) 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 (24 gauge) thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.
- .3 Gaskets: neoprene
- .4 Hardware:
  - .1 Up to 300 mm (12"): 2 sash locks
  - .2 301 mm to 450 mm (13" to 18"): 4 sash locks Complete with safety chain.
  - .3 451 mm to 1000 mm (19" to 40"): piano hinge and minimum 2 sash locks.
  - .4 Doors over 1000 mm (40"): piano hinge and 2 handles operable from both sides.
  - .5 Hold open devices.
- .5 Acceptable materials:
  - .1 Nailor
  - .2 E. H. Price
  - .3 Titus

## 2.4 TURNING VANES

- .1 Factory or shop fabricated double thickness, to recommendations of SMACNA and as indicated.
- .2 Acceptable materials:
  - .1 Duro Dyne
  - .2 Ductmate

## 2.5 INSTRUMENT TEST PORTS

- .1 1.6 mm (16 gauge) thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm (1 1/8") minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable material:
  - .1 Duro Dyne IP1 or IP2
  - .2 Duct mate

## 2.6 PREFABRICATED ROOF CURB

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: 1.3 mm (18 gauge) galvanized steel with raised cant and wood nailer.
- .3 25 mm (1") insulation 3 lbs density.
- .4 Acceptable materials:
  - .1 Greenheck GPR – 600 mm (24") high
  - .2 Penn



**2.7 SPIN-IN COLLAR**

- .1 Construction: galvanized straight or conical spin-in collar complete with spin-in bead and crimped collar connection.
- .2 Provide balancing damper where indicated.
- .3 Acceptable materials:
  - .1 Ecco Manufacturing
  - .2 Flex Master

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Flexible connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans. (Unless internally isolated)
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of connection: 100 mm (4").
  - .3 Minimum distance between metal parts when system in operation: 75 mm (3").
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on each side of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
- .2 Access doors and viewing panels:
  - .1 Size:
    - .1 600 mm x 600 mm (24" x 24") for person size entry.
    - .2 600 mm x 1000 mm (24" x 40") for servicing entry.
    - .3 300 mm x 300 mm (12" x 12") for viewing.
    - .4 As indicated.
  - .2 Location:
    - .1 At fire and smoke dampers.
    - .2 At control dampers.
    - .3 At devices requiring maintenance.
    - .4 At locations required by code.
    - .5 At inlet and outlet of reheat coils.
    - .6 Elsewhere as indicated.
    - .7 Inlet and outlet of duct mounted coils.

- .3 Instrument test ports.
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
    - .2 Locate to permit easy manipulation of instruments
    - .3 Install insulation port extensions as required.
    - .4 Locations.
      - .1 For traverse readings:
        - .1 At ducted inlets to roof and wall exhausters.
        - .2 At inlets and outlets of other fan systems.
        - .3 At main and sub-main ducts.
        - .4 And as indicated.
      - .2 For temperature readings:
        - .1 At outside air intakes.
        - .2 In mixed air applications in locations as approved by Consultant.
        - .3 At inlet and outlet of coils.
        - .4 Downstream of junctions of two converging air streams of different temperatures.
        - .5 And as indicated.
- .4 Turning vanes:
  - .1 Install in accordance with recommendations of SMACNA and as indicated.
  - .2 Install on supply ducts only.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements
- .2 Indicate the following: performance data.

**Part 2 Products**

**2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2 SPLITTER DAMPERS**

- .1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double 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 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened, minimum 1.6 mm (16 gauge).
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").
- .3 Shaft extension to accommodate insulation thickness and locking quadrant.
- .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:
  - .1 50 mm (2") up to 375 mm (15") high duct.
  - .2 100 mm (4") max 400 mm (16") high duct and over.
- .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.
- .7 **Shaft extension to accommodate insulation thickness and locking quadrants.**
- .8 Acceptable materials:
  - .1 Duro Dyne
  - .2 National Controlled Air (NCA)
  - .3 Nailor
  - .4 T.A. Morrison
  - .5 Tamco
  - .6 Ruskin
  - .7 Ventex/Alumavent
  - .8 United Enertech

## 2.5 LOCKING QUADRANTS

- .1 6 mm (1/4") dial regulator with square bearing shaft.
  - .1 18 gauge oval frame, cadmium plated, clearly shows damper position.
  - .2 18 gauge formed handle for easy adjustment.
  - .3 Bolt and wing nut lock damper securely.
  - .4 Offset mounting holes avoid interference with damper movement and mechanical fastening to duct.
- .2 9 mm (3/8") and larger: clamp quadrant with square bearing shaft.
  - .1 Accommodates and securely locks square rod, bearing fitting and adaptor pins.
  - .2 Heavily ribbed 16 gauge steel frame, 3 mm (1/8") thick formed steel handle, cadmium-plated.
  - .3 By tightening nut, bearing is securely locked in handle, preventing slippage and rattle.
  - .4 Neoprene and steel washer assembly seals bearing opening to eliminate air-leakage.
  - .5 Screw holes for mechanically fastening to ductwork.

- .3 High pressure system locking quadrant:
  - .1 Airtight, rattle-proof regulator, designed for ZERO leakage at high pressure. Use for applications up to 500°F constant temperature.
  - .2 Handle design for easy recognition of damper position.
  - .3 Heavy-gauge, zinc-plated steel, 2 high temperature rubber seals and washers, end bearing support, and 2 end bearings. Pressure loss and damper rattle in ductwork has been a constant annoyance for as long as HVAC ductwork has been installed. Now, a truly air-tight, rattle-proof regulator is available. The SPEC-SEAL regulator utilizes a special high-temperature rubber seal to eliminate leakage and rattle even at many times the pressure found in high pressure.
  - .4 Soft, comfortable grip handle with a highly-visible, plastic cover which indicates the damper position.
  - .5 Handle to accommodate 9 mm (3/8") or 12 mm (1/2") to match damper shaft size, square and round bearing shafts.
- .4 Acceptable manufacturers:
  - .1 Duro Dyne
  - .2 Ductmate

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
  - .1 Single blade dampers up to 200 mm (8").
  - .2 Multi-blade dampers over 200 mm (8").
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Leave all dampers in open position for T.A.B.
- .7 Fasten locking quadrants to ductwork and shaft.
- .8 Place locking quadrants on standoffs where ductwork insulated.
- .9 Lock down quadrant arm in the open position.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .3 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies.
- .4 CAN/ULC-S112.1, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .5 ULC-S505, Fusible Links for Fire Protection Service.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Fire dampers.
  - .2 Operators.
  - .3 Firestop flaps.
  - .4 Fusible links.

**1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.4 MAINTENANCE MATERIALS**

- .1 Provide following:
  - .1 6 fusible links of each type.

**1.5 CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**Part 2 Products**

**2.1 FIRE DAMPERS (STATIC)**

- .1 Fire dampers: arrangement as indicated, listed and bear label of ULC, meet requirements of provincial fire authority and authorities having jurisdiction. Fire damper assemblies to be 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.

- .3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; 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 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Acceptable materials:
  - .1 Ruskin
  - .2 Nailor
  - .3 National Controlled Air (NCA)
  - .4 T.A. Morrison
  - .5 Tamco
  - .6 Ventex/Alumavent
  - .7 United Enertech
  - .8 Safeair-Dowco (stainless steel)
  - .9 Greenheck

## **2.2 FIRE DAMPERS (DYNAMIC)**

- .1 Multi blade or roll type, fire damper suitable for HVAC system velocities up to 2000 fpm (610 m/min), dual direction air flow, max 4" wg pressure.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; guillotine type; sized to maintain full duct cross section.
- .4 Stainless closure spring to positively close damper upon fusible link release, for horizontal or vertical orientations.
- .5 Linkage concealed in frame.
- .6 40 mm x 40 mm x 3 mm (1½" x 1½" x 16ga) retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .7 Fire damper assemblies and type to meet requirements of provincial fire authority and authority having jurisdiction.
- .8 Acceptable materials:
  - .1 Ruskin
  - .2 Nailor
  - .3 National Controlled Air (NCA)
  - .4 T.A. Morrison
  - .5 Tamco
  - .6 Greenheck
  - .7 Ventex/Alumavent

**2.3 FIRE STOP FLAPS**

- .1 To be ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.1.
- .2 Construct of minimum 1.5 mm (16 gauge) thick sheet steel with 1.5 mm (16 gauge) thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74°C (165°F).

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Provide where indicated and at all fire rated partitions indicated, on architectural drawing.
- .2 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .3 Maintain integrity of fire separation.
- .4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .5 Install access door adjacent to each damper.
- .6 Coordinate with installer of firestopping.
- .7 Static fire dampers: Only on transfer air ducts where ductwork is not connected to a fan/blower.
- .8 Dynamic fire dampers: In all duct work where air is moved by a fan/blower.

**END OF SECTION**



**Part 1 General**

**1.1 GENERAL**

- .1 This section applies to operating dampers not specified in Controls Section.

**1.2 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

**1.3 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Performance data.

**1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.5 CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

**Part 2 Products**

**2.1 MOTORIZED DAMPERS**

- .1 Opposed blade type.
- .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: Refer to BAS Section.
- .6 Performance:
  - .1 Leakage: in closed position to be less than 2% of rated air flow at 250 kPa (36 psi) differential across damper.
  - .2 Pressure drop: at full open position to be less than 100 kPa (15 psi) differential across damper.

- .7 Insulated aluminum dampers:
  - .1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.
  - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.
  - .3 Use on services to the exterior.
- .8 Acceptable materials:
  - .1 Honeywell
  - .2 Johnson
  - .3 T. A. Morrison
  - .4 National Controlled Air (NCA)
  - .5 Tamco
  - .6 Ruskin
  - .7 Nailor
  - .8 Henderson Industrial
  - .9 Ventex/Alumavent

## **2.2 RELIEF DAMPERS**

- .1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open at 100 Pa (0.4" w.c.) static pressure, (adjustable).
- .2 Acceptable material:
  - .1 T. A. Morrison
  - .2 Henderson Industrial
  - .3 Ventex/Alumavent

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Duct Accessories Section.
- .5 Insulated dampers on all outside air intake and exhaust damper.
- .6 Non-insulated dampers on all interior motorized dampers not exposed to outside air.

### **3.2 GENERATOR DAMPER OPERATION**

- .1 On start of generator outdoor air opens to 100% (2-position).
- .2 As room temperature increases (80°F) recirc air damper modulates closed and exhaust air damper modulates open.
- .3 On generator shutdown, outside air and exhaust air damper close and recirc air damper opens.

**3.3 ELECTRICAL ROOM DAMPER OPERATION**

- .1 Outdoor air damper modulates open on increase of room temperature above 80°F.
- .2 When damper is fully open end switch start exhaust fan.
- .3 When temperature reaches below setpoint damper is closed and exhaust fan off.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
- .3 UL 181, Factory Made Air Ducts and Air Connectors.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .6 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

**1.2            PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Thermal properties.
  - .2 Friction loss.
  - .3 Acoustical loss.
  - .4 Leakage.
  - .5 Fire rating.

**1.3            CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**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 NON-METALLIC – UNINSULATED**

- .1 Non-collapsible, coated aluminum foil mylar type, mechanically bonded to, and helically supported by, external steel wire, Class 1 duct material.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.
  - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
  - .1 Flexmaster FAB-3
  - .2 Ductmate

**2.3 NON-METALLIC – INSULATED**

- .1 Non-collapsible, coated aluminum foil mylar type mechanically bonded to, and helically supported by, external steel wire with factory applied, 25 mm (1") thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, Class 1 duct material.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.
  - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
  - .1 Flexmaster FAB 3T
  - .2 Ductmate

**2.4 METALLIC – UNINSULATED**

- .1 Spiral wound flexible aluminum, Class 1 duct material.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.
  - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
  - .1 Flexmaster T/L
  - .2 Ductmate

**2.5 METALLIC –INSULATED**

- .1 Spiral wound flexible aluminum with factory applied, 25 mm (1") thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, Class 1 duct material.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa (10" w.c.) without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.
  - .3 Operating pressure: 300 mm (12").
- .3 Acceptable materials:
  - .1 Flexmaster T/L – VT
  - .2 Ductmate

**2.6 METALLIC – ACOUSTIC with POLY COVER**

- .1 Spiral wound perforated flexible aluminum, wrapped in 1" thick fiberglass insulation and covered with a flame retardant non-toxic polyethylene vapour barrier.
- .2 Performance:
  - .1 Factory tested to 0.5 kPa and 0.25 kPa pressure with no leakage.
- .3 Acceptable material:
  - .1 Flexmaster T/L-A.

**2.7 METALLIC – ACOUSTIC with ALUMINUM COVER**

- .1 Spiral wound perforated flexible aluminum, wrapped in 1" thick fiberglass insulation and covered with a spiral wound flexible aluminum duct.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa positive pressure and 0.25 kPa negative pressure without leakage.
- .3 Acceptable material:
  - .1 Flexmaster T/L-A-T/L.

**Part 3            Execution**

**3.1                DUCT INSTALLATION**

- .1      Install in accordance with: SMACNA.
- .2      Maximum length of flexible duct: 1.8 m (6' 0").
- .3      Minimum length of acoustical ductwork; 1.5 m (5' 0") with minimum of 1 bend.
- .4      Provide support at centre of flexible duct with 25 mm (1") wide galvanized hanger.
- .5      **Insulated flexible ductwork in areas where ceilings are not utilized as return air plenums.**
- .6      **Uninsulated flexible ductwork in areas where ceilings are utilized as return air plenums.**

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .3 ASTM C553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .4 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
- .6 **ASTM C177, Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.**
- .7 **CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.**

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.

**Part 2 Products**

**2.1 DUCT LINER**

- .1 General:
  - .1 Rigid fibrous glass duct liner: air stream side faced with 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.
  - .3 Acceptable material:
    - .1 Johns Manville, Permacote Linacoustic R-300
    - .2 Owen Corning
- .2 Rigid:
  - .1 Use on flat surfaces.
  - .2 25 mm (1") thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
  - .3 Density: 36 kg/m<sup>2</sup> (7.4 lb/ft<sup>2</sup>).
  - .4 Thermal resistance to be minimum 750 mm (30") C/W for 25 mm (1") thickness 1150 mm (45") C/W for 40 mm (1½") thickness when tested in accordance with ASTM C177, at 24°C (75°F) mean temperature.



**2.2 ADHESIVE**

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -29°C (-20°F) to 93°C (200°F).
- .3 Acceptable material:
  - .1 Duro Dyne 1A-22
  - .2 Ductmate

**2.3 FASTENERS**

- .1 Weld pins 2.0 mm (14 gauge) diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1¼") square.
- .2 Acceptable material:
  - .1 Duro Dyne
  - .2 Ductmate

**2.4 JOINT TAPE**

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm (2") wide.
- .2 Acceptable materials:
  - .1 Duro Dyne FT2
  - .2 Ductmate

**2.5 SEALER**

- .1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68°C (-90°F) to 93°C (200°F).
- .3 Acceptable materials:
  - .1 Duro Dyne 1A-94
  - .2 Ductmate

**Part 3 Execution**

**3.1 GENERAL**

- .1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.
- .4 Provide an interior of ductwork from fans from minimum distance of 3 m (10'-0").

**3.2 DUCT LINER**

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 300 mm (12") on centres.
- .2 Weld pins are to have cupped or beveled heads to prevent damage to lining surface.
- .3 Store foam liners away from sunlight.

**3.3 JOINTS**

- .1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's 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 Consultant.
- .3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm (1/2") overlap and fastened to duct.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 AMCA 99, Standards Handbook.
- .3 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .4 AMCA 300, Revised 1987, Reverberant Room Method for Sound Testing of Fans.
- .5 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .6 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Certified Aerodynamics Performance Rating.
- .7 ANSI/NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.
- .2 Product data to include fan curves and sound rating data.

**1.3 OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for incorporation into manual specified in general requirements.

**1.4 CERTIFICATION OF RATINGS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

**Part 2 Products**

**2.1 FANS GENERAL**

- .1 Capacity: flow rate, total static pressure Pa, r/min, W (" w.c., r/min, bhp) model and size and sound ratings as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

- .5 Bearings: sealed lifetime of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 100,000 h in accordance with AFBMA L10 life standard. Bearings to be rated and selected in accordance with AFBMA 9 and AFBMA 11.
- .6 Provide vibration isolation hangers/pads for all fans.
- .7 Electrical components and motors within the airstream shall be classified for use in a Class I, Zone 2 system (as defined by the Electrical Safety Code) when connected to ductwork systems served by refrigerant containing air handling systems.
- .8 Acceptable materials:
  - .1 Greenheck
  - .2 Penn-Barry
  - .3 Cook
  - .4 Jenco (S & P)/Jenn
  - .5 Carnes
  - .6 Acme
  - .7 Zonex
  - .8 Nutone (Range hood)
  - .9 Broan (Range hood)
  - .10 Twin-City
  - .11 Reversomatic
  - .12 Fantech
  - .13 Aerovent
- .9 Provide factory mounted speed control for all direct drive motors.

## **2.2 CABINET FANS – IN-LINE**

- .1 Fan characteristics and construction: as centrifugal fans.
- .2 Casing floor mounted or cabinet hung single inlet aluminum wheel in factory fabricated casing complete with vibration isolators and seismic control measures, motor, V-belt drive and guard inside or outside casing as indicated.
- .3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Uncoated, steel parts shall be painted over with corrosion resistant paint to CAN/CGSB 1.181. Internally line cabinet with 25 mm (1") thick rigid acoustic insulation, pinned and cemented bell mouth inlet cone.
- .4 Size, type, and capacity: as indicated.

**2.3 CEILING DISCHARGE FANS**

- .1 Centrifugal direct drive, with plug in type electric motor suitable for ceiling installation, zinc coated rectangular metal housing.
- .2 Sizes and capacity: as indicated.
- .3 Toggle switch operated complete with integral electrical outlet box with plug-in type receptacle.
- .4 Side duct outlet with integral backdraft damper, size as indicated.
- .5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.
- .6 Silver anodized aluminum grille paint finish.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide flexible duct connection for all fans.
- .3 Provide backdraft damper at building exterior penetration.
- .4 Provide and install vibration isolation.
- .5 Provide and install roof curb for all roof mounted fans.
- .6 Provide and install sleepers for utility set style roof mounted fans; provide roof curb for duct penetration.

**3.2 WARRANTY**

- .1 Warranty Start Date:
  - .1 Warranty period starts as of the date of Ready for Takeover.
  - .2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.
- .2 Warranty Duration:
  - .1 One (1) year warranty period applies.
- .3 Warranty Coverage:
  - .1 Applies to parts and labour.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Performance data.
  - .2 Noise data.
  - .3 Physical dimensions.

**1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.4 CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by an independent testing agency.

**Part 2 Products**

**2.1 VARIABLE AIR VOLUME BOXES**

- .1 Single duct, variable volume air distribution assemblies of the sizes and capacities as shown on the plans.
- .2 The assemblies shall be pressure independent and shall reset to any air flow between zero and the maximum catalogued air volume.
- .3 At an inlet velocity of 610 m/min (2,000 fpm), the differential static pressure for any unit with attenuator section, sizes 4 through 16, shall not exceed 25 Pa (0.10" w.c.).
- .4 Sound ratings of air distribution assemblies, shall not exceed 30 NC at 25 Pa (0.10" w.c.) static pressure.
- .5 Pressure shall be ARI Certified.
- .6 The air flow sensor shall be of a cross configuration located at the inlet of the assembly and shall have multiple pickup points, designed to average the flow across the inlet of the assembly. The air flow sensor shall amplify the sensed air flow signal.
- .7 Provide a discharge air temperature sensor on discharge of VAV box. Temperature sensor shall be capable of display on BAS.

- .8 The assembly casing shall be constructed of 0.7 mm (22 gauge) zinc coated steel, internally lined with 20 mm (¾") thick, dual density fiberglass insulation, which complies with UL-181 and NFPA-90A. Any cut edges of fiberglass exposed to the air stream shall be coated with NFPA-90A approved sealant.
- .9 The primary air valve damper shall be heavy gauge metal, with peripheral gasket, pivoted in self-lubricating bearings. In the full closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalogue rating at 750 Pa (3" w.c.) inlet static pressure, as rated by ARI Standard 880.
- .10 Provide 900 mm (36") long discharge sound attenuator for each unit.
- .11 Provide hot water reheat coil mounted in 0.7 mm (22 gauge) galvanized steel housing. Reheat coil to have copper tubes, aluminum fins with O.D. sweat connections, and quick opening cam lock access door. Refer to schedule for reheat coil requirements. Provide minimum 2 row coil.
- .12 DDC controls including controller, flow transducer, electric actuator and protective shroud if required to be provided by controls manufacturer.
- .13 Terminal unit manufacturer shall factory mount controller and actuator including tubing from cross flow sensor to controls, wiring controller to motor and calibration.
- .14 Size and capacity: as indicated.
- .15 Acceptable materials:
  - .1 E.H. Price SDV
  - .2 Nailor
  - .3 Titus
  - .4 Krueger
  - .5 Carnes
  - .6 Metalaire

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Install quick opening access door (with sash locks) adjacent to each damper.
- .4 Install controls as per manufacturer's requirements.
- .5 Install with at least 100 mm (4") of flexible inlet ducting.

**END OF SECTION**

**Part 1 General**

**1.1 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

**1.2 MAINTENANCE MATERIALS**

- .1 Include:
  - .1 Keys for volume control adjustment.
  - .2 Keys for air flow pattern adjustment.

**1.3 MANUFACTURED ITEMS**

- .1 Grilles, registers, and diffusers of same generic type to be product of one manufacturer.

**1.4 CERTIFICATION OF RATINGS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**Part 2 Products**

**2.1 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 operators.
- .4 Colour and Finish: standard as directed by Consultant.



.5 Acceptable materials:

- .1 E.H. Price
- .2 Nailor
- .3 Krueger
- .4 Titus
- .5 Carnes
- .6 Seiho
- .7 Metalaire

## **2.2 SUPPLY GRILLES AND REGISTERS**

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.
- .2 Type, size, and capacity: as indicated.

## **2.3 RETURN AND EXHAUST GRILLES**

- .1 General: with opposed blade dampers as indicated, concealed manual operator and gaskets.
- .2 Type, size, and capacity: as indicated.

## **2.4 DIFFUSERS**

- .1 General: volume control dampers with flow straightening devices and blank-off quadrants, as indicated and gaskets.
- .2 Type, size, and capacity: as indicated.

## **2.5 OPEN MESH SCREEN**

- .1 15 mm x 15 mm (½"x ½") open mesh screen fastened on 25 mm (1") border, screw fasten.
- .2 On all open ends of ductwork and where indicated.
- .3 Size: To match ductwork size.

## **2.6 DOOR GRILLES**

- .1 Heavy duty steel construction, sight proof, complete with flat border both sides, screwed fastening. Finish by Consultant.
- .2 Install door grille in door.
- .3 Acceptable manufacturer:
  - .1 EH Price STG-1BF.

**2.7            INSTALLATION**

- .1      Install in accordance with manufacturer's instructions.
- .2      Install with flat head screws in countersunk holes where fastenings are visible.
- .3      Bolt grilles, registers and diffusers, in place
- .4      Provide concealed safety chain on each grille, register and diffuser in gymnasium, similar game rooms, and on exposed diffusers, and elsewhere as indicated.
- .5      Clean grilles upon completion.
- .6      Paint ductwork beyond grilles, matte black where visible.
- .7      Ensure all grilles, diffusers, etc. match opening sizes as indicated on the drawings and as fabricated on site by the contractor.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, and Elements.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with general requirements.
- .2 Indicate the following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.
  - .4 Colour and finish.

**1.3 CERTIFICATION OF RATINGS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**1.4 TEST REPORTS**

- .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

**Part 2 Products**

**2.1 FIXED LOUVRES – ALUMINUM**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm (60").
- .4 Frame, head, sill and jamb: 100 mm (4") deep one piece extruded aluminum, minimum 3 mm (1/8") thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm (60") maximum centres.
- .6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 15 mm (1/2") exhaust 20 mm (3/4") intake mesh, 2 mm (5/64") diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: Kynar 500  
Colour: to Consultant's approval.

.9 Acceptable materials:  
.1 Greenheck  
.2 Construction Specialties  
.3 E.H. Price  
.4 Krueger  
.5 Ruskin  
.6 Ventmaster  
.7 Ventex  
.8 Nailor

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 In accordance with manufacturers and SMACNA recommendations.
- .2 Reinforce and brace air vents, intakes and goosenecks as indicated.
- .3 Anchor securely into opening.
- .4 Seal with caulking all around to ensure weather tightness.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 All codes, standards, etc. as referenced shall be the latest edition.
- .2 ANSI/ARI 210/240, Unitary Air-Conditioning, and Air-Source Heat Pump Equipment.
- .3 ARI 270, Standard for Sound Rating of Outdoor Unitary Equipment.
- .4 CSA C22.1, Canadian Electrical Code, Part 1.
- .5 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .6 ANSI/UL 1995, Central Cooling Air Conditioning.
- .7 AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
- .8 AMCA 99 – Standards Handbook
- .9 AMCA 500 – Test Methods for Louver, Dampers, and Shutters.
- .10 AHRI 340/360 – Unitary Large Equipment.
- .11 NEMA MG1 – Motors and Generators.
- .12 National Electrical Code.
- .13 NFPA 70 – National Fire Protection Agency.
- .14 SMACNA – HVAC Duct Construction Standards – Metal and Flexible.
- .15 UL 900 – Test Performance of Air Filter Units.
- .16 C.1 CSA B52-2023, Mechanical Refrigeration Code
- .17 C.2 CAN/CSA-C22.2 No 60335 Safety of Household and similar electrical appliances – Heat Pumps, Air-conditioners and dehumidifiers

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with general requirements.
- .2 Indicate:
  - .1 Equipment, and connections, together with control assemblies, 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 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.

- .5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, controllers.
- .6 Details of vibration isolation.
- .7 Estimate of sound levels to be expected across each individual octave band in dB referred to A rating.
- .8 Type of refrigerant used (A1 or A2L type only).

### **1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.
- .2 Indicate:
  - .1 Brief description of unit, indexed, with details of function, operation, control, and service for each component.
- .3 Manufacturer's installation instructions shall govern and unless otherwise noted, operation, maintenance, and service of items. Include names and addresses of spare part suppliers.
- .4 Include following:
  - .1 Provide for each unit, manufacturer's name, type, year, number of units, and capacity.

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 Aeon
- .2 Daikin Applied DPS (Vision)
- .3 Valent

### **2.2 GENERAL DESCRIPTION**

- .1 Furnish as shown on plans, Single zone Heating and Cooling Unit(s). Unit performance and electrical characteristics shall be per the job schedule
- .2 Configuration: Fabricate as detailed on prints and drawings:
  - .1 Return plenum/economizer section complete with power exhaust
  - .2 Filter section
  - .3 Cooling coil section
  - .4 Supply fan section
  - .5 Condensing unit section
- .3 The complete unit shall be cETLus listed.
- .4 The unit shall be ASHRAE 90.1-2016 compliant and labeled.

- .5 Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with refrigerant and oil.
- .6 The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
- .7 All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up report forms shall be supplied with each unit.
- .8 Efficiency:
  - .1 Units under 5 tons of cooling meet a SEER rating of 14.0.
  - .2 Units 6 tons of cooling and larger meeting an EER rating of 12.0 (9.6 for 12 ½ ton unit).
  - .3 Electronic controls with data link and diagnostic operation.
  - .4 Energy Star rated.

## **2.3 CABINET, CASING, AND FRAME**

- .1 Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 2" thick with an R-value of 13.0 and shall be 2-part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.
- .2 Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat
- .3 Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless-steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.
- .4 The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

## 2.4 OUTDOOR/RETURN AIR SECTION

- .1 Unit shall be provided with an outdoor air economizer section. The economizer section shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in accordance with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges.
- .2 Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.
- .3 Unit shall be provided with a 100% outdoor air hood. The 100% outdoor air hood shall allow outdoor air to enter from the back of the unit, at the draw-through filter section. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.

## 2.5 ENERGY RECOVERY

- .1 The rooftop unit shall be provided with an AHRI certified rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt. The energy recovery wheel shall be an integral part of the rooftop unit with unitary construction and does not require field assembly. Bolt-on energy recovery units that require field assembly and section to section gasketing and sealing are not acceptable.
- .2 The wheel capacity, air pressure drop, and effectiveness shall be AHRI certified per AHRI Standard 1060. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
- .3 The rooftop unit shall be designed with a track so the entire energy recovery wheel cassette can slide out from the rooftop unit to facilitate cleaning.
- .4 The unit shall have 2" Merv 7 filters for the outdoor air before the wheel to help keep the wheel clean and reduce maintenance. Filter access shall be by a hinged access door with ¼ turn latches.



- .5 The matrix design shall have channels to reduce cross contamination between the outdoor air and the exhaust air. The layers shall be effectively captured in aluminum and stainless-steel segment frames that provide a rigid and self-supporting matrix. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belt(s) of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
- .6 The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
- .7 Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning.
- .8 Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel. Wheels shall be connected to the shaft by means of taper lock hubs.
- .9 The exhaust air fan shall be a direct drive SWSI plenum fan. The exhaust fan shall be sized for the airflow requirements per the construction schedule. The unit controller shall control the exhaust fan to maintain building pressure. A VFD shall be provided for the exhaust fan motor, or the exhaust fan motor shall be an ECM motor. The rooftop unit shall have single point electrical power connection and shall be ETL listed.
- .10 The control of the energy recovery wheel shall be an integral part of the rooftop unit's DDC controller. The DDC controller shall have visibility of the outdoor air temperature, leaving wheel temperature, return air temperature, and exhaust air temperature. These temperatures shall be displayed at the rooftop units DDC controller LCD display. All of these temperatures shall be made available through the BACnet interface.
- .11 The rooftop unit DDC controller shall provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall (stop, slow down) the wheel. When in the frost control mode, the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

## **2.6 FILTERS**

- .1 Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" prefilter and a 4" post filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2" MERV 8 construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.
- .2 Provide two (2) sets of final filters.

## **2.7 COOLING COIL**

- .1 The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.
- .2 The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.
- .3 The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.
- .4 The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.
- .5 The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

## **2.8 HOT GAS REHEAT DEHUMIDIFICATION CONTROL (OPTION)**

- .1 Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser.
- .2 Hot gas reheat coil shall be a microchannel design. The aluminum tube shall be a microchannel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.
- .3 The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature setpoints shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.
- .4 Each coil shall be factory leak tested with high-pressure air under water.

## **2.9 SUPPLY FAN**

- .1 Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.
- .2 All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

- .3 Supply fan and motor assembly combinations larger than 8 hp or 22" diameter shall be internally isolated on 1" deflection, spring isolators and include removable shipping tie downs.
- .4 **Units 15 tons and under:** the fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.
- .5 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

## 2.10 VARIABLE AIR VOLUME CONTROL

- .1 The unit manufacturer shall install all power and control wiring.
- .2 **Units 15 tons and under:** the unit controller shall proportionally control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.

## 2.11 HEATING SECTION

- .1 Gas Heat
  - .1 The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.
  - .2 Each module shall have minimum four (4) stages of heating control for units under 15 tons and be modulating for larger units.
  - .3 The heat exchanger tubes shall be constructed of stainless steel.
  - .4 The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.
  - .5 Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.
  - .6 The factory installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

## **2.12 HEAT PUMP HEATING**

- .1 The evaporator coil, condenser coil, compressors and refrigerant circuit shall be designed for heat pump operation. The refrigerant circuit shall contain a 4-way reversing valve for the heat pump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.
- .2 The refrigerant system shall have a pump-down cycle.
- .3 The unit shall have a natural gas furnace for hybrid heating. When the heat pump operation cannot maintain the discharge air temperature setpoint the natural gas furnace shall temper the airstream to the discharge air temperature setpoint.

## **2.13 CONDENSING SECTION**

- .1 Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.
- .2 Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of (0,25)-120°F. Mechanical cooling shall be provided to (0, 25) ° F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.
- .3 The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material
- .4 The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and low oil safety protection.
- .5 Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.
- .6 Each circuit shall be dehydrated, and factory charged with refrigerant and oil.
- .7 Refrigerant to be A1 or A2L classification.

**2.14 REFRIGERATION DETECTION SYSTEM:**

- .1 The Refrigerant detection system shall meet the requirements of CSA B52 and have the following functionality:
  - .1 Utilize a set point, nonadjustable in the field, to generate a digital output signal to initiate mitigation actions to both internal safeties and external components in the ductwork (dampers, electric coils etc.). Signal shall be generated in not more than 30 seconds from sensor exposure to refrigerant concentration of 25% LFL (+0%, -1%)
  - .2 Sensor within the equipment, near potential source of leaks.
  - .3 Field calibration of the system is not allowed.
  - .4 Be capable of detecting the refrigerant used in the system.
  - .5 Have self diagnostics
  - .6 Energize fans upon failure of a self-diagnostic check
  - .7 Activate refrigerant safety shut off valves in the event of a leak being detected.

**2.15 ELECTRICAL**

- .1 Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 120-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.
- .2 **Kilo Ampere Interrupting Capacity (kAIC) Rating**
  - .1 **Equipment shall be rated a interrupting capacity rating of 25 kAIC.**
  - .2 **All products supplied to the site shall meet or exceed this kAIC rating.**
  - .3 **The kAIC rating may be lowered to match or exceed the available fault current indicated on the Short Circuit Co-ordination Study completed by the electrical trade.**

**2.16 CONTROLS**

- .1 Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

- .2 The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in non-volatile memory. No settings shall be lost, even during extended power shutdowns.
- .3 The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/ disable, heat indication, cool indication, and fan operation.
- .4 All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.
- .5 The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in non-volatile memory to ensure that it is not lost during a power failure. There shall be one start/stopper per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.
- .6 The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:
  - .1 Return air temperature.
  - .2 Discharge air temperature.
  - .3 Outdoor air temperature.
  - .4 Space air temperature.
  - .5 Outdoor enthalpy, high/low.
  - .6 Compressor suction temperature and pressure.
  - .7 Compressor head pressure and temperature.
  - .8 Expansion valve position.
  - .9 Condenser fan speed.
  - .10 Inverter compressor speed.
  - .11 Dirty filter indication.
  - .12 Airflow verification.
  - .13 Cooling status.
  - .14 Control temperature (changeover).
  - .15 VAV box output status.

- .16 Cooling status/capacity.
- .17 Unit status.
- .18 All time schedules.
- .19 Active alarms with time and date.
- .20 Previous alarms with time and date.
- .21 Optimal start.
- .22 Supply fan and exhaust fan speed.
- .23 System operating hours.
  - .1 Fan
  - .2 Exhaust fan
  - .3 Cooling
  - .4 Individual compressor
  - .5 Heating
  - .6 Economizer
  - .7 Tenant override
- .7 The user interaction with the keypad shall provide the following:
  - .1 Controls mode
    - .1 Off manual
    - .2 Auto
    - .3 Heat/Cool
    - .4 Cool only
    - .5 Heat only
    - .6 Fan only
  - .2 Occupancy mode
    - .1 Auto
    - .2 Occupied
    - .3 Unoccupied
    - .4 Tenant override
  - .3 Unit operation changeover control
    - .1 Return air temperature
    - .2 Space temperature
    - .3 Network signal
  - .4 Cooling and heating change-over temperature with deadband
  - .5 Cooling discharge air temperature (DAT)
  - .6 Supply reset options
    - .1 Return air temperature
    - .2 Outdoor air temperature
    - .3 Space temperature
    - .4 Airflow (VAV)

- .5 Network signal
  - .6 External (0-10 vdc)
  - .7 External (0-20 mA)
- .7 Temperature alarm limits
  - .1 High supply air temperature
  - .2 Low supply air temperature
  - .3 High return air temperature
- .8 Lockout control for compressors.
- .9 Compressor interstage timers
- .10 Night setback and setup space temperature.
- .11 Building static pressure.
- .12 Economizer changeover
  - .1 Enthalpy
  - .2 Drybulb temperature
- .13 Currently time and date
- .14 Tenant override time
- .15 Occupied/unoccupied time schedule
- .16 One event schedule
- .17 Holiday dates and duration
- .18 Adjustable set points
- .19 Service mode
  - .1 Timers normal (all time delays normal)
  - .2 Timers fast (all time delays 20 sec)
- .8 If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
  - .1 Zone sensor with tenant override switch
  - .2 Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)
- .9 To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:
  - .1 Airflow
  - .2 Outside air temperature
  - .3 Space temperature
  - .4 Return air temperature
  - .5 External signal of 1-5 vdc
  - .6 External signal of 0-20 mA
  - .7 Network signal



**2.17 SYSTEM CONTROL**

- .1 Equipment control will be by the unit manufacturer and integral economizer controls.
- .2 System controls will be by Building Automation System Contractor.
- .3 **BAS contractor to provide outside air damper motor for control of outside air.**
- .4 **Provide unit manufacturer programmable room thermostat with fan switching and locking cover. All control wiring shall be by this contractor.**

**2.18 CAPACITY**

- .1 As indicated.

**2.19 ACCESSORIES**

- .1 600 mm (24") high roof curb.
- .2 Leveling curb on sloped roof.
- .3 Vibration rail.
- .4 Opposed blade economizer dampers.
- .5 Condenser coil hail guard.
- .6 Power exhaust on units nominal 10 tons and larger (with field installed wiring).
- .7 Stainless steel vertical extension on flue gas discharge.
- .8 Stainless steel heat exchanger.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer as indicated. Provide all necessary continuous wolmanized wood blocking to install roof curb level complete with 20 gauge liner to ensure combustible wood blocking is not exposed in the building.
- .2 Manufacturer to certify installation, supervise start-up and commission unit.
- .3 Run drain line from cooling coil condensate drain pan to discharge over roof drain.

**3.2 START-UP/COMMISSIONING**

- .1 Unit manufacturer shall perform start-up and commissioning.

**3.3 ELECTRICAL REQUIREMENTS**

- .1 Field installed devices.
  - .1 Provide all field installed wiring required for all units that are equipped with power exhaust. Provide transformers as required.
- .2 Mount all accessories shipped loose onto the units.

### **3.4 REFRIGERANT LEAK DETECTION SYSTEM**

- .1 This contractor shall provide all wiring between leak detection systems installed within the provided equipment and system components in the spaces served and ductwork system.
- .2 Specifically, the following shall occur for each independent system on registration of a refrigerant leak:
  - .1 Open all zone dampers in the affected system.
  - .2 Disable all electric reheat coils within the affected system.
  - .3 Activate field installed safety shut off valves within the affected refrigeration system.
  - .4 Energize all fans within the affected ductwork system.
  - .5 Activate and refrigerant leak system specific ventilation systems.
  - .6 De-energize any other potential sources of ignition within the affected system.
- .3 All interlocks between field installed detection systems and associated safety system components shall be tested and verified to operate as per the requirements of CSA B52.

### **3.5 TRAINING**

- .1 Provide 2 hours training to owner's staff on the care, maintenance and operation of the equipment. Dedicated visit to site is required as it will not be paired with equipment startup.

### **3.6 SPARE PARTS**

- .1 Two (2) complete sets of filters.
- .2 One (1) set of spare belts.

### **3.7 WARRANTY**

- .1 Warranty Start Date:
  - .1 Warranty period starts as of the date of Ready for Takeover.
  - .2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.
- .2 Warranty Duration:
  - .1 One (1) year on parts and labour on all components.
  - .2 Five (5) years on compressor.
  - .3 Ten (10) years on stainless steel heat exchanger.
  - .4 Manufacturer hereby warrants refrigeration compressors in accordance with GC 24, but for five (5) years.
  - .5 Manufacturer hereby warrants the gas heat sections for a minimum of ten (10) years.

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with general requirements.

**1.2 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in general requirements.

**1.3 MANUFACTURED ITEMS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

**Part 2 Products**

**2.1 DIRECT STEAM INJECTION TYPE**

- .1 Include:
  - .1 Stainless steel jacketted duct distribution manifolds. Number to suit duct shape and size.
  - .2 Steam separator with baffle.
  - .3 Steam control valve with pneumatic electric actuator, field factory installed for modulating on-off control.
  - .4 Steam trap assembly: as recommended by manufacturer.
  - .5 Capacity:
    - .1 As indicated
- .2 Acceptable materials:
  - .1 Condiar
  - .2 Armstrong
  - .3 Nortec

**2.2 PACKAGED ELECTRODE STEAM GENERATING TYPE**

- .1 CSA certified and ULC listed.
- .2 All components housed in factory fabricated cabinet with factory enameled finish and electrically interlocked door.
- .3 Factory sealed disposable steam cylinder complete with factory installed electrodes to suit water condition.

- .4 Controls:
  - .1 Solid state panel.
  - .2 Solenoid valve on water and drain lines.
  - .3 Wall (Duct) humidistat.
  - .4 Airflow proving switch.
  - .5 Adjustable flush cycle timer.
  - .6 Amp meter.
  - .7 Cylinder replacement indicator light.
  - .8 High limit switch.
- .5 Duct distribution header complete with condensate drain and supply hose.
- .6 Acceptable Materials:
  - .1 Condair RS Series
  - .2 Nortec NH 075
  - .3 DRI Steem
- .7 Capacity: as indicated.
- .8 Electrical: as indicated.

## **2.3 WATER TREATMENT SYSTEM**

- .1 Provide reverse osmosis water treatment system to suit steam humidifier requirements.
- .2 System shall include:
  - .1 Reverse osmosis manifold.
  - .2 Reverse osmosis cartridges.
  - .3 Reverse osmosis pressure tank.
  - .4 Leak detector.
  - .5 Water filters.
- .3 Acceptable Manufacturer:
  - .1 Condair RO-A Series
  - .2 Nortec
  - .3 Dristeem

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturers instructions.
- .2 Humidifier and evaporator media to be new and clean when project is accepted.
- .3 Install humidistat as indicated
- .4 Water service overflow drain: as indicated and to manufacturers' recommendation.
- .5 Install in accessible location.

- .6 Install access doors or panels in adjacent ducting.
- .7 When installing in ducting, provide waterproof duct up and downstream in accordance with ductwork.
- .8 Install capped drain connection at low point in duct.

### **3.2 TRAINING**

- .1 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers.
  - .1 Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
  - .2 Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
  - .3 Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

### **3.3 WARRANTY**

- .1 Warranty Start Date:
  - .1 Warranty period starts as of the date of Ready for Takeover.
  - .2 Warranty start dates based on shipment date, start up date, substantial completion date, etc. are not applicable.
- .2 Warranty Duration:
  - .1 One (1) year warranty period applies.
  - .2 Descaling electrode humidifier: two (2) year warranty.
- .3 Warranty Coverage:
  - .1 Applies to parts and labour.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Conform to the General Mechanical requirements.
- .2 Conform to the General Electrical requirements.

**1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- .1
- .2 Ductwork Accessories:
  - .1 Airflow Stations
  - .2 Terminal Unit Controls.

**1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION**

- .1 Rooftop Air-Handling Equipment:
  - .1 Thermostats

**1.4 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION**

- .1 Rooftop Air-Handling Equipment:
  - .1 Discharge Air Temperature Control
  - .2 Economizer Control
  - .3 Volume Control
- .2 VAV Terminal Units:
  - .1 Cross-Flow Velocity Sensor
- .3 Variable Frequency Drives.

**1.5 DESCRIPTION**

- .1 General: The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and remote access thru the internet using a PC. Thru the WEB, a PC shall allow a user to interface with the network via dynamic color graphics. Each mechanical system, building floor plan, and control device will be depicted by point-and-click graphics. A WEB access will be provided for remote access to the network and for paging the operators when an alarm occurs.
- .2 The system will directly control
  - .1 Each existing and new air-handling unit by maintaining discharge air temperature, duct and building static pressure, and outside air economizer control.
  - .2 The existing hot water boiler plant and pumping system will operate to reset the hot water supply temperature based upon outside air temperature and pump lead-lag control.

- .3 Each terminal variable air volume (VAV) and fan-powered VAV unit will be controlled by individual DDC zone controllers networked with the primary DDC panels.
- .4 Each zone controller will provide for occupied/unoccupied mode of operation by individual zone.
- .5 For energy conservation, the system will be programmed for optimal Start/Stop, night setback, and night purge control.
- .6 Lighting control.
- .7 Fire alarm monitoring.
- .8 Security system arm/disarm, monitoring of exterior lights.
- .9 Terminal heating devices (force flow, perimeter radiation, unit heaters, etc.).
- .10 Domestic hot water recirc pump.
- .11 All existing exhaust fans.
- .3 The system will provide for future expansion.
- .4 Phase 2 of this project will include a renovation of the Warehouse Area (TDC) and a truck storage facility. This proposed Building Automation System shall be capable of accommodating the future developments.

#### **1.6 EXISTING BUILDING**

- .1 The existing building currently has a controls system by automated logic.
- .2 This renovation shall be an expansion of the existing automated logic control system.
- .3 The successful contractor shall locate the communication line and identify its entire length with yellow caution tape. The successful contractor shall maintain it during construction and verify proper operation after construction. Educate other trades and repair all damages that may have occurred.
- .4 Relocate controls and wiring to accommodate new services being installed i.e. ductwork, piping, etc.
- .5 Non compatible manufacturers shall provide their own communication loop in the building for their new services. Wherever possible both communication loops shall be beside each other.
- .6 Non compatible manufacturers (i.e. Siemens and Tour Anderson) shall be in addition to providing graphics. Provide for a monolithic programming so the operator does not have to alter between software programs. All systems shall be graphically shown on the same floor plan of the building.
- .7 The new building automation system (BAS) shall be open protocol using BACnet communication. Only systems that built on the Niagara 4 Frameworks shall satisfy the requirements of this project.

#### **1.7 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS**

- .1 The following are the approved Control System Contractors and manufacturers: automated logic, no alternates.

##### **Notes:**

- .1 The above list of Contractors is printed in random order and does not display a preference.

- .2 The Contractor shall use only products from the corresponding manufacturer and product line listed.
- .3 The above list of manufacturers applies to controller software, the custom application programming language, Building Controllers, Custom Application Controllers, and Application Specific Controllers.
- .4 All other products specified herein (e.g. sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

## 1.8 QUALITY ASSURANCE

- .1 Contractor/Manufacturer Qualifications
  - .1 The Installer shall have an established working relationship with the Control System Manufacturer of not less than three years.
  - .2 The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.

## 1.9 CODES AND STANDARDS

- .1 All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
  - .1 National Electric Code (NEC)
  - .2 Uniform Building Code (UBC)
    - .1 Section 608, Shutoff for Smoke Control
    - .2 Section 403.3, Smoke Detection Group B Office Buildings and Group R, Division 1 Occupancies
    - .3 Section 710.5, Wiring in Plenums
    - .4 Section 713.10, Smoke Dampers
    - .5 Section 1106 Refrigeration Machinery Rooms
    - .6 Section 1107, Refrigeration Machinery Room Ventilation
    - .7 Section 1108, Refrigeration Machinery Room Equipment and Controls
    - .8 Section 1120, Detection and Alarm Systems
  - .3 Uniform Mechanical Code (UMC).
  - .4 The Ontario Building Code (OBC).

## 1.10 SYSTEM PERFORMANCE

- .1 Performance Standards. The system shall conform to the following:
  - .1 Performance: Programmable controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
  - .2 Multiple Alarm Annunciation: All workstations on the network must receive alarms within 5 seconds of each other.



- .3 Reporting Accuracy: The system shall report all values with an end-to-end accuracy as listed or better than those listed in Table 1.
- .4 Stability of Control. Control loops shall maintain measured variable at set point within the tolerances listed in Table 2.

#### 1.11 SUBMITTALS

- .1 Product Data and Shop Drawings: Meet requirements of Section 15001 on Shop Drawings, Product Data, and Samples. In addition, Contractor shall provide shop drawings or other submittals on all hardware, and installation to be provided. No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent.
- .2 Submittals shall be provided within 2 weeks of contract award. Submittals shall include:
  - .1 Direct Digital Control System Hardware:
    - .1 A complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data.
    - .2 Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for the items listed below and other relevant items not listed below:
      - .1 Direct Digital Controller (controller panels)
      - .2 Transducers/Transmitters
      - .3 Sensors (including accuracy data)
      - .4 Actuators
      - .5 Valves
      - .6 Relays/Switches
      - .7 Control Panels
      - .8 Power Supply
      - .9 Batteries
      - .10 Operator Interface Equipment
      - .11 Wiring
    - .3 Wiring diagrams and layouts for each control panel. Show all termination numbers.
    - .4 Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware.
  - .2 Central System Hardware and Software:
    - .1 A complete bill of material of equipment used, indicating quantity, manufacturer, model number, and other relevant technical data.
    - .2 Manufacturer's description and technical data, such as product specification sheets and installation/maintenance instructions for the items listed below and other relevant items not listed below:
      - .1 Interface Equipment Between WEB portal and Control Panels
      - .2 Operating System Software
      - .3 Operator Interface Software

- .4 Color Graphic Software
    - .5 Third-Party Software
  - .3 Schematic diagrams for all control, communication, and power wiring.
  - .4 Riser diagrams of wiring between central control unit and all control panels.
  - .5 A list of the color graphic screens to be provided. For each screen, provide a conceptual layout of pictures and data and show or explain which other screens can be directly accessed.
- .3 Controlled Systems:
  - .1 A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
  - .2 A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled.
  - .3 An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
  - .4 A mounting, wiring, and routing plan-view drawing. The drawing shall be done in ¼ in. scale. The design shall take into account HVAC, electrical, and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
  - .5 A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
  - .6 A point list for each system controller including both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, and the location of the I/O device. Software flag points, alarm points, etc.
- .3 Project Record Documents: Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:
  - .1 Project Record Drawings. These shall be as-built versions of the submittal shop drawings.

## **1.12 TESTING AND COMMISSIONING**

- .1 Testing and Commissioning Reports and Checklists. Completed versions of all reports and checklists, along with all trend logs, used to meet the requirements of Part 3: "Control System Demonstration and Acceptance."

**1.13 OPERATION AND MAINTENANCE MANUAL**

- .1 Operation and Maintenance (O & M) Manual. This shall include as-built versions of the submittal product data. In addition to the information required for submittals, the O & M manual shall include:
  - .1 Names, addresses, and 24-hour telephone numbers of contractors installing equipment and the control systems and service representatives of each.
  - .2 Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
  - .3 One set of Programming Manuals with a description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation.
  - .4 Engineering, Installation, and Maintenance Manual(s) that explain how to design and install new points, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
  - .5 A listing and documentation of all custom software created using the programming language, including the set points, tuning parameters, and object database. One set of magnetic/optical media containing files of the software and database also shall be provided.
  - .6 One set of magnetic/optical media containing files of all color graphic screens created for the project.
  - .7 A list of recommended spare parts with part numbers and suppliers.
  - .8 Complete original issue documentation, installation, and maintenance information for all third-party hardware provided, including computer equipment and sensors.
  - .9 Complete original issue diskettes for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
  - .10 Licenses, guarantees, and warranty documents for all equipment and systems.
  - .11 Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions.

**1.14 TRAINING MANUAL**

- .1 The contractor shall provide a course outline and training manuals for all training classes at least six weeks prior to the first class. The consultant may modify any or all of the training course outline and training materials to meet the needs of the owner. Review and approval by the consultant shall be completed at least three weeks prior to the first class.

**1.15 WARRANTY**

- .1 Labour and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the owner. The contractor shall respond to the owner's request for warranty service within 24 hours during normal business hours.

- .2 All work shall have a single warranty date, even when the owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period.
- .3 At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the consultant, the consultant shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.
- .4 Project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above-mentioned items also can be provided during the warranty period for an additional charge to the owner by purchasing an in-warranty service agreement from the contractor. Written authorization by the owner must, however, be granted prior to the installation of any of the above-mentioned items.

#### **1.16 OWNERSHIP OF PROPRIETARY MATERIAL**

- .1 All project-developed software and documentation shall become the property of the owner. These include, but are not limited to:
  - .1 Project graphic images
  - .2 Record drawings
  - .3 Project database
  - .4 Project-specific application programming code
  - .5 All documentation.

#### **1.17 TESTING AND BALANCING**

- .1 During the system testing and balancing by an independent agency fully demonstrate the operation of all sensors, dampers, actuators, controls, valves, etc. This contractor shall be present during the testing and balancing and make adjustments as often as necessary to satisfy the testing and balancing agency.

#### **1.18 WIRING**

- .1 Provide all wiring, conduit in accordance with Electrical Division, labour, including calibration, commissioning, software programming and data base generation, generation of colour graphics and additional work necessary to provide a complete and fully operating system.
- .2 Provide 120 Volt, 20 amp circuits to field panels and other devices requiring a main supply from circuits. supplied by Electrical Division.
- .3 Surge transient protection shall be incorporated in design of system to protect electrical components.
- .4 Obtain Hydro permit and inspection.

**Part 2            Products**

**2.1                General**

- .1    Scope
  - .1    Furnish all labor, materials and equipment necessary for a complete and operating Building Automation System (BAS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate on a peer-to-peer bus over a single LonTalk open protocol bus.
  - .2    System head end manufacturer shall be based on a Niagara System.
  - .3    Head end will require a fully open Niagara Compatibility Statement (NiCS).
  - .4    NiCS will include in and out compatibility for both station and tool compatibility.
  - .5    Controls contractor shall provide a new BAS server for the client that is capable of integrating future Niagara based controls systems by other vendors.
  - .6    The BAS server shall host all graphic files for the control system.
  - .7    System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, LonTalk, BACnet, and Modbus.
  - .8    System architecture shall provide secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
  - .9    All control devices furnished with this Section shall be programmable directly from the Niagara 4™ Workbench embedded toolset upon completion of this project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.
  - .10   Any control vendor that must provide additional BAS server software shall be unacceptable.
- .2    Installation Contractor Requirements
  - .1    Contractor needs to be Niagara certified.
  - .2    Contractor needs to have completed a minimum of five (5) Niagara 4™ installations, with at least one of these installations having in excess of five (5) JACE controllers.
  - .3    Prime contractor needs to have the ability to provide 24/7 response in under 4 hours during the project by a Niagara 4™ certified technician.
  - .4    Prime contractor shall have in excess of four (4) Niagara 4™ certified staff members and be located within a 100 km radius of the project site.
- .3    Software Ownership
  - .1    The Owner shall have full ownership and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BAS.

- .4 Open, Interoperable, Integrated Architecture
  - .1 The supplied software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Physical connection of any BACnet® or LonWorks® or Modbus® control equipment, such as VFD's, Boilers, Computer Room Air Conditioning Units, Variable Refrigerant Flow Units, Main Electrical Distribution Panels, shall be via Ethernet.
  - .2 All air handlers, even if packaged controls exist, shall be fitted with District standard level 1 or level 2 controllers.
  - .3 The supplied system must incorporate the ability to access all data web enabled browsers without requiring plug-ins or proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on the Operating System Server currently located on the LAN. Systems requiring proprietary database and user interface programs shall not be acceptable.
  - .4 A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
    - .1 Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
    - .2 Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.
  - .5 Level 1 controllers shall provide overall system coordination, accept control programs, perform automated DDC and energy management functions, control peripheral devices, and perform all necessary mathematical functions.
    - .1 Level 1 controllers shall permit multi-user operation from workstations and laptop computers connected either locally or over the Level 1 network.
    - .2 Level 1 controllers shall be housed in a locking. The enclosure will include knockouts on all sides of the cabinet for connection to field and power wiring.
    - .3 The 120VAC power wiring to each Level 1 controller shall be a dedicated run with a separate breaker. Each run will include a separate hot, neutral, and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device. Multiple Level 1 controllers in the same cabinet may utilize the same circuit.
    - .4 All Level 1 controllers shall have a dedicated battery backup in a separate enclosure. Pre-approved product is Altronix eFlow3N with substitutions upon approval.
  - .6 Level 2 controllers shall provide intelligent stand-alone control of HVAC. Each unit shall have its own internal RAM memory and will continue to operate all local control functions in the event of a failure to any Level 1 controller. In addition, it shall be able to share information with and from the entire network for full global control.

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- .7 Level 1 controllers shall be JACE 8000-O JACE Controllers with a minimum of:
    - .1 WEB-8000 Base unit includes two RS485 ports, two 10/100MB Ethernet ports, USB Backup & Restore and WiFi.
    - .2 Required Selections of Device/Point Core (NC-8005, NC-8010, NC-8025, NC-8100 or NC-8200) and Upgrade Device/Point Packs (DEVICE-10, DEVICE-25 or DEVICE-50) as required to support all connected Level 2 controllers.
    - .3 Software Maintenance Agreement (SMA) to provide five (5) years of coverage for all software updates, patches and revision upgrades based on Device/Point quantity. (SMA-8005-5YR, SMA-8010-5YR, SMA-8025-5YR, SMA-80100-5YR or SMA-8200-5YR)
    - .4 If LonWorks devices are to be connected, include one (1) NPB-8000-LON add on single port LON FTT10A module to support a maximum of fifty (50) LonWorks devices per wired communication bus segment. Provide additional modules as required.
  - .8 Each site will have a minimum of one Level 1 controller. All Level 1 controllers shall be compatible with the Niagara supervisor.
  - .5 System Network Controller (SNC)
    - .1 Level One - These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC), and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.
    - .2 The controllers must be fully programmable to meet the unique requirements of the facility it must control.
    - .3 The controllers must be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via modem or connected via the Internet.
    - .4 The communication protocols utilized for peer-to-peer communications between SNC's shall be FOX, Tridiums TCP/IP based protocol included with Niagara 4 Framework. Use of any other proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.
    - .5 The SNC shall be capable of executing application control programs to provide:
      - .1 Calendar functions
      - .2 Scheduling
      - .3 Trending
      - .4 Alarm monitoring and routing
      - .5 Time synchronization
      - .6 Integration of LonWorks, BACnet, and ModBus controller data
      - .7 Network management functions for all SNC, PEC and ASC based devices
    - .6 The SNC must provide the following hardware features as a minimum:
      - .1 Two Ethernet Port-10/100 Mbps
      - .2 Two isolated RS-485 port

- .3 Capability to add LonWorks Interface Port – 78KB FTT-10A if required
- .4 1GB DDR3 SDRAM
- .5 Integrated 24VAC/DC Global Power Supply
- .6 4GB Flash Total Storage / 2GB User Storage
- .7 WiFi (client or WAP)
- .7 The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- .8 The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.
- .9 The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network, or wide-area network.
  - .1 Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
    - .1 Alarm,
    - .2 Return to normal,
    - .3 To default.
  - .2 Alarms shall be annunciated in any of the following manners as defined by the user:
    - .1 Screen message text,
    - .2 Email of complete alarm message to multiple recipients.
    - .3 Pagers via paging services that initiate a page on receipt of email message.
    - .4 Graphics with flashing alarm object(s).
  - .3 The following shall be recorded by the SNC for each alarm (at a minimum):
    - .1 Time and date
    - .2 Equipment (air handler #, accessway, etc.)
    - .3 Acknowledge time, date, and user who issued acknowledgement.
- .10 Programming software and all controllers “Setup Wizards” shall be embedded into the SNC.
- .11 Level 2 controllers prequalified are:
  - .1 Spyder Sylk Enhanced
  - .2 Spyder Micro
- .12 Level 2 controllers shall provide stand-alone control of HVAC control. Each controller shall have its own control programs and will continue to operate in the event of a failure to its associated Level 1 controller.
- .13 Each piece of HVAC equipment will have its points and programs contained in a single Level 2 controller. Equipment programming may not extend across multiple controllers. Level 1 controllers may be used in lieu of Level 2 controllers.



- .14 Each Level 2 controller shall be able to have its program edited and/or modified either locally through a laptop computer or through a workstation connected to a Level 1 controller. Each Level 2 controller shall complete its internal scan in less than one second. Each scan shall consist of updating of inputs, importing of data from other controllers, performing mathematical calculations, and sequencing appropriate outputs for local loop control.
- .15 POWER SUPPLY:
  - .1 The Level 2 controller shall have a built-in supply operating at 24 VAC 50/60 Hz with an accuracy of  $\pm 20\%$ .
  - .2 Power supplies should have a built in breaker to protect transformers.
  - .3 When using power supplies sharing 24Vac to power level 2 controllers power supplies should be labeled to what they serve.
  - .4 The 120VAC power wiring to Level 2 controllers shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral, and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
  - .5 A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
- .16 Level 2 controllers shall be housed in a panel mounted enclosure. The enclosure will include a removable cover for access to field and power wiring.
- .6 System Network Software
  - .1 The BAS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BAS server shall communicate using Ethernet and TCP/IP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.
  - .2 The intent of the thin-client architecture is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support Microsoft and Netscape Navigator browsers (latest versions), and Windows as well as non-Windows operating systems. No special software or plug-ins, other than free public domain programs shall be required to be installed on PC's used to access the BAS via a web browser.
  - .3 The BAS server software must support at least the following server platforms (Windows, and/or Linux). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.
  - .4 The web browser GUI shall provide a completely interactive user interface and must offer and be configured with the following features as a minimum:
    - .1 Trending
    - .2 Scheduling
    - .3 Electrical demand limiting
    - .4 Duty Cycling
    - .5 Downloading Memory to field devices
    - .6 Real time 'live' Graphic Programs
    - .7 Tree Navigation
    - .8 Parameter change of properties

- .9 Setpoint Adjustments
  - .10 Alarm / Event information
  - .11 Configuration of operators
  - .12 Execution of global commands
  - .13 Add, delete, and modify graphics and displayed data
- .5 Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project .BAS software components shall include:
  - .1 Server Software, Database and Web Browser Graphical User Interface
  - .2 System Configuration Utilities for future modifications to the system, and controllers.
  - .3 Graphical Programming Tools
  - .4 Direct Digital Control software
  - .5 Application Software
  - .6 Any required third party software
  - .7 If licensing credits are required provide a minimum of 10% additional to as built control system requires.
- .6 BAS Server Database: The BAS server software shall utilize the integral database installed during the loading of the N4 Supervisor software included with the software platform built on the Niagara 4™ Framework. BAS systems written to other Non -Standard and/or Proprietary databases are not acceptable.
- .7 Database Open Connectivity: The BAS server database shall allow real time access of data via the following standard mechanisms:
  - .1 Open protocol standard like SOAP
  - .2 OLE/OPC (for Microsoft Client's/Server platform only)
  - .3 Import/Export of the database from or to XML (extensible Mark-up Language)
- .8 Communication Protocol(s): The native protocol for the BAS server software shall be TCPIP over Ethernet. Proprietary protocols over TCP/IP, other than FOX are not acceptable.
- .9 Thin Client – Web Browser Based: The GUI shall be browser based.
- .7 Programmable Equipment Controller (PEC)
  - .1 Level Two - HVAC control shall be accomplished using BACnet based devices where the application has a BACnet profile defined. The controller platform shall provide options and advanced system functions, programmable and configurable using the N4 software platform built on the Niagara 4™ Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".
  - .2 All PECs shall be application programmable and shall at all times maintain their BACnet certification. All control sequences within or programmed into the ILC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.
  - .3 The PECs shall communicate with the SNC at a baud rate of not less than 78.8K baud. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.

- .4 The following integral and remote Inputs/Outputs shall be supported per each PEC:
  - .1 Eight integral dry contact digital inputs.
  - .2 Any two digital inputs may be configured as pulse counters with a maximum pulse read rate of 15 Hz.
  - .3 Eight integral analog inputs (configurable as 0-10V, 0-10,000 ohm or, 20K NTC).
  - .4 Six integral 4-20 ma analog outputs.
  - .5 Eight integral 24 Vac Triac digital outputs, configurable as maintained or floating motor control outputs.
  - .6 One integral 20 Vdc, 65-mA power supply for auxiliary devices.
  - .7 If a 20 Vdc 65-mA power supply terminal is not integral to the ILC, provide at each PEC a separate, fully isolated, enclosed, current limited and regulated UL listed auxiliary power supply for power to auxiliary devices
- .5 Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules
- .6 PEC Controllers shall support the following control techniques:
  - .1 Ten configurable general-purpose control loops that can incorporate Demand Limit Control strategies, Setpoint reset, adaptive intelligent recovery, and time of day bypass.
  - .2 Ten general-purpose, non-linear control loops.
  - .3 Eight start/stop Loops.
  - .4 Thirty-two If/Then/Else logic loops.
  - .5 Thirty six Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV, ENTHALPY).
- .8 Advanced Unitary Controller (AUC)
  - .1 Level Two - The advanced unitary controller (AUC) platform shall be designed specifically to control HVAC – ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units, and radiant panels. The controller platform shall provide options and advanced system functions, programmable and configurable using the N4 software platform built on the Niagara 4™ Framework, that allow standard and customizable control solutions required in executing the “Sequence of Operation”. Spyder Independent License Controller (ILC) option is not required.
  - .2 Minimum Requirements:
    - .1 The controller shall be fully programmable with full functionality on software platform built on the Niagara 4 Framework.
      - .1 Support downloads and uploads using Supervisor or Supervisor Workbench via WEB-8000 JACE controller connected to TCP/IP network.
      - .2 Support online and offline simulation/debug mode of the controller.
      - .3 Maintain native GUI.

- .4 Native function-block programming within the Niagara 4 environment.
- .2 The controller shall be capable of either integrating with other devices or stand-alone operation.
- .3 The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications. Controller memory minimum requirements include:
  - .1 FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
  - .2 FLASH Memory settings retained for ten years.
  - .3 RAM: 2 Kilobytes
- .4 The controller shall have an FTT transformer-coupled communications port interface for common mode-noise rejection and DC isolation.
- .5 The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
  - .1 Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
  - .2 Accuracy:  $\pm 1$  minute per month at 77° F (25° C).
  - .3 Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).
- .6 The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
- .7 The controller shall have an internal DC power supply to power external sensors.
  - .1 Power Output: 20 VDC  $\pm 10\%$  at 75 mA.
- .8 The controller shall have a visual indication (LED) of the status of the device:
  - .1 Controller operating normally.
  - .2 Controller in process of download.
  - .3 Controller in manual mode under control of software tool.
  - .4 Controller lost its configuration.
  - .5 No power to controller, low voltage, or controller damage.
  - .6 Processor and/or controller are not operating.
- .9 The minimum controller Environmental ratings
  - .1 Operating Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
  - .2 Storage Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
  - .3 Relative Humidity: 5% to 95% non-condensing.

- .10 The controller shall have the additional approval requirements, listings, and approvals:
  - .1 UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
  - .2 CSA (LR95329-3) Listed
  - .3 Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
  - .4 Meets Canadian standard C108.8 (radiated emissions).
  - .5 Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity)
  - .6 Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission)
- .11 The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
- .12 The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
  - .1 Analog outputs (AO) shall be capable of being configured as digital outputs (DO)
  - .2 Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
  - .3 Input and Output wiring terminals shall be designated with color coded labels.
  - .4 Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).

- .13 The controller shall provide for “user defined” Network Variables (NV) for customized configurations and naming using Niagara 4™ Framework.
  - .1 The controller shall support 62 Network Variables with a byte count of 31 per variable.
  - .2 The controller shall support 1,922 separate data values.
- .14 The controller shall be capable of continuous automated loop tuning with an Adaptive Integral Algorithm Control Loop.
- .15 Timed local override switches should be installed on air handlers which may be needed to run occasionally after hours.
- .16 The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized “sequence of operations” as outlined in Section 4.
  - .1 Discharge air control and low limit
  - .2 Pressure-dependent dual duct without flow mixing.
  - .3 Variable air volume with return flow tracking.
  - .4 Economizer with differential enthalpy.
  - .5 Minimum airflow coordinated with CO2.
  - .6 Unit ventilator cycle (1,2,3) 2-pipe.
  - .7 Unit ventilator cycle (1,2,3) 2-pipe with face/bypass.
  - .8 Unit ventilator cycle (1,2,3) 4-pipe.
  - .9 Unit ventilator cycle (1,2,3) 4-pipe with EOC valve.
- .9 Advanced Specific Controller (ASC)
  - .1 Level Two - The advanced specific controller platform shall be designed specifically for room-level control – pressure-independent air flow control, pressure dependent damper control, supply and exhaust pressurization/de-pressurization control; temperature, humidity, complex CO2, occupancy, and emergency control. Equipment includes: Terminal HVAC Equipment. The controller platform shall provide options and advanced system functions, programmable and configurable using the N4 software platform built on the Niagara 4™ Framework, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.
  - .2 Minimum requirements:
    - .1 The controller shall be fully programmable with full functionality on N4 software platform built on the Niagara 4 Framework.
      - .1 Support downloads and uploads using N4 Supervisor or N4 Supervisor Workbench via JACE controller connected to TCP/IP network.
      - .2 Support online and offline simulation/debug mode of the controller.
      - .3 Maintain native GUI.
      - .4 Native function-block programming within the Niagara 4 environment.
    - .2 The controller shall be capable of either integrating with other devices or stand-alone room-level control operation.

- .3 The controller shall have an internal velocity pressure sensor.
  - .1 Sensor Type: Microbridge air flow sensor with dual integral restrictors.
  - .2 Operating Range: 0 to 1.5 in. H<sub>2</sub>O (0 to 374 Pa).
  - .3 Accuracy:  $\pm 2\%$  of full scale at 32° to 122°F (0° to 50° C);  $\pm 1\%$  of full scale at null pressure.
- .4 The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications.
  - .1 FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
  - .2 FLASH Memory settings retained for ten years.
  - .3 RAM: 2 Kilobytes
- .5 The controller shall have an FTT transformer-coupled communications port interface for common mode-noise rejection and DC isolation.
- .6 The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
  - .1 Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
  - .2 Accuracy:  $\pm 1$  minute per month at 77° F (25° C).
  - .3 Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).
- .7 The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
- .8 The controller shall have an internal DC power supply to power external sensors.
  - .1 Power Output: 20 VDC  $\pm 10\%$  at 75 mA.
- .9 The controller shall have a visual indication (LED) of the status of the device:
  - .1 Controller operating normally.
  - .2 Controller in process of download.
  - .3 Controller in manual mode under control of software tool.
  - .4 Controller lost its configuration.
  - .5 No power to controller, low voltage, or controller damage.
  - .6 Processor and/or controller are not operating.
- .10 The minimum controller Environmental ratings:
  - .1 Operating Temperature Ambient Rating: 32° to 122° F (0° to 50° C).
  - .2 Storage Temperature Ambient Rating: 32° to 122° F (0° to 50° C).
  - .3 Relative Humidity: 5% to 95% non-condensing.

- .11 The controller shall have the additional approval requirements, listings, and approvals:
  - .1 UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
  - .2 CSA (LR95329-3) Listed
  - .3 Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
  - .4 Meets Canadian standard C108.8 (radiated emissions).
  - .5 Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity)
  - .6 Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission)
- .12 The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
- .13 The controller shall provide an integrated actuator option.
  - .1 Actuator type: Series 60 Floating.
  - .2 Rotation stroke: 95° ±3° for CW or CCW opening dampers.
  - .3 Torque rating: 44 lb-in. (5 Nm).
  - .4 Run time for 90° rotation: 90 seconds at 60 Hz.
- .14 The controller shall have four digital inputs (DI), eight digital Triac outputs (DO) or six digital Triac outputs (DO) with Integrated Actuator, three analog outputs (AO), and six universal inputs (UI).
  - .1 Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
  - .2 Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
  - .3 Input and Output wiring terminals shall be designated with color coded labels.
- .15 The controller shall provide for user defined Network Variables (NV) for customized configurations and naming using Niagara 4™ Framework.
  - .1 The controller shall support a range of Network Variables to 62 with a byte count of 31 per variable.
  - .2 The controller shall support 1,922 separate data values.
- .16 The controller shall be capable of continuous automated loop tuning with an Adaptive Integral Algorithm Control Loop.
- .17 The controller shall have a loop execution response time of 1 second.
- .18 The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in Section 4.
  - .1 VAV terminal unit.
  - .2 VAV terminal unit fan speed control.
  - .3 Series fan.
  - .4 Parallel fan.
  - .5 Regulated air volume (room pressurization/de-pressurization).



- .6 CV dual-duct.
- .7 Room CO2 control.
- .8 Room Humidity.
- .9 TOD occupancy sensor stand-by setpoints.
- .10 WEB Browser Graphical User Interface
  - .1 Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to “feel” like a single application and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.
  - .2 Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and password. Navigation in the system shall be dependent on the operator’s role privileges, and geographic area of responsibility.
  - .3 Navigation: Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft’s Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
    - .1 Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.
    - .2 Groups View shall display Scheduled Groups and custom reports.
    - .3 Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).
  - .4 Action Panel: The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. A functional view shall be accessed by clicking on the corresponding button:
    - .1 Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh.
    - .2 Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an ‘accept/cancel’ button.
    - .3 Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy (using the navigation tree).

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- .4 Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
  - .5 Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
  - .6 Logic - Live Graphic Programs: Shall be used to display 'live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
  - .7 Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.
- .5 Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated .gifs or .jpg, vector scalable, active setpoint graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
- .1 Display Size: The GUI workstation software shall graphically display in a minimum of 1024 by 768 pixels 24 bit True Color. Match standard graphic sizing already implemented on N4 Supervisor.
  - .2 General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
  - .3 Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective setpoints. The colors shall be updated dynamically as a zone's actual comfort condition changes.
  - .4 Global HVAC Air Balancing Table: A graphic showing the HVAC System, i.e. all VAV boxes on their individual air handling system, on the same screen with the individual VAV Name, AHU served by, Room Served, Occ\_mode, Rm Temp, Current STP, Valve Pos, Valve OVR, FTR Vlv Pos, FTR Vlv OVR, DMPR Pos, Damper OVR, Air Flow CFM showing. The purpose for this graphic is to open all of the boxes to their maximum cooling CFM settings so the duct static pressure setting can be optimized, from that of the design value. Global hot water valve override (Fan specific, global override located on fan graphic for VAV's served by associated fan) See exhibit below.
  - .5 Global HVAC Hot Water Balancing Table: A graphic showing the Boiler System, i.e. all heating coils on their individual pumping system, on the same screen with the individual GPM values showing, if available. The purpose for this graphic is to open all of the hot water valves to their maximum settings so the heating piping pressure setting can be optimized, from that of the design value. Global hot water valve override (pump specific, global override located on fan graphic for coils served by associated pump).

- .6 Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability. If there are more than one fan or pump, all fans or pumps must be shown, if there are multiple coils or dampers, all of these components must be shown.
  - .1 Each piece of equipment monitored or controlled including each terminal unit
  - .2 Each HVAC mechanical system: chiller-pumps, boiler-pumps, AHU-EF-VAV, ventilation
- .7 Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
  - .1 Each building
  - .2 Each floor and zone controlled, with alarm representations when space temperatures go outside of the set limits
- .8 Graphics shall incorporate room numbers
- .9 Backgrounds on the graphics shall not be on a white background. Dark background colors are not acceptable.
- .6 Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day 'Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the 'Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
  - .1 Schedules: Schedules shall comply with the LonWorks standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
    - .1 Types of schedule shall be Normal, Holiday or Override
    - .2 A specific date,
    - .3 A range of dates,
    - .4 Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
    - .5 Wildcard (example, allow combinations like second Tuesday of every month).

- .2 Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of “things” to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
- .3 Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ‘individual tenant’ group – who may occupy different areas within a building or buildings. Schedules applied to the ‘tenant group’ shall automatically be downloaded to control modules affecting spaces occupied by the ‘tenant group’
- .4 Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler, and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
- .5 Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
- .6 Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.
- .7 Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ‘Alarms’ view. Alarms, and reporting actions shall have the following capabilities:
  - .1 Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report, and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
  - .2 Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.

- .3 Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
- .4 Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
- .5 Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
- .6 Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A 'network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
- .7 Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement, and total number of Alarms in the BAS Server database.
- .8 Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
- .9 Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
  - .1 Print: Alarm information shall be printed to the BAS server's PC or a networked printer.
  - .2 Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
  - .3 File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).

- .4 Write Property: The write property reporting action updates a property value in a hardware module.
  - .5 SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
  - .6 Run External Program: The Run External Program reporting action launches specified program in response to an event.
- .8 Trends: Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
- .1 Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
  - .2 Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
  - .3 Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.
  - .4 Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
  - .5 Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and 'pan through' historical data by simply scrolling the mouse.
  - .6 Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
  - .7 Copy/Paste. The operator must have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).

- .9 Security Access: Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:
  - .1 Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of 'easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
    - .1 View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
    - .2 Edit Privileges shall comprise: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
    - .3 Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.
  - .2 Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.
- .10 Graphical Programming
  - .1 The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors, etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
  - .2 Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

- .3 Graphic Sequence: The clarity of the graphic sequence must be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming must be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation. Graphics and navigation shall follow existing MPS standards. See drawings and the example below.
- .4 GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:
  - .1 Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
  - .2 Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
  - .3 Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
  - .4 Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
  - .5 Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
  - .6 Parameter: A parameter shall be a value that may be tied to the input of a microblock.
  - .7 Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.
  - .8 Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
  - .9 Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
  - .10 Live Graphical Programs: The Graphic Programming software must support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode.
  - .11 All BAS Control Sequences will be shown on a separate Mechanical Plan Sheet. Examples are shown below.



.11 Network Management

- .1 Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- .2 The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- .3 The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system shall not be accepted.

.12 Third Party Integration Management – Open Protocol Devices

- .1 PURPOSE: The purpose of the Integration is to gather and use a larger number of points from specific mechanical equipment units that will provide more information and controllability to the BAS system than just by adding a few sensors. Mechanical equipment, which can have BACnet, LonWorks, Modbus, OPC, SMS devices are: variable frequency drives, chillers, boiler controllers, packaged energy recovery units, make up air units, computer room air conditioning units, etc. The actual values the equipment it is controlling are to be displayed to aid with future troubleshooting and understanding equipment performance where the offset value shown from a second independent sensor may hide the root problem.
- .2 CONTROLS CONTRACTOR RESPONSIBILITIES: The successful controls contractor is to research do planning and reading to figure out how to implement the integration. The controls contractor and mechanical contractor must call the phone number on the installations and operations manual of the successful equipment supplier and discuss a plan and details with factory tech support. There will be a point's list and description somewhere that helps define each value.
- .3 COMMUNICATIONS CARD AND PROTOCOL: The mechanical contractor shall purchase the communication card to be provided on the mechanical equipment. Specific protocols; Use BACnet, LonWorks, Modbus, OPC, SMS or what other specific manufacturer has chosen to standardize on. If a standard factory option, provide a self-discovery protocol like BACnet or LonWorks.
- .4 NETWORK MANAGEMENT COMMUNICATIONS TRUNK: Keep the wiring to integrated pieces of equipment separated from the field controllers. Run a separate comm port and comm wire segment to support the integrated equipment because it expedites the process to rule out many of the first tech support questions like; address conflict, comm bus length and routing, interference from other types of controllers. It also helps to adjust baud rate, parity and other comm settings where if you have to change all the other controllers on a comm bus, this can really take time. Comm wires should get polled as a test to make sure comm drop and this problem is reflected on the Niagara system. However, "if after all the steps above are completed and the integration fails, then the contractor is not responsible for going any further"

- .5 VERIFICATION OF INTEGRATED VALUES: Integrated values must be verified, double-check against an LCD display or measured values from an instrument. Typically just one point of each type of facet needs to be verified to confirm any conversion factors or zero shifting and the remaining points are all done the same way.

.13 Continuity of Operation after Electric Power Interruption

- .1 Equipment and associated factory-installed controls, field installed controls, electrical equipment and power supplies connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without the need for manual interventions by operator when power is restored either through backup power source or through normal power is restored before backup power is brought online.

## 2.2 POWER SUPPLIES AND LINE FILTERING

- .1 Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
  - .1 DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
    - .1 Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
    - .2 Line voltage units shall be UL recognized and CSA approved.
- .2 Power line filtering.
  - .1 Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:
    - .1 Dielectric strength of 1000 volts minimum
    - .2 Response time of 10 nanoseconds or less
    - .3 Transverse mode noise attenuation of 65 dB or greater
    - .4 Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

## 2.3 MOTORIZED CONTROL DAMPERS

- .1 Control dampers shall be the parallel or opposed blade type as below or as scheduled on drawings.
  - .1 Outdoor and/or return air mixing dampers and face and bypass (F & BP) dampers shall be parallel blade, arranged to direct air-streams toward each other.
  - .2 Other modulating dampers shall be the opposed blade type.
  - .3 Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
- .2 Damper frames shall be 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.
- .3 Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades are to be suitable for medium velocity performance (10 m/s [2000 fpm]). Blades shall be not less than 16 gauge.
- .4 Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze or better.
- .5 All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 50 L/s m<sup>2</sup> (10 cfm per ft<sup>2</sup>) at 1000 Pa (4 in. w.g.) differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s (1500 fpm).
- .6 Individual damper sections shall not be larger than 125 cm x 150 cm (48 in. x 60 in.). Provide a minimum of one damper actuator per section.
- .7 Modulating dampers shall provide a linear flow characteristic where possible.
- .8 Dampers shall have exposed linkages.

## 2.4 ELECTRIC DAMPER/VALVE ACTUATORS

- .1 The actuator shall have mechanical or electronic stall protection to prevent damage to the actuator throughout the rotation of the actuator.
- .2 Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing. Alternatively, an uninterruptible power supply (UPS) may be provided.
- .3 Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range.
- .4 All 24 VAC/VDC actuators shall operate on Class 2 wiring.
- .5 All non-spring-return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 N m (60 in.-lb) torque capacity shall have a manual crank for this purpose.

## 2.5 CONTROL VALVES

- .1 Control valves shall be two-way or three-way type for two-position or modulating service as shown.
- .2 Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
  - .1 Water Valves:
    - .1 Two-way: 150% of total system (pump) head.
    - .2 Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
  - .3 Water Valves:
    - .1 Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
    - .2 Sizing Criteria:
      - .1 Two-position service: Line size.
      - .2 Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
      - .3 Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 35 kPa (5 psi) maximum.
      - .4 Valves 1/2 in. through 2 in. shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless steel ball.
      - .5 Valves 2 1/2 in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
      - .6 Water valves shall fail normally open or closed, as scheduled on plans, or as follows:
        - .7 Water zone valves-normally open preferred.
        - .8 Heating coils in air handlers-normally open.
        - .9 Chilled water control valves-normally closed.
        - .10 Other applications-as scheduled or as required by sequences of operation.

## 2.6 TEMPERATURE DEVICES

- .1 Low-voltage space thermostat shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) set point range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

- .2 Line-voltage space thermostat shall be bimetal-actuated, open contact type, or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
- .3 Low-limit thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type, with an element of 6 m (20 ft) minimum length. Element shall respond to the lowest temperature sensed by any 30 cm (1 ft) section. The low-limit thermostat shall be manual reset only.

## 2.7 THERMOSTATS

- .1 DDC Temperature Thermostat
  - .1 Digital room sensors shall have LCD display, day / night override button, and setpoint slide adjustment to  $\pm 5^{\circ}\text{C}$  adjustment and override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment.

Temperature monitoring range	+20/120°F (13° to 49°C)
Output signal	Changing resistance
Accuracy at Calibration point	$\pm 0.5^{\circ}\text{F}$ (+/- 0.3°C)
Set Point and Display Range	55° to 95° F (13° to 35°C)
  - .2 Provide guards on thermostat in common areas.
- .2 Line voltage thermostat
  - .1 Wall-mounted thermostat for [heating] [cooling] [heating-cooling] with:
    - .1 Full load rating: [6] A at [120] V.
    - .2 Temperature setting range: 10°C to 27°C.
    - .3 Thermometer range: 7°C to 29°C.
    - .4 Markings in [10] [5] degree increments.
    - .5 Differential temperature fixed at 1.1°C.
  - .3 Heavy-duty line voltage
    - .1 Wall mounted thermostat for [heating] [cooling] [electric heating].
      - .1 Full load rating: [8] A at [120] V.
      - .2 Temperature setting range: 10°C to 27°C.
      - .3 Thermometer range: 7°C to 29°C.
      - .4 Markings in [10] [5] degree increments.
      - .5 Differential temperature fixed at 1.1°C.

.4 Line voltage [wall mounted] [integral] electric heating thermostat with:

- .1 Full load rating: [22] A at [120] V.
- .2 Temperature setting range: 10°C to 25°C.
- .3 [Single] [Double] pole.
- .4 Thermometer range: 10°C to 25°C.
- .5 Scale markings: Off-5-10-15-20-25°C.

.5 Low voltage

- .1 Wall mounted thermostat:
  - .1 For use on 24 V circuit at 1.5 A capacity.
  - .2 [With] heating anticipator adjustable [0.1 to 1.2] A.
  - .3 Temperature setting range: 10°C to 25°C.
  - .4 [Without] sub-base.

## 2.8 TEMPERATURE SENSORS

- .1 Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
- .2 Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5m (5ft) in length per 1 m<sup>2</sup> (10 ft<sup>2</sup>) of duct cross section.
- .3 Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.
- .4 Space sensors shall be equipped with set point adjustment, override switch, display, and/or communication port as shown.
- .5 Provide matched temperature sensors for differential temperature measurement.

## 2.9 HUMIDITY SENSORS

- .1 Duct and room sensors shall have a sensing range of 20% to 80%.
- .2 Duct sensors shall be provided with a sampling chamber.
- .3 Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall be suitable for ambient conditions of -40°C to 75°C (-40°F to 170°F).
- .4 Humidity sensor's drift shall not exceed 1 % of full scale per year.

## 2.10 FLOW SWITCHES

- .1 Flow-proving switches shall be either paddle or differential pressure type, as shown.
- .2 Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum) and shall have adjustable sensitivity with NEMA 1 enclosure unless otherwise specified.
- .3 Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application or as specified.

**2.11 CO<sub>2</sub> DETECTOR**

- .1 Technical Performance – Infrared CO<sub>2</sub> monitor complete with 4-20mA or 0-5 VDC output, accuracy of +/- 40 ppm +3% reading.
- .2 Standard of Acceptance:
  - .1 Duct Mounted Vulcain 90DM4DT-C-2000
  - .2 Wall Mounted Vulcain 90DM4ASM.

**2.12 ELECTRICAL DEVICES**

- .1 Relays
  - .1 Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
  - .2 Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable  $\pm 200\%$  (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.
- .2 Override timers.
  - .1 Override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified. Timer shall be suitable for flush mounting on control panel face and located on local control panels or where shown.
- .3 Current transmitters.
  - .1 AC current transmitters shall be the self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, with internal zero and span adjustment and +1 % full-scale accuracy at 500 ohm maximum burden.
  - .2 Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA Recognized.
  - .3 Unit shall be split-core type for clamp-on installation on existing wiring.
- .4 Current transformers.
  - .1 AC current transformers shall be UL/CSA Recognized and completely encased (except for terminals) in approved plastic material.
  - .2 Transformers shall be available in various current ratios and shall be selected for  $\pm 1\%$  accuracy at 5 A full-scale output.
  - .3 Transformers shall be fixed-core or split-core type for installation on new or existing wiring, respectively.

- .5 Voltage transmitters.
  - .1 AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
  - .2 Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with  $\pm 1$  % full-scale accuracy with 500 ohm maximum burden.
  - .3 Transmitters shall be UL/CSA Recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.
- .6 Voltage transformers.
  - .1 AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.
  - .2 Transformers shall be suitable for ambient temperatures of 4°C to 55°C (40°F to 130°F) and shall provide  $\pm 0.5$ % accuracy at 24 VAC and a 5 VA load.
  - .3 Windings (except for terminals) shall be completely enclosed with metal or plastic material.
- .7 Power monitors.
  - .1 Power monitors shall be the three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers, and UL Listed split-core current transformers.
  - .2 They shall provide a selectable rate pulse output for kWh reading and a 4 to 20mA output for kW reading. They shall operate with 5 A current inputs with a maximum error of  $\pm 2$ % at 1.0 power factor or  $\pm 2.5$ % at 0.5 power factor.
- .8 Current switches.
  - .1 Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

## 2.13 PRESSURE TRANSDUCERS

- .1 Transducer shall have linear output signal. Zero and span shall be field adjustable.
- .2 Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
- .3 Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 4 to 20 mA output, required mounting brackets, and block and bleed valves.
- .4 Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 4 to 20 mA output, required mounting brackets, and five-valve manifold.
- .5 Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA I enclosure, with scale range and differential suitable for intended application or as shown.



- .6 Pressure-Electric (PE) Switches.
  - .1 Shall be metal or neoprene diaphragm actuated, operating pressure rated 0-175 kPa (0-25 psig), with calibrated scale setpoint range of 14-125 kPa (2-18 psig) minimum, UL listed.
  - .2 Provide one- or two-stage switch action SPDT, DPST, or DPDT, as required by application. Electrically rated for pilot duty service (125 VA minimum) and/or for motor control.
  - .3 Shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA I unless otherwise specified.
  - .4 Shall have a permanent indicating gauge on each pneumatic signal line to PE switches.
- .7 Electro-pneumatic (E/P) transducers.
  - .1 Electronic/pneumatic transducer shall provide a proportional 20 to 100 kPa (3 to 15 psig) output signal from either a 4 to 20 mA or 0 to 10 VDC analog control input.
  - .2 E/P transducer shall be equipped with the following features:
    - .1 Separate span and zero adjustments
    - .2 Manual output adjustments
    - .3 Pressure gauge assembly
    - .4 Feedback loop control
    - .5 Air consumption of 0.05 L/s (0.1 scfm) at mid-range

## **2.14 LOCAL CONTROL PANELS**

- .1 All indoor control cabinets shall be fully enclosed NEMA I construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
- .2 Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
- .3 Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

## **2.15 WIRING AND RACEWAYS**

- .1 General: Provide copper wiring, plenum cable, and raceways.
- .2 All insulated wire to be copper conductors, ULC labeled for 90°C minimum service.

**2.16 FIBER OPTIC CABLE SYSTEM**

- .1 Optical cable: Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 mm.
- .2 Connectors: All optical fibers shall be field-terminated with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

**2.17 ROOM VVT CONTROL**

- .1 The VVT damper is normally held to a minimum of 80% airflow measured by the air flow sensor adjacent to each damper, in the ventilation mode as long as the supply air temperature from the unit is within the ventilation band of the room temperature. As the room temperature goes further off setpoint (heating/cooling) the demand signal broadcast to the rooftop unit increases to request heating or cooling.
- .2 If the room temperature goes below the "heating dead band" the rooftop will be commanded to heating mode. If the temperature in an individual room falls below the room heating set point and the rooftop is supplying heat, the damper modulates open 100% to anticipate a heating demand. All other zones will also be commanded open until the heating setpoint is exceeded. Above the setpoint the VVT dampers will modulate to a minimum position (30%) to prevent overheating. When the calling room is satisfied the rooftop unit is returned to ventilation mode. The VVT dampers are returned to the minimum of 80% airflow when the rooftop unit's supply air temperature drops to within 5°C (41°F) (adjustable) the ventilation band of the room temperature.
- .3 Where a remote heating valve is installed (reheat coil or radiation) on a call for heat, the heating valve modulates open to maintain set point. On a further drop in temperature the unit is commanded to the heating mode or when supply air temperature is above set point the valve closes and the damper modulates to maintain space temperature.
- .4 If the room temperature goes above the "cooling dead band" the rooftop will be commanded to cooling mode. If the temperature in an individual room rises above the room cooling set point and the rooftop is supplying cooling the damper modulates open 100% to anticipate a cooling demand. All other zones will also be commanded open until the cooling setpoint is satisfied. Below the setpoint the VVT dampers will modulate to a minimum position to prevent overcooling. When the calling room is satisfied the rooftop unit is returned to ventilation mode. The VVT damper is returned to the minimum of 80% airflow when the rooftop unit's supply air temperature increases to within the ventilation band 5°C (41°F) (adjustable) of the room temperature.

## 2.18 VAV TERMINAL WITH REHEAT OPERATION

### .1 Description

- .1 The variable volume terminal consists of a damper and electric reheat coil.
- .2 The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes as follows:
  - .1 Occupied  
The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. The controller monitors the room temperature sensor and air velocity sensor and modulates the supply air damper in sequence with the reheat coil to maintain the room temperature at set point. Supply air volume remains at minimum when reheat coil is modulated.
  - .2 Unoccupied  
The reheat coil is closed off. The reheat coil will operated as needed to maintain night set point.  
Should additional heat be required at night the controller may reset to the terminal unit Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 The project plans **and renovation sites** shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/consultant for resolution before rough-in work is started.
- .2 The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the consultant for resolution before rough-in work is started.
- .3 The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate-or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others-the contractor shall report these discrepancies to the consultant and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by-and at the expense of-this contractor.

### 3.2 PROTECTION

- .1 The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.
- .2 The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

### 3.3 COORDINATION

- .1 Site
  - .1 Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
  - .2 Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- .2 Submittals. Refer to the "Submittals" article in Part 1 of this specification for requirements.
- .3 Test and Balance
  - .1 The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
  - .2 The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
  - .3 In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
  - .4 The tools used during the test and balance process will be returned at the completion of the testing and balancing.
- .4 Life Safety
  - .1 Duct smoke detectors required for air handler shutdown are supplied under the mechanical section of this specification. The contractor shall interlock smoke detectors to air handlers for shutdown as described in Part 3, "Sequences of Operation."
  - .2 Smoke dampers and actuators required for duct smoke isolation are provided under mechanical section. The contractor shall interlock these dampers to the air handlers as described in Part 3, "Sequences of Operation."
  - .3 Fire/smoke dampers and actuators required for fire rated walls are provided under another Section of mechanical section. Control of these dampers shall be by electrical. The contractor shall provide control air to the dampers.
- .5 Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
  - .1 All communication media and equipment shall be provided as specified in Part 2, "Communication" of this specification.
  - .2 Each supplier of a controls product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this section.
  - .3 The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

- .4 The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
- .5 The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

### **3.4 GENERAL WORKMANSHIP**

- .1 Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- .2 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- .3 Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).
- .4 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- .5 All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

### **3.5 FIELD QUALITY CONTROL**

- .1 All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification.
- .2 Contractor shall continually monitor the field installation for code compliance and quality of workmanship.
- .3 Contractor shall have work inspected by local and/ or state authorities having jurisdiction over the work.

### **3.6 EXISTING EQUIPMENT**

- .1 Wiring: The contractor may reuse any abandoned wires. The integrity of the wire and its proper application to the installation are the responsibility of the contractor. The wire shall be properly identified and tested in accordance with this specification. Unused or redundant wiring must be properly identified as such.} {Interconnecting control wiring shall be removed and become the property of the contractor, unless specifically noted or shown to be reused.
- .2 Unless otherwise directed, the contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the contractor find existing equipment that requires maintenance, the consultant is to be notified immediately.
- .3 Temperature Sensor Wells: The contractor may reuse any existing wells in piping for temperature sensors. These wells shall be modified as required for proper fit of new sensors.
- .4 Indicator Gauges: Where these devices remain and are not removed, they must be made operational and recalibrated to ensure reasonable accuracy. Maintain the operation of existing pneumatic transmitters and gauges.

- .5 Room Thermostats: Shall be removed and become the property of the contractor, unless otherwise noted.
- .6 Electronic Sensors and Transmitters: Unless specifically noted otherwise, become the property of the contractor.
- .7 Controllers and Auxiliary Electronic Devices: Become the property of the contractor.
- .8 Damper Actuators, Linkages, and Appurtenances: Salvage, recondition, and reuse.
- .9 Control Valves: Replace with new.
- .10 Control Compressed Air System: {Deliver to owner and replace with new system} {Salvage, recondition, and reuse} {Becomes the property of the contractor, unless otherwise noted}.
- .11 The mechanical system must remain in operation between the hours of 6 a.m. and 6 p.m., Monday through Friday. No modifications to the system shall cause the mechanical system to be shut down for more than 15 minutes or to fail to maintain space comfort conditions during any such period. Perform cut-over of controls that cannot meet these conditions outside of those hours.
- .12 The scheduling of fans through existing or temporary time clocks or control system shall be maintained throughout the DDC system installation.
- .13 Install control panels in existing Mechanical Rooms.
- .14 Modify existing starter control circuits, if necessary, to provide hand/off/auto control of each starter controlled. If new starters or starter control packages are required, these shall be included as part of this contract.
- .15 Patch holes and finish to match existing walls.

### **3.7 WIRING**

- .1 All control and interlock wiring shall comply with national and local electrical codes and the Electrical sections of this specification. Where the requirements of this section differ from those in the Electrical Division, the requirements of this section shall take precedence.
- .2 All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway according to NEC and the Electrical Division requirements.
- .3 All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.)
- .4 Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenums shall be UL Listed specifically for that purpose.
- .5 All wiring in mechanical, electrical, or service rooms-or where subject to mechanical damage- shall be installed in raceway at levels below 3 m (loft).
- .6 Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- .7 Do not install wiring in raceway containing tubing.

- .8 Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.
- .9 Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
- .10 All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- .11 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- .12 All wiring concealed in walls and chases and all exposed wiring shall be run in conduit.
- .13 Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
- .14 All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- .15 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- .16 Size of raceway and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.
- .17 Include one pull string in each raceway 2.5 cm (1 in.) or larger.
- .18 Use coded conductors throughout with conductors of different colors.
- .19 Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- .20 Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).
- .21 Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- .22 Adhere to this specification's Electrical Division 6 requirements where raceway crosses building expansion joints.
- .23 Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.
- .24 The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- .25 Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal raceway less than 1/2 in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

- .26 Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes and ends not terminating in boxes shall have bushings installed.

### **3.8 COMMUNICATION WIRING**

- .1 The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.
- .2 All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- .3 Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
- .4 Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- .5 Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- .6 When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- .7 All runs of communication wiring shall be unspliced length when that length is commercially available.
- .8 All communication wiring shall be labeled to indicate origination and destination data.
- .9 Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

### **3.9 FIBER OPTIC CABLE SYSTEM**

- .1 Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- .2 All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

### **3.10 INSTALLATION OF THERMOSTATS**

- .1 Install sensors in accordance with the manufacturer's recommendations.
- .2 Mount sensors rigidly and adequately for the environment within which the sensor operates.
- .3 Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- .4 All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- .5 Install thermostats at handicapped elevations 1200 mm above finish floor (AFF).
- .6 Where not indicated on drawing, place where directed by consultant.



- .7 Co-ordinate location with architectural and electrical items.

### 3.11 INSTALLATION OF SENSORS

- .1 Install sensors in accordance with the manufacturer's recommendations.
- .2 Mount sensors rigidly and adequately for the environment within which the sensor operates.
- .3 Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- .4 All wires attached to sensors shall be air in EMT raceways.
- .5 Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
- .6 Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (10 ft.) of sensing element for each 1m2 (1 ft of sensing element for each 1 ft2) of coil area.
- .7 All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
- .8 Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
- .9 Differential air static pressure.
  - .1 Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
  - .2 Return Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.
  - .3 Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
  - .4 The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
  - .5 All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
  - .6 All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shutoff valves installed before the tee.

### 3.12 FLOW SWITCH INSTALLATION

- .1 Use correct paddle for pipe diameter.
- .2 Adjust flow switch in accordance with manufacturer's instructions.

### 3.13 ACTUATORS

- .1 Mount and link control damper actuators according to manufacturer's instructions.
  - .1 To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
  - .2 Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
  - .3 Provide all mounting hardware and linkages for actuator installation.
- .2 Electric/Electronic
  - .1 Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.
  - .2 Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

### 3.14 WARNING LABELS

- .1 Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.
  - .1 Labels shall use white lettering (12-point type or larger) on a red background.
  - .2 Warning labels shall read as follows:

#### CAUTION

**"Operating under automatic control". "Switch disconnect to "Off" position before servicing".**

- .2 Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.
  - .1 Labels shall use white lettering (12-point type or larger) on a red background.
  - .2 Warning labels shall read as follows:

#### CAUTION

**"Fed from more than one power source".**

### 3.15 IDENTIFICATION OF HARDWARE AND WIRING

- .1 All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.
- .2 Permanently label or code each point of field terminal strips to show the instrument or item served.

- .3 Identify control panels with minimum 1 cm (1/2 in.) letters on laminated plastic nameplates.
- .4 Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
- .5 Identify room sensors relating to terminal box or valves with nameplates.
- .6 Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- .7 Identifiers shall match record documents.
- .8 **All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.**

### 3.16 CONTROLLERS

- .1 Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
- .2 Building Controllers and Custom Application Controllers shall be selected to suit the application (i.e. fan powered box, heat pump, VAV etc.)

### 3.17 PROGRAMMING

- .1 Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.
- .2 Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.
- .3 Software Programming
  - .1 Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
    - .1 Text-based:
      - .1 Must provide actions for all possible situations
      - .2 Must be modular and structured
      - .3 Must be commented
    - .2 Graphic-based:
      - .1 Must provide actions for all possible situations
      - .2 Must be documented
    - .3 Parameter-based:
      - .1 Must provide actions for all possible situations
      - .2 Must be documented

.4 Operator Interface

- .1 Standard graphics-Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as set points.
- .2 Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point shown.
- .3 The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

**3.18 CONTROL SYSTEM CHECKOUT AND TESTING**

- .1 Start-up Testing: All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. Submit test worksheets to the consultant. This testing shall be completed before the owner's representative is notified of the system demonstration.
  - .1 The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
  - .2 Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
  - .3 Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.
  - .4 Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
  - .5 Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
  - .6 Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum start/stop routines.
  - .7 Alarms and Interlocks:
    - .1 Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
    - .2 Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
    - .3 Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

### 3.19 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

#### .1 Demonstration

- .1 Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
- .2 The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The consultant will be present to observe and review these tests. The consultant shall be notified at least 10 days in advance of the start of the testing procedures.
- .3 The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
- .4 The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.
- .5 As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
- .6 Demonstrate compliance with Part 1, "System Performance."
- .7 Demonstrate compliance with sequences of operation through all modes of operation.
- .8 Demonstrate complete operation of operator interface.
- .9 Additionally, the following items shall be demonstrated:
  - .1 DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
  - .2 Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.

- .3 Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
- .4 Interface to the building fire alarm system.
- .5 Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/consultant. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
- .10 Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.
- .2 Acceptance
  - .1 All tests described in this specification shall have been performed to the satisfaction of both the consultant and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the consultant. Such tests shall then be performed as part of the warranty.

### **3.20 CLEANING**

- .1 The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove alt cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
- .2 At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
- .3 At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

### **3.21 TRAINING**

- .1 Provide a minimum of one on-site or classroom training sessions, throughout the contract period for personnel designated by the owner.
- .2 Provide two additional training sessions at one month following building's turnover. Each session shall be for one day in length and must be coordinated with the building owner.
- .3 Train the designated staff of owner's representative and owner to enable them to do the following:
  - .1 Day-to-day Operators:
    - .1 Proficiently operate the system
    - .2 Understand control system architecture and configuration
    - .3 Understand DDC system components

- .4 Understand system operation, including DDC system control and optimizing routines (algorithms)
- .5 Operate the workstation and peripherals
- .6 Log on and off the system
- .7 Access graphics, point reports, and logs
- .8 Adjust and change system set points, time schedules, and holiday schedules
- .9 Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
- .10 Understand system drawings and Operation and Maintenance manual
- .11 Understand the job layout and location of control components
- .12 Access data from DDC controllers and ASCs
- .13 Operate portable operator's terminals
- .2 Advanced Operators:
  - .1 Make and change graphics on the workstation
  - .2 Create, delete, and modify alarms, including annunciation and routing of these
  - .3 Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals
  - .4 Create, delete, and modify reports
  - .5 Add, remove, and modify system's physical points
  - .6 Create, modify, and delete programming
  - .7 Add panels when required
  - .8 Add operator interface stations
  - .9 Create, delete, and modify system displays, both graphical and others
  - .10 Perform DDC system field checkout procedures
  - .11 Perform DDC controller unit operation and maintenance procedures
  - .12 Perform workstation and peripheral operation and maintenance procedures
  - .13 Perform DDC system diagnostic procedures
  - .14 Configure hardware including PC boards, switches, communication, and I/O points
  - .15 Maintain, calibrate, troubleshoot, diagnose, and repair hardware
  - .16 Adjust, calibrate, and replace system components
  - .17 System Managers/Administrators:
    - .18 Maintain software and prepare backups
    - .19 Interface with job-specific, third-party operator software
    - .20 Add new users and understand password security procedures
- .4 These objectives will be divided into three logical groupings. Participants may attend one or more of these, depending on level of knowledge required.
  - .1 Day-to-day Operators: parts 1-13
  - .2 Advanced Operators: parts 1-29
  - .3 System Managers/Administrators: parts 1-13 and 30-32

- .5 Provide course outline and materials in accordance with the "Submittals" article in Part I of this specification. The instructor(s) shall provide one copy of training material per student.
- .6 The instructor(s) shall be factory-trained instructors experienced in presenting this material.
- .7 Classroom training shall be done using a network of working controllers representative of the installed hardware.

### **3.22 CONTROL VALVE INSTALLATION**

- .1 Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.
- .2 Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the horizontal position.
- .3 Valves shall be installed in accordance with the manufacturer's recommendations.
- .4 Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.
- .5 Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system. (*Note to designer: this must also be shown.*) Unions shall be installed at all connections to screw-type control valves.
- .6 Provide tags for all control valves indicating service and number. Tags shall be brass, 1.5 inch in diameter, with 1/4" high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.

### **3.23 CONTROL DAMPER INSTALLATION**

- .1 Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
- .2 Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 1/4 in. larger than damper dimensions and shall be square, straight, and level.
- .3 Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8 in.) of each other.
- .4 Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
- .5 Install extended shaft or jackshaft according to manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)
- .6 Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.



- .7 Provide a visible and accessible indication of damper position on the drive shaft end.
- .8 Support ductwork in area of damper when required to prevent sagging due to damper weight.
- .9 After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

### 3.24 DUCT SMOKE DETECTION

- .1 Submit data for coordination of duct smoke detector interface to HVAC systems as required in Part 1, "Submittals."
- .2 This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

### 3.25 CONTROLS COMMUNICATION PROTOCOL

- .1 General. The electronic controls packaged with this equipment shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control set points as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in *ANSI/ASHRAE Standard 135* (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.
- .2 Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
- .3 I/O Capacity. The controller shall contain sufficient I/O capacity to control the target system.
- .4 Communication. The controller shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol. Each network of controllers shall be connected to one building controller.
- .5 The Controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool.
- .6 Environment. The hardware shall be suitable for the anticipated ambient conditions.
  - .1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 65°C (-40°F to 150°F).
  - .2 Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- .7 Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
- .8 Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90 days. Immunity to Power and Noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

- .9 Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

**3.26 STARTUP AND CHECKOUT PROCEDURES**

- .1 Start up, check out, and test all hardware and software and verify communication between all components.
- .2 Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
- .3 Verify that all analog and binary input/output points read properly.
- .4 Verify alarms and interlocks.
- .5 Verify operation of the integrated system.
- .6 Submit report to the consultant and include as built information.

**END OF SECTION**

## **Division 26 Common Requirements for Electrical**

26 00 11	Electrical Specification Index
	<b>Common Contract Requirements for Electrical</b>
26 01 16	Electrical Contract General Requirements
	<b>Common Work Results for Electrical</b>
26 05 19	Wires and Cables
26 05 20	Splitters, Junction, and Pull Boxes
26 05 21	Outlet Boxes, Conduit Boxes and Fittings
26 05 22	Wire and Box Connectors – 0 –1000 V
26 05 26	Grounding Secondary
26 05 33	Conduits, Conduit Fastenings and Conduit Fittings
26 05 74	Short Circuit/Coordination Study Arc Flash Hazard Analysis
26 05 75	Auxiliary Systems
26 05 76	Electric Heating Systems
	<b>Low-Voltage Transformers</b>
26 22 13	Dry Type Transformers
	<b>Switchboard and Panelboards</b>
26 24 16	Panelboards
26 24 17	Moulded Case Circuit Breakers
	<b>Low-Voltage Distribution Equipment</b>
26 27 26	Wiring Devices
	<b>Low-Voltage Circuit Protective Devices</b>
26 28 13	Fuses – Low Voltage
26 28 16	Disconnect Switches
	<b>Low-Voltage Controllers</b>
26 29 13	Starters and Contactors
	<b>Electrical and Cathodic Protection</b>
26 43 13	Surge Protective Devices
	<b>Lighting</b>
26 51 13	Lighting Equipment
26 51 16	Digital Occupancy & Daylight Control Systems

## **Division 28 Electronic Safety and Security**

	<b>Fire Detection and Alarm</b>
28 31 25	Fire Alarm System (Addressable)

END OF SECTION

**Part 1 General**

**1.1 GENERAL**

- .1 This Section covers items common to Electrical Division 26, as well as Division 27 and Division 28.**
- .2 This section supplements requirements of Division 1.
- .3 Furnish labour, materials, and equipment necessary for completion of work as described in contract documents.

**1.2 INTENT**

- .1 Mention herein or indication on Drawings of articles, materials, operations, or methods requires: supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to conditions stated: and, performance of each operation prescribed with furnishing of necessary labour, equipment, and incidentals for electrical work.
- .2 Where used, words "Section" and "Division" shall also include other Subcontractors engaged on site to perform work to make building and site complete in all respects.
- .3 Where used, word "supply" shall mean furnishing to site in location required or directed complete with accessory parts.
- .4 Where used, word "install" shall mean secured in place and connected up for operation as noted or directed.
- .5 Where used, word "provide" shall mean supply and install as each is described above.

**1.3 TENDERS**

- .1 Submit tender based on specified described equipment or Alternates listed.
- .2 State in Tender, names of all Subcontractors proposed for work under this Division.

**1.4 LIABILITY INSURANCE**

- .1 This contractor must maintain and produce at the request of the consultant proof of proper insurance to fully protect the owner, the consultant and the contractor from any and all claims due to accidents, misfortunes, acts of God, etc.

**1.5 ELECTRICAL SAFETY AUTHORITY**

- .1 The contractor is to determine general inspection fees with Electrical Safety Authority and include as part of tender.
- .2 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be coordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action. Contractor will not be responsible for these review costs.

**1.6 DRAWINGS**

- .1 Electrical Drawings do not show structural and related details. Take information involving accurate measurement of building from building drawings, or at building. Make, without additional charge, any necessary changes or additions to runs of conduits and ducts to accommodate structural conditions. Location of conduits and other equipment may be altered by the consultant without extra charge provided change is made before installation and does not necessitate major additional material.
- .2 As work progresses and before installing fixtures and other fittings and equipment which may interfere with interior treatment and use of building, provide detail drawings or obtain directions for exact location of such equipment and fitments.
- .3 Electrical drawings are diagrammatic. Where required work is not shown or only shown diagrammatically, install same at maximum height in space to conserve head room (minimum 2200 mm (88") clear) and interfere as little as possible with free use of space through which they can pass. Conceal wiring, conduits and ducts in furred spaces, ceilings and walls unless specifically shown otherwise. Install work close to structure so furring will be small as practical.
- .4 Before commencing work, check and verify all sizes, locations, grades, elevations, levels and dimensions to ensure proper and correct installation. Verify existing/municipal services.
- .5 Locate all electrical equipment in such a manner as to facilitate easy and safe access to and maintenance and replacement of any part.
- .6 In every place where there is indicated space reserved for future or other equipment, leave such space clear, and install services so that necessary installation and connections can be made for any such apparatus. Obtain instructions whenever necessary for this purpose.
- .7 Relocate equipment and/or material installed but not co-ordinated with work of other Sections as directed, without extra charge.
- .8 Where drawings are done in metric and product not available in metric, the corresponding imperial trade size shall be utilized.

**1.7 INTERFERENCE AND CO-ORDINATION DRAWINGS**

- .1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the constructed spaces provided.
- .2 Prepare drawings to indicate co-ordination 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 co-ordinated.
- .3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.
- .4 Upon consultant's request submit copies of interference drawings to the consultant.

- .5 Due to the nature of the building and the complexity of the building systems provide the following:
  - .1 Interference drawings, showing coordination of architectural, structural, mechanical, and electrical systems for the consultant's review prior to fabrication.
  - .2 Detailed equipment room drawings clearly showing all distribution equipment.
  - .3 Detailed layout drawings clearly showing conduit/feeder runs 78mm diameter or larger, including hangers or tray.
- .6 Provide CAD drawings (minimum file version AutoCAD 2013) in addition to hard copies.

#### **1.8 QUALITY ASSURANCE**

- .1 The installations of the division must conform to the latest edition of the Electrical Safety Code as well as its supplemental bulletins and instructions. Provide materials and labour necessary to comply with rules, regulations, and ordinances.
- .2 Complete underground systems in accordance with CSA C22.3 No. 7-94 except where specified otherwise.
- .3 Abbreviations for electrical terms: to CSA Z85-1983.
- .4 In case of differences between building codes, provincial laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify consultant in writing of such differences.

#### **1.9 ALTERNATES AND SUBSTITUTIONS**

- .1 Throughout these sections are lists of "Alternate Equipment" manufacturers acceptable to consultant if their product meets characteristics of specified described equipment.
- .2 Each bidder may elect to use "Alternate Equipment" from lists of Alternates where listed. Include for any additional costs to suit Alternated used. Prices are not required in Tender for Alternates listed.
- .3 When two or more suppliers/manufacturers are named in the Bid Documents, only one supplier/manufacturer of the products named will be acceptable; however, it is the responsibility of this Division to ensure "Alternate Equipment" fits space allocated and gives performance specified. If an "Alternate Equipment" unit is proposed and does not fit space allotted nor equal specified product in consultant's opinion, supply of specified described equipment will be required without change in Contract amount. Only manufacturers listed will be accepted for their product listing. All other manufacturers shall be quoted as substitution stating conditions and credit amount.
- .4 If item of material specified is unobtainable, state in Tender proposed substitute and amount added or deducted for its use. Extra monies will not be paid for substitutions after Contract has been awarded.

**1.10 EXAMINATION**

- .1 Site Reviews
  - .1 Examine premises to understand conditions, which may affect performance of work of this Division before submitting proposals for this work.
  - .2 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- .2 Drawings:
  - .1 Electrical Drawings show general arrangement of fixtures, power devices, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  - .2 Consider Architectural, Mechanical, and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Electrical Drawings.
  - .3 Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- .3 Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

**1.11 SEQUENCING AND SCHEDULING**

- .1 It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to consultant. Should conditions arise where certain changes would be advisable, secure consultant's approval of these changes before proceeding with work.
- .2 Coordinate work of various trades in installing interrelated work. Before installation of electrical items, make proper provision to avoid interferences in a manner approved by consultant. Changes required in work specified in these sections caused by neglect to do so shall be made at no cost to owner.
- .3 Arrange fixtures, conduit, ducts, and equipment to permit ready access to junction boxes, starters, motors, control components, and to clear openings of doors and access panels.

- .4 Furnish and install inserts and supports required by these sections unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by the electrical trade.
- .5 Adjust locations of ducts, conduits, equipment, fixtures, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each conduit and duct prior to installation.
  - .1 Make offsets, transitions, and changes in direction of ducts, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
  - .2 Supply and install pull boxes, etc, as required to effect these offsets, transitions, and changes in direction.

#### 1.12 REQUEST FOR INFORMATION (RFI) PROCEDURES

- .1 RFIs shall be submitted to the consultant minimum two (2) weeks prior to answer being required. Failure to submit and RFI in a timely manner will forfeit delay claims and schedule extension requests by the contractor.
- .2 All RFIs will be submitted with the following information:
  - .1 RFI number
  - .2 Name of project
  - .3 Date of initiation
  - .4 Date response required by (minimum two (2) weeks)
  - .5 Subject
  - .6 Submitter's name
  - .7 Drawing/specification reference
  - .8 Photograph of the issue (if applicable)
  - .9 Description of the issue
  - .10 Contractor's proposed resolution

#### 1.13 DRAW BREAKDOWN

- .1 This contractor MUST submit a breakdown of the tender price into classifications to the satisfaction of the consultant, with the aggregate of the breakdown totaling the total contract amount. **Each item must be broken out into material and labour costs.** Progress claims, when submitted are to be itemized against each item of the draw breakdown. This shall be done in table form showing contract amount, amount this draw, total to date, % complete and balance.
- .2 Breakdown shall be as follows:
  - .1 Permits and fees
  - .2 Mobilization (maximum 1%)
  - .3 Demolition



- .4 Panelboards and miscellaneous distribution equipment
- .5 Secondary cables
- .6 Feeder conduits
- .7 Branch conduits
- .8 Feeder cables
- .9 Branch wiring
- .10 Lighting fixtures (interior)
- .11 Emergency lighting
- .12 Exterior lighting
- .13 Fire alarm system
- .14 Voice/Data system rough in
- .15 Starters, contactors and control devices
- .16 Electric heating
- .17 Electric vehicle charger rough in
- .18 Wiring for mechanical equipment
- .19 Wiring for owner's equipment
- .20 Electrical contractor closeout requirements (minimum of 3% but not less than \$5,000.00)
- .3 The breakdown must be approved by the consultant prior to submission of the first draw.
- .4 Breakdowns not complying to the above will not be approved.
- .5 Breakdown must indicate total contract amount.
- .6 **Mobilization amount may only be drawn when all required shop drawings have been reviewed by the consultant.**

#### 1.14 SHOP DRAWINGS AND PRODUCT DATA

- .1 General
  - .1 Furnish complete catalog data for manufactured items of equipment to be used in the work to consultant for review within 14 days after award of Contract.
  - .2 Upon receipt of reviewed shop drawing, product is to be ordered immediately.
  - .3 Provide a complete list of shop drawings to be submitted prior to first submission.
  - .4 Before submitting to the consultant, review all shop drawings to verify that the products illustrated therein conform to the Contract Documents. By this review, the contractor agrees that it has determined and verified all field dimensions, field construction criteria, materials, catalogue numbers, and similar data and that it 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 drawings shall be indicated by stamp, date and signature of a qualified and responsible person possessing by the appropriate authorization.

- .5 If material or equipment is not as specified or submittal is not complete, it will be rejected by consultant.
- .6 Additional shop drawings required by the contractor for maintenance manuals, site copies etc., shall be photocopies of the "reviewed" shop drawings. All costs to provide additional copies of shop drawings shall be borne by the contractor.
- .7 **Submit all shop drawings for the project as a package. Partial submittals will not be accepted.**
- .8 Catalog data or shop drawings for equipment, which are noted as being reviewed by consultant or his engineer shall not supersede Contract Documents.
- .9 Review comments of consultant shall not relieve this Division from responsibility for deviations from Contract Documents unless consultant's attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.
- .10 Check work described by catalog data with Contract Documents for deviations and errors.
- .11 Shop drawings and product data shall show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances. e.g. access door swing spaces.
- .12 Shop drawings and product data shall be accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Manufacturer test data where requested.
  - .3 Manufacturer to certify as to current model production.
  - .4 Certification of compliance to applicable codes.
- .13 State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. List on catalog covers page numbers of submitted items. Underline applicable data.
- .14 **If a shop drawing is returned "reviewed as noted" this contractor must provide written indication that the comments have been complied with.**
- .15 A partial list of shop drawings includes:
  - .1 Panelboards and transformers
  - .2 Fire alarm system
  - .3 Luminaires and drivers
  - .4 Emergency battery units, exit signs, and fixtures
  - .5 Electrical heaters
  - .6 Snow melting equipment
  - .7 Starters, contactors and control devices
  - .8 Firestopping materials
  - .9 Surface raceways
  - .10 Hand dryers
  - .11 Wiring devices
  - .12 Cable management hangers

- .13 Lighting controls
  - .14 Fuses
  - .15 Surge protection devices
  - .16 Grounding system components
  - .17 Roof cone
  - .18 Miscellaneous enclosures
  - .19 Co-ordination study and arc flash hazard analysis
- .2 Submissions shall be submitted electronically as per the following directions:
- .1 Electronic Submissions:
    - .1 Electronically submitted shop drawings shall be prepared as follows:
      - .1 Use latest software to generate PDF files of submission sheets.
      - .2 Scanned legible PDF sheets are acceptable. Image files are not acceptable.
      - .3 PDF format shall be of sufficient resolution to clearly show the finest detail.
      - .4 PDF page size shall be standardized for printing to letter size (8.5"x11"), portrait with no additional formatting required by the consultant. Submissions requiring larger detail sheets shall not exceed 11"x17".
      - .5 Submissions shall contain multiple files according to section names as they appear in Specification.
      - .6 File names shall include consultant project number and description of shop drawing section submitted.
      - .7 Each submission shall contain an index sheet listing the products submitted, indexed in the same order as they appear in the Specification. Include associated PDF file name for each section.
      - .8 On the shop drawing use an "electronic mark" to indicate what is being provided.
      - .9 **Each file shall bear an electronic representation of the "company stamp" of the contractor. If not stamped the file submission will not be reviewed.**
    - .2 Email submissions shall include subject line to clearly identify the consultants' project number and the description of the shop drawings submitted.
    - .3 Electronic attachments via email shall not exceed 10MB. For submissions larger than 10MB, multiple email messages shall be used. Denote related email messages by indicating "1 of 2" and "2 of 2" in email subject line for the case of two messages.
    - .4 Electronic attachments via web links (URL) shall directly reference PDF files. Provide necessary access credentials within link or as username/password clearly identified within body of email message.

- .5 On site provide one copy of the “reviewed” shop drawings in a binder as noted above.
- .6 Contractor to print copies of “reviewed” shop drawings and compile into maintenance manuals in accordance with requirements detailed in this section.

**1.15 CARE, OPERATION AND START-UP**

- .1 Instruct consultant and operating personnel in the operation, care and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

**1.16 VOLTAGE RATINGS**

- .1 Operating voltages: to CAN3-C235-83.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

**1.17 PERMITS, FEES AND INSPECTION**

- .1 A submission has been made (if required by this scope of project) by the consultant to the Electrical Safety Authority for review of this project. The payment of the required review costs will be co-ordinated by the consultant. A copy of the Electrical Safety Authority review report will be forwarded to the successful contractor for information and action.
- .2 The contractor is required to include in his tender all required inspection costs by the Electrical Safety Authority. Permit application is the responsibility of the contractor.
- .3 Reproduce drawings and specifications required by Electrical Safety Authority at no cost.
- .4 Notify consultant of changes required by Electrical Safety Authority prior to making changes.
- .5 Furnish Certificates of Acceptance to consultant from Electrical Safety Authority and other authorities having jurisdiction upon completion of work.
- .6 This contractor must furnish any certificates required to indicate that the work completed conforms with laws and regulations of authorities having jurisdiction.

**1.18 ADDITIONAL INSTALLED EQUIPMENT**

- .1 The electrical contractor is to review all specification sections forming part of the electrical bid documents and include additional equipment or components, as well as all associated installation costs and testing costs as noted, in the electrical bid price.

**1.19 MATERIALS AND EQUIPMENT**

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Safety Authority.
- .2 Factory assemble control panels and component assemblies.

**1.20 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS**

- .1 Supplier and installer responsibility is indicated in the Equipment Wiring Schedule on electrical drawings.
- .2 Control wiring and conduit is specified in the Electrical specifications except for conduit, wiring and connections below 50 V, which are related to control systems specified in the Mechanical specifications.

**1.21 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint indoor switchgear and distribution enclosures light grey.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks, fastenings, and conduits etc. to prevent rusting.

**1.22 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates:
  - .1 Lamicoid 3 mm (1/8") thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

**NAMEPLATE SIZES**

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Size 1	9 mm x 50 mm (3/8" x 2")	1 line	3 mm (1/8") high letters
Size 2	12 mm x 70 mm (1/2" x 2 1/2")	1 line	5 mm (3/16") high letters
Size 3	12 mm x 70 mm (1/2" x 2 1/2")	2 lines	3 mm (1/8") high letters
Size 4	20 mm x 90 mm (3/4" x 3 1/2")	1 line	9 mm (3/8") high letters
Size 5	20 mm x 90 mm (3/4" x 3 1/2")	2 lines	5 mm (3/16") high letters
Size 6	25 mm x 100 mm (1" x 4")	1 line	12 mm (1/2") high letters
Size 7	25 mm x 100 mm (1" x 4")	2 lines	6 mm (1/4") high letters

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- .3 Wording on nameplates labels to be approved by consultant prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

- .7 Nameplates for disconnects, starters and contactors must indicate equipment being controlled and voltage.
- .8 Nameplates for transformers must indicate transformer label as indicated and capacity, primary, and secondary voltages.

#### 1.23 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

#### 1.24 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m (45') intervals.
- .3 Colour bands must be 25 mm (1") wide.

	<u>Prime</u>
up to 208 V	yellow
209 to 600 V	white
Voice system	green
Data System	orange
Security	brown
Fire alarm	red
Emergency lighting	pink
- .4 This contractor must paint all system junction boxes and covers in conformance with the above schedule.

#### 1.25 PROTECTION OF OPENINGS

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

#### 1.26 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

#### 1.27 MANUFACTURERS AND CSA LABELS

- .1 All labels must be visible and legible after equipment is installed.

#### 1.28 WARNING SIGNS

- .1 To meet requirements of Electrical Safety Authority and consultant.
- .2 Provide porcelain enamel signs, with a minimum size of 175 mm x 250 mm (7" x 10").

**1.29 LOCATION OF OUTLETS**

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm (6") horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m (10'), and information is given before installation.
- .3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door.

**1.30 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise. Coordinate with block coursing (if applicable).
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1100 mm (43.3").
  - .2 Wall receptacles:
    - .1 General: 400 mm (16").
    - .2 Above top of continuous baseboard heater: 200 mm (8").
    - .3 Above top of counters or counter splash backs: 100 mm (4").
    - .4 In mechanical rooms: 1200 mm (48").
  - .3 Panelboards: as required by Code or 1400 mm (56").
  - .4 Voice/Data outlets: At height of adjacent outlet or at 400 mm (16").
  - .5 Fire alarm stations: 1200 mm (3' - 11").
  - .6 Fire alarm visual and signal devices: 2250 mm (88 ½").
  - .7 Thermostat: 1200 mm (3'-11").
  - .8 Heaters: 200 mm (8" AFF) to bottom of heater.
  - .9 Emergency call switches and/or pushbuttons: 900 mm (36").

**1.31 LOAD BALANCE**

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

**1.32 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete shall be schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm (2") beyond either side.
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

**1.33 FIELD QUALITY CONTROL**

- .1 Conduct and pay for following tests:
  - .1 Power distribution system including phasing, voltage, grounding, and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: fire alarm system, communications, security.
- .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 Insulation resistance testing.
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing.
- .4 Carry out tests in presence of consultant.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Submit test results for consultant's review.

**1.34 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings as indicated on drawings or as determined from co-ordination study.
- .2 Electrical connections to all equipment requiring connection to the electrical distribution system as part of this electrical tender have been specified according to the anticipated equipment manufacturer electrical requirements and the applicable sections of the OESC. This contractor must coordinate electrical connections to all equipment specified to be connected as part of this electrical tender.



- .3 Prior to submitting electrical distribution shop drawings to the consultant, review all shop drawings for all equipment specified for connection to the electrical distribution system to verify that the product electrical connection requirements listed by the manufacturer conform to the equipment electrical connections specified on the electrical design drawings and specifications. Make necessary revisions to breaker ratings associated with the review of all product shop drawings and identify such changes as part of the electrical distribution equipment shop drawing submission.
- .4 Prior to making final equipment connections, this electrical contractor shall examine equipment nameplates at the project site to confirm voltage and phase requirements, minimum circuit ampacity and maximum overcurrent protection values, and bring to the attention of the consultant in writing any connection requirements which may vary from the designed connections or approved electrical distribution shop drawings. No subsequent allowance for time or money for changes to breaker or wire and conduit sizes will be considered for any consequence related to failure to examine site conditions.

#### 1.35 GUARANTEE AND WARRANTY

- .1 At ready for takeover of this project this Contractor must provide a written guarantee indicating that any defects, not due to ordinary wear and tear or improper use which occur within the first year from the date of ready for takeover will be corrected at the contractors expense.
- .2 **If the electrical sub-contractor's office is 50 kilometers (30 miles) or more from the project site, the sub-contractor is to provide a service/warranty work agreement for warranty period with a local electrical sub-contractor approved by consultant. Include copy of service/warranty agreement in warranty section of operation and maintenance manual.**
- .3 Warranty period shall start from date of ready for takeover completion.
- .4 Refer to individual specification sections for information on any special manufacturer's equipment warranties.

#### 1.36 SYSTEM START UP

- .1 Provide consultant with written notice verifying all equipment operation and installation is complete prior to scheduled start-up period.
- .2 Start up shall be in presence of the following: owner or representative, contractor, and manufacturer's representative. Each person shall witness and sign off each piece of equipment. Consultant's attendance will be determined by consultant.
- .3 Arrange with all parties and provide 72 hours notice for start up procedure.
- .4 Simulate system start up and shut down and verify operation of each piece of equipment.
- .5 These tests are to demonstrate that the systems and equipment installed are operational as specified.
- .6 The contractor must describe during the start up session the required maintenance for each piece of equipment according to the manufacturer.

- .7 The contractor must provide all necessary tools (including a digital multimeter) to successfully complete the start up procedure.

**1.37 OPERATION AND MAINTENANCE MANUAL**

- .1 Provide operation and maintenance data for incorporation into manual as specified in other Sections of this Division.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, consultant before final inspection.
  - .1 Submit 1 copy of Operation and Maintenance Manual to consultant for approval. Submission of individual data will not be accepted unless so directed by consultant. Submission can be done electronically in pdf format or as a hardcopy.
    - .1 Electronic submission/pdf file is required to be bookmarked. Any submission received without bookmarking will be immediately returned as unacceptable.
    - .2 Hardcopy submission shall be in a three-ring binder (minimum 50 mm (2") ring) and labelled as 'Operation and Maintenance Manual' with project name and location. Dividers are to be used for binder organization.
  - .2 Make changes as required and re-submit as directed by consultant.
- .3 Each manual must include (in "tabbed" sections) the following:
  - .1 Index
  - .2 List of General, Mechanical, Electrical Contractors and all associated sub-contractor names, addresses and contact numbers.
  - .3 List of suppliers and equipment wholesalers local to the project.
  - .4 Letter of contractor's warranty and guarantee for all parts, equipment and workmanship.
  - .5 List of manufacturers, spare parts list and source.
  - .6 Copy of typewritten schedules for all new and renovated panels.
  - .7 Copy of all substantial performance final certificates.
  - .8 Copy of electrical shop drawings which have been stamped and reviewed by consultant.
  - .9 Electrical As-built drawings including contractor company's as built stamp.
  - .10 Coordination study/Arc flash hazard study shop drawings
  - .11 Any special warranties on equipment required (i.e. LED lighting, digital lighting control, SPDs).
  - .12 System commissioning certificate and report.

- .4 Final Submittals:
  - .1 Upon acceptance of Operation and Maintenance Manual by the consultant provide the following:
    - .1 Provide one (1) copy of final operation maintenance manual, as well as a PDF file of the entire approved manual on a USB stick. Only one USB stick is to be provided containing both the approved manual and as-built drawings.

### **1.38 AS-BUILT DRAWINGS**

- .1 Site records:
  - .1 Contractor shall provide 2 sets of reproducible electrical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include field and contract changes to electrical systems.
  - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection at all times.
- .2 As-built drawings:
  - .1 Identify each drawing in lower right-hand corner in letters at least 3 mm (1/8") high as follows: - "AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  - .2 Submit hard copy to consultant for approval. When returned, make corrections (if any) as directed.
  - .3 Once approved, submit completed reproducible paper as-built drawings as well as a scanned pdf file copy on USB stick with Operating and Maintenance Manuals.

### **1.39 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS**

- .1 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.
- .2 Manufacturers or their representatives are to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, As-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, consultants may record these demonstrations on video tape for future reference.

**1.40 OCCUPANCY REQUIREMENTS**

- .1 The contractor shall provide the following documentation to the consultant's satisfaction prior to receiving occupancy. Failure to provide the proper documentation will result in the occupancy not being granted. List of required documentation:
  - .1 Final Certificates (required prior to consultant's release of conformance letter).
    - .1 Electrical Safety Authority.
    - .2 Emergency Lighting.
    - .3 Fire Alarm Verification Certificate.

**1.41 READY FOR TAKEOVER**

- .1 Complete the following to the satisfaction of the consultant prior to request for ready for takeover.
  - .1 As-built Drawings.
  - .2 Maintenance Manuals.
  - .3 System Start up.
  - .4 Instructions to Owners.
  - .5 Coordination Study / Arc Flash Hazard (including photos of each breaker).
  - .6 Lighting Control System.
  - .7 **Outlet cover circuit labels.**

**1.42 TRIAL USAGE**

- .1 Consultant or owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

**1.43 REVISION TO CONTRACT**

- .1 Provide the following for each item in a given change notice:
  - .1 Itemized list of material with associated costs.
  - .2 Labour rate and itemized list of labour for each item.
  - .3 Copy of manufacturers/suppliers invoice if requested.

**1.44 EQUIPMENT SUPPORTS**

- .1 Equipment supports supplied by equipment manufacturer: shall be installed by the electrical contractor.
- .2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel meeting requirements of - Structural Steel Section. Submit structural calculations with shop drawings if necessary.
- .3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm (4") high and 150 mm (6") larger than equipment dimensions all around. This installation of this pad shall be the responsibility of the electrical contractor.
- .4 This contractor shall be responsible for providing all anchor bolts and associated formed concrete bases for lighting standards as detailed.

**1.45 SLEEVES**

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete, or fire rated assemblies and as indicated.
- .2 Schedule 40 steel pipe.
- .3 Sleeves with annular fin continuously welded at midpoint:
  - .1 Through foundation walls.
  - .2 Where sleeve extends above finished floor.
- .4 Sizes: minimum 6 mm (1/4") clearance all around, between sleeve and conduit.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm (1") above other floors.
- .6 Through foundation walls PVC sleeves are acceptable.
- .7 Fill voids around pipes:
  - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
  - .2 Where sleeves pass through walls or floors, provide space for firestopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
  - .3 Fill future-use sleeves with easily removable filler.

**1.46 FIRESTOPPING**

- .1 Firestopping material and installation within annular space between conduits, ducts, and adjacent fire separation.
- .2 Provide materials and systems capable of maintaining effective barrier against flame, smoke, and gases.
- .3 Comply with the requirements of CAN4-S115-M35, and do not exceed opening sized for which they have been tested.
- .4 Systems to have an F or FT rating (as applicable) not less than the fire protection rating required for closures in a fire separation.
- .5 The firestopping materials are not to shrink, slump or sag and be free of asbestos, halogens and volatile solvents.
- .6 Firestopping materials are to consist of a component sealant applied with a conventional caulking gun and trowel.
- .7 Firestop materials are to be capable of receiving finish materials in those areas, which are exposed and scheduled to receive finishes.
- .8 Firestopping shall be inspected and approved by local authority prior to concealment or enclosure.
- .9 Install material and components in accordance with ULC certification, manufacturers instructions and local authority.

**.10 Submit product literature and installation material on firestopping in shop drawing and product data manual.**

**.11 Acceptable manufacturers:**

- .1 Rectorseal Corporation (Metacaulk)
- .2 Proset Systems
- .3 3M
- .4 Hilti
- .5 STI Firestop

**Note: Fire stop material must conform to requirements of local authorities having jurisdiction. Contractor to confirm prior to application and ensure material used is compatible with that used by other trades on site.**

**.12 Ensure firestop manufacturer representative performs on site inspections and certifies installation. Submit inspection reports/certification at time of ready for takeover.**

**1.47 PAINTING**

- .1 Refer to Section Interior Painting and specified elsewhere.
- .2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Prime and touch up marred finished paintwork to match original.
- .4 Restore to new condition, or replace equipment at discretion of consultant, finishes which have been damaged too extensively to be merely primed and touched up.

**1.48 ACCESS DOORS**

- .1 Supply access doors to concealed electrical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 mm x 600 mm (24" x 24") for body entry and 300 mm x 300 mm (12" x 12") for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
  - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by consultant.
  - .2 Remaining areas: use prime coated steel.
  - .3 Fire rated areas: provide ULC listed access doors
- .4 Installation:
  - .1 Locate so that concealed items are accessible.
  - .2 Locate so that hand or body entry (as applicable) is achieved.
  - .3 Installation is specified in applicable sections.

- .5 Acceptable materials:
  - .1 Le Hage
  - .2 Zurn
  - .3 Acudor
  - .4 Nailor Industries Inc.

**1.49 DELIVERY STORAGE & HANDLING**

- .1 Follow Manufacturer's directions in delivery, storage, and protection, of equipment and materials. Contractor to include all costs associated with delivery storage and handling in tender price.
- .2 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury, but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in dry, heated space.

**1.50 REPAIR, CUTTING, CORING AND RESTORATION**

- .1 Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of consultant. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
- .2 Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
- .3 Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
- .4 Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.
- .5 Slots, cores and openings through floors, walls, ceilings, and roofs shall be provided by this contractor but performed by a trade specializing in this type of work. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

**1.51 EXISTING SYSTEMS**

- .1 Connections into existing systems to be made at time approved by consultant. Request written approval of time when connections can be made.
- .2 Be responsible for damage to existing plant by this work.

**1.52 CLEANING**

- .1 Clean interior and exterior of all electrical equipment provided including light fixture lenses.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

**1.53 DISCONNECTION AND REMOVAL**

- .1 Disconnect and/or remove equipment as indicated.
- .2 Cap and conceal all redundant and obsolete connections.
- .3 Provide a list of equipment to be removed to the owner, for his acceptance of same.  
Remove all equipment from site, which the owner does not retain.
- .4 Store equipment to be retained by owner on site where directed by consultant.

**1.54 OWNER SUPPLIED EQUIPMENT**

- .1 Connect to equipment supplied by the owner and make operable.
- .2 Design drawings are diagrammatic and do not necessarily indicate all specific final connection requirements. For the purposes of bidding, electrical trade shall include but not be limited to provision of a junction box to connect equipment wiring tail, provision of suitable disconnecting means, and flexible connection directly to equipment.

**1.55 ENCLOSURES**

- .1 This contractor must ensure that all electrical equipment mounted in sprinklered areas is provided with an enclosure in conformance with the Electrical Safety Code.

**1.56 ELECTRICAL SYSTEMS COMMISSIONING**

- .1 This electrical contractor shall work with the building commissioning agent to perform commissioning of all electrical systems.

**1.57 EXISTING CONCRETE SLAB X-RAY/SCANNING**

- .1 This contractor shall retain the services of a qualified company to provide and X-ray and/or scan of the existing buried services in walls and/or floors prior to starting any work in the affected area.
- .2 Failure to locate existing piping, conduit, rebar etc., shall not relieve this contractor of repair of same prior to installing his service.
- .3 This contractor shall be responsible for all repairs and/or replacement of existing services caused by cutting the existing concrete slabs and/or walls.

**ND OF SECTION**



**Part 1            General**

**1.1            INTENT**

- .1 Life safety and fire protection systems are to be installed to comply with the provisions of the current Ontario Building and Fire Codes. As a result, testing of these integrated systems must be performed as a whole to ensure the proper operation and inter-relationship between systems (functional testing).
- .2 The testing is to provide functional verification and documented confirmation that these building systems satisfy the intent of the Building Code.
- .3 These systems as applicable to any given project include but are not limited to fire alarm, smoke and carbon monoxide alarms, sprinkler system and associated valves, standpipe, smoke control, ventilation, and pressurization systems, door hold open devices, elevator recalls, smoke, fire shutters, and dampers, emergency power generator, fire pump assemblies, and emergency lighting.

**1.2            GENERAL**

- .1 This testing process is the responsibility of the Integrated Testing Firm as a sub-contractor to the electrical trade. Electrical trade to include all costs associated with the Integrated Testing Coordinator in contract.
- .2 This process must be co-ordinated with suppliers and sub-contractors associated with these systems (mechanical and/or electrical).
- .3 This process must be co-ordinated with the project construction schedule and be completed, including all associated documentation, prior to the consultant's certification of the project for occupancy.
- .4 All applicable contractors, sub-contractors, and suppliers are to include all required costs in their respective tender costs.
- .5 All work is to be performed in accordance with CAN/ULC S1001-2011. Special consideration is to be given to the Sample Integrated Testing Plan (ITP), the review of life safety system design documents, and the provision of test plans and reports.
- .6 The work to be performed by this contractor is also described in CAN/ULC S1001-2011.
- .7 Refer to CAN/ULC S1001-11 Rev1-2019 Informative Annex (C) for Sample Integrated Testing Plan (ITP).

**1.3            QUALITY ASSURANCE**

- .1 The following criteria must be met in order to be considered an acceptable Integrated Testing Coordinator for this project:
  - .1 Manufacturers: Firms regularly engaged in functional testing and implementation of life safety and fire protection systems for not less than five years.

- .2 Qualifications: Firms with at least five years of successful experience in facility construction, inspection, acceptance testing or commissioning as it relates to fire protection and life safety and equipment similar to that required for this project.
  - .3 The Contractor shall be an established commissioning contractor that has had and currently maintains a locally run and operated business for at least five years.
  - .4 The Contractor shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the systems.
- .2 For bidder information only, experienced Life Safety Systems Testing Firms include these listed below or local branches of the companies noted in the vicinity of this project:
- .1 ITC Solutions  
20 Hanson Ave Unit 3  
Kitchener, ON, N2C 2E2
  - .2 Troy Life and Fire Safety  
805 Boxwood Dr., Unit #201  
Cambridge, Ontario N3E 1A4
  - .3 Control Tech Systems  
31 Regal Road  
Guelph, Ontario N1K 1B6
  - .4 Lonergan Engineering  
4 Industrial Parkway South  
Aurora, Ontario L4G 3W1
- NOTE: This agent must be a third party firm NOT associated with this project in any way and be under contract with the electrical sub-contractor not the fire alarm supplier.**
- .3 Other firms to these listed above, who feel they are capable, must submit in writing, to the Consultant's office confirmation of the items listed in the criteria above, a minimum of one week prior to tender close in order to be considered as a bidder.

#### **1.4 GENERAL REQUIREMENTS**

- .1 The Commissioning Process shall generally encompass and co-ordinate the following key areas:
  - .1 Integrated systems testing planning.
  - .2 Integrated systems testing implementation (functional testing).
  - .3 Integrated systems testing documentation

**1.5 RESPONSIBILITIES**

**.1 General Contractor:**

- .1** The general contractor shall verify completeness of the building envelope, perimeter and interior items which affect proper operation of the noted systems.
- .2** The general contractor will assure participation and co-operation of Sub-Contractors and Specialty Contractors (mechanical, electrical, building management, etc.) under the General Contractor's jurisdiction as required for the commissioning process.

**.2 Mechanical Contractor:**

- .1** Verify Functional performance of associated mechanical systems for compliance with design intent as specified in the appropriate Specification sections.
- .2** Provide the documentation with standard Functional performance reports on completion of the testing.
- .3** Verify submissions for system operation and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.

**.3 Electrical Contractor:**

- .1** The Integrated Life Safety Systems Testing Coordinator (ITC) is being retained by the electrical contractor, however; this contractor's work to satisfy the ITC requirements shall be included in the tender price.
- .2** Verify Functional performance of electrical systems for compliance with design intent as specified in the appropriate Specification sections.
- .3** Provide the documentation with standard Functional performance reports on completion of the testing.
- .4** Verify submissions for electrical system operation and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.
- .5** As a minimum this contractor must include for:
  - .1** Providing the ITC with documentation of design and shop drawings.
  - .2** Provide documents for sequence of operation and maintenance of system.
  - .3** Testing of all components and accessories to confirm Alarm/Supervisory/Trouble at the fire panel.
  - .4** Testing and operation of any generator (s) as applicable to the project.
  - .5** Other items that may be requested by the ITC.
  - .6** Re-commissioning of any items that may have failed.

- .7 Re-setting of the system to proper operation after tests are completed.
  - .8 Provide written confirmation that life safety systems are installed in accordance with applicable codes and standards, as well as the scope of the project engineering documents.
- .4 Equipment Manufacturers:
  - .1 The equipment manufacturers shall be responsible for providing labour, material, equipment, etc., required within the scope of the respective equipment to facilitate the commissioning process.
  - .2 The equipment manufacturers will perform Pre-Functional and Functional Performance Tests required by the commissioning process.
- .5 Design Engineer:
  - .1 The design engineer shall review and provide written confirmation of acceptance of the Integrated Testing Plan (ITP).
  - .2 The design engineer shall observe Functional Performance Testing, at his discretion.
  - .3 The design engineer shall provide technical capabilities for resolution of deficiencies, where required.
  - .4 The design engineer shall provide necessary information to assist Integrated Test Coordinator including written confirmation of life safety systems installation in accordance with project engineering documents and are ready for integrated testing.

## **Part 2 Commissioning Process**

### **2.1 OPERATIONS AND MAINTENANCE MANUALS**

- .1 Furnish Final, reviewed Operation and Maintenance Manuals to the Consultant fourteen (14) days prior to scheduled Functional Performance Tests.

### **2.2 FUNCTIONAL PERFORMANCE TEST**

- .1 The contractor shall be responsible for the Functional Performance Tests. These tests ensure that all equipment and systems are installed in accordance with the Specifications, Drawings and manufacturers' requirements.
- .2 The contractor shall be responsible for co-ordinating schedule for Functional tests of various equipment and systems.

- .3 In the Functional Test, all noted systems and sub-systems shall be checked for the following:
  - .1 Verify that each element has been properly installed, properly identified, and that all connections have been made correctly.
  - .2 Verify that tests, meter readings, and specific mechanical/electrical performance characteristics agree with those required by equipment or system manufacturer.
  - .3 Re-commission any item(s) that may have failed.
  - .4 Notify the consultant in writing, at least fourteen (14) days prior to the date of Functional Performance Testing. Schedule the Functional performance tests over a period of consecutive business days.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No.131-M89(R1994), Type TECK 90 Cable.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with Electrical General Requirements Section.

**Part 2 Products**

**2.1 BUILDING WIRES**

- .1 Conductors: stranded for 10 AWG and larger.
- .2 Minimum size: 12 AWG.
- .3 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material 90°C (194°F) rated T90 for indoor above grade installations and RW90 for below grade installations.

**2.2 TECK CABLE**

- .1 Cable: to CAN/CSA-C22.2 No.131.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper, size as indicated.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: aluminum.
- .5 Overall covering: polyvinyl chloride material.
- .6 Fastenings:
  - .1 One hole steel zinc straps to secure surface cables 50 mm (2") and smaller. Two hole steel straps for cables larger than 50 mm (2").
  - .2 Channel type supports for two or more cables at 1500 mm (60") centres.
  - .3 Threaded rods: 6 mm (1/4") diameter to support suspended channels.
- .7 Connectors must be suitable for:
  - .1 Installed environment and approved for use with TECK cable.

**2.3 ARMoured CABLES**

- .1 Conductors: insulated, copper minimum size as indicated above.
- .2 Type: AC90 (minimum size 12 AWG).
- .3 Armour: interlocking type fabricated from aluminum strip.

- .4 Connectors must be suitable for installed environment and approved for use with armoured cable.

**Part 3 Execution**

**3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring from source to load through raceways as specified.
- .2 Provide separate neutral conductors for all lighting circuits and circuits originating from surge protected panels. Size raceways accordingly.

**3.2 INSTALLATION OF TECK CABLE 0 - 1000 V**

- .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.

**3.3 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Wire and Box Connectors - 0 - 1000 V Section.
- .3 These cables are to be installed in concealed locations only. These concealed locations are considered to be stud walls and "drops" to stud walls, lighting fixtures, and ceiling mounted devices.
- .4 **These "drops" shall not be permitted to exceed 2.4 m (8'-0"). To limit these "drops" to lengths noted above provide additional branch wiring in conduit.**

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data for cabinets in accordance with Electrical General Requirements Section.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Junction and pull boxes must conform to CSA C22.2 No. 40 (latest edition)

**2.2 JUNCTION AND PULL BOXES**

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm (1") minimum extension all around, for flush-mounted pull and junction boxes.

**Part 3 Execution**

**3.1 JUNCTION AND PULL BOXES INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Install junction and pull boxes so as not to exceed 30 m (100') of conduit run between pull boxes and in conformance with the Electrical Safety Code.

**3.2 IDENTIFICATION**

- .1 Provide equipment identification in accordance with General Electrical Requirements Section.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Outlet boxes, conduit boxes, and fittings must conform to CSA C22.2 No. 18 (latest edition).

**Part 2 Products**

**2.1 OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm (4") square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

**2.2 SHEET STEEL OUTLET BOXES**

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 mm x 50 mm x 64 mm (3" x 2" x 2½") or as indicated. 102 mm (4") square outlet boxes when more than one conduit enters one side with extension and plaster rings as required. Iberville 1104 Series.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit **in utility rooms**, minimum size 102 mm x 57 mm x 38 mm (4" x 2¼" x 1½"). Iberville 1110 Series.
- .3 102 mm (4") square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm (4") square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

**2.3 MASONRY BOXES**

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

**2.4 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

**2.5 FLOOR BOXES**

- .1 Flush floor boxes where indicated shall be complete with the following features:
  - .1 Four (4) independent wiring compartments.
  - .2 Flexible activation cover.

- .3 Fully adjustable.
- .4 Sixteen (16) Kos 12.7 mm ( $\frac{1}{2}$  ") – 32 mm ( $1\frac{1}{4}$  ").
- .5 Stamped steel construction (concrete-tight).
- .2 Manufacturers:
  - .1 Wiremold Cat# RFB4-DTB-2-2T-RAKM11- flush floor box complete with two duplex receptacle brackets, 2 dual RJ brackets, and recessed activation with carpet trim plate.  
Approved alternates:
    - .1 Hubbell Cat. #LCFBSS complete with LCFB XX (colour by architect), flush cover and internal faceplate to suit devices noted on the drawings.
    - .2 Wellmark Electric Inc. Cat. #400B-1-YY-XX-CRL.

## 2.6 CONDUIT BOXES

- .1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle **in areas (other than utility rooms) where surface conduit is used.**

## 2.7 FITTINGS- GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm (1- 1/4") and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm (1/4") of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA C22.2 No.65-1956(R1965) Wire Connectors.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as indicated.
- .2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable, mineral insulated cable, and flexible conduit, as required.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
  - .3 Install fixture type connectors and tighten. Replace insulating cap.

**END OF SECTION**

**Part 1**            **General**  
**Not Applicable.**

**Part 2**            **Products**

**2.1**            **MATERIALS**

- .1            Grounding equipment must conform to CSA C22.2 No 41 (latest edition).

**2.2**            **EQUIPMENT**

- .1            Clamps for grounding of conductor: size as required to electrically conductive underground water pipe and electrically conductive metal gas piping.
- .2            Plate electrodes: galvanized steel, surface area 0.2 m<sup>2</sup>, minimum 1.6 mm thick.
- .3            Insulated grounding conductors: green with insulation type that matches specified phase conductors. Gauge shall be in conformance with the latest edition of the Electrical Safety Code to suit required installation conditions.
- .4            Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .5            Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1            Grounding and bonding bushings.
  - .2            Protective type clamps.
  - .3            Bolted type conductor connectors.
  - .4            Thermit welded type conductor connectors.
  - .5            Bonding jumpers, straps.
  - .6            Pressure wire connectors.

**Part 3**            **Execution**

**3.1**            **INSTALLATION GENERAL**

- .1            Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. **Where EMT is used, run ground wire in conduit.**
- .2            Install connectors in accordance with manufacturer's instructions.
- .3            Protect exposed grounding conductors from mechanical injury.
- .4            Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5            Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6            Soldered joints not permitted.

- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install separate ground conductor to outdoor lighting standards.

### **3.2 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, frames of motors, starters, building steel work, distribution panels, and outdoor lighting.

### **3.3 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, computer network systems as follows:
  - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
  - .2 Sound, fire alarm, computer network systems as indicated.

### **3.4 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Electrical General Requirements Section.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA C22.2 No.18-92, Outlet Boxes, Conduit Boxes, and Fittings.
  - .2 CSA C22.2 No.45-M1981(R1992), Rigid Metal Conduit.
  - .3 CSA C22.2 No.56-1977(R1977), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No.83-M1985(R1992), Electrical Metallic Tubing.
  - .5 CSA C22.2 No.211.2-M1984(R1992), Rigid PVC (Unplasticized) Conduit.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No.45, aluminum threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT) with couplings: to CSA C22.2 No.83.
- .4 Rigid PVC conduit: to CSA C22.2 No.211.2.
- .5 Flexible metal conduit: to CSA C22.2 No.56, aluminum and liquid-tight flexible metal.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 53 mm (2") and smaller. Two hole steel straps for conduits larger than 53 mm (2").
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m (5'0") oc.
- .4 Threaded rods, 6 mm (1/4") diameter, to support suspended channels.

**2.3 CONDUIT FITTINGS**

- .1 EMT fittings shall be set screw style (zinc alloy).
- .2 Flexible metal conduit fittings shall be screw-in type.
- .3 Liquid type flexible metal conduit fittings shall be sealtite type.
- .4 PVC fittings shall be PVC type complete with PVC adaptors at all boxes.
- .5 Rigid conduit and mineral insulated conduit fittings shall be threaded type.
- .6 Coating: same as conduit.
- .7 Factory "ells" where 90° bends are required for 27 mm (1") and larger conduits.

- .8 Where bushings are noted to be provided, they must be "screwed" type fastened to a conduit connector. Push-fit or glued in place bushings will NOT be accepted.

## 2.4 FISH CORD

- .1 Nylon twine.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical/ electrical service rooms and in unfinished areas. Where devices are to be installed on existing walls in finished area, which cannot be "fished", install feeds in a surface metal raceway equal to Wiremold V700 series. Co-ordinate surface installations with consultant prior to rough-in.
- .3 **Use electrical metallic tubing (EMT) for all branch circuits unless specified otherwise.**
- .4 Use rigid PVC conduit underground and in kitchen areas.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed fixtures without a prewired outlet box, connection to surface or recessed fixtures, work in movable metal partitions.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations and for connections to kitchen equipment.
- .7 Conduits terminating at electrical equipment in sprinklered areas are to be provided with insulated compression style connectors equal to Thomas & Betts Cat. #TC8XXSC or approved equal.
- .8 **Minimum conduit size for branch circuits shall be 21 mm (3/4").** Single drops from ceiling mounted junction boxes down to a light switch or duplex receptacle may be reduced to 16 mm (1/2").
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 27 mm (1") diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Run 2- 27 mm (1") spare conduits up to accessible ceiling space from each flush panel. Terminate these conduits in 152 mm x 152 mm x 102 mm (6" x 6" x 4") junction boxes in ceiling space.
- .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

### 3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m (5') clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm (3") parallel to steam or hot water lines with minimum of 25 mm (1") at crossovers.
- .7 Do not fasten surface conduit to roof deck. Provide standoffs or supports as manufactured by Caddy or use unistrut trapeze fastened to structure.**

### 3.3 CONCEALED CONDUITS

- .1 Do not install horizontal runs in masonry walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

### 3.4 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 27 mm (1") and larger 300 mm (12") below slab (measured from top of slab to bottom of conduit) and encased in 78 mm (3") sand envelope.

### 3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

**END OF SECTION**



**Part 1 General**

**1.1 GENERAL REQUIREMENTS**

- .1 The studies must be submitted to the Consultant prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Consultant may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.
- .2 The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system, **as well as mechanical unit equipment**. Normal system connections and those, which result in maximum fault conditions, shall be adequately covered in the study.
- .3 The firm should be currently involved in high- and low-voltage power system evaluation. The study must be performed, stamped and signed by a registered professional engineer in the Province of Ontario. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Consultant for approval prior to start of the work. A minimum of five (5) years experience in power system analysis is required for the individual in charge of the project.
- .4 The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

**1.2 DATA COLLECTION FOR THE STUDY**

- .1 The Contractor shall provide the required data for preparation of the studies. The Consultant performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.
- .2 The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.
- .3 Data collected for the study, including correspondence with local utility, shall be included with study report.

**Part 2 Products**

**2.1 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY**

- .1 The short-circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

- .2 In the short-circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short-circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant overcurrent protective device locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor fault contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
- .3 In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
- .4 Include on the curve sheets power company relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. In addition, include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.  
Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical fault current to which the device is exposed.
- .5 Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.
- .6 Include complete fault calculations as specified herein based on contract documents.
- .7 Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Provide studies in conjunction with equipment submittals to verify equipment ratings required. Submit the study to Consultant for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.

- .8 Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendum's issued prior to bid openings.
- .9 Include fault contribution of all motors in the study. Notify the Consultant in writing of circuit protective devices not properly rated for fault conditions.
- .10 When emergency generator is provided, include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Contractor shall obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.
- .11 Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.
- .12 For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.
- .13 **Evaluate proper rating of applicable mechanical unit equipment based on available fault at unit connection. Mechanical unit equipment in study shall include packaged assemblies identified as, but not limited to, AHUs, MUAs, DOAS, Chillers, and Cooling Towers.**

## 2.2 ARC FLASH HAZARD ANALYSIS

- .1 The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D and CSA Z462-(latest edition).
- .2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
- .3 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.
- .4 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- .5 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.
- .6 Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- .7 The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

- .8 Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
- .9 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-latest edition section B.1.2.

## 2.3 STUDY REPORT

- .1 The results of the power system study shall be summarized in a final report. Submit report in accordance with Electrical General Requirements Section as a shop drawing.
- .2 The report shall include the following sections:
  - .1 Descriptions, purpose, basis, and scope of the study.
  - .2 Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
  - .3 **Tabulations of mechanical unit equipment ratings as identified on equipment shop drawings versus calculated short-circuit, and commentary regarding same. Short-circuit calculations for mechanical equipment shall be based on unit MCA with conductor sizes as identified on electrical design drawings, and not based on equipment MOC.**
  - .4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
  - .5 Fault current calculations including a definition of terms and guide for interpretation of computer printout.
  - .6 Incident energy and flash protection boundary calculations
    - .1 Arcing fault magnitude
    - .2 Device clearing time
    - .3 Duration of arc
    - .4 Arc flash boundary
    - .5 Working distance
    - .6 Incident energy
    - .7 Hazard Risk Category
    - .8 Recommendations for arc flash energy reduction
    - .9 **Recommendations for Personal Protection Equipment (PPE) level.**

## Part 3 Execution

### 3.1 POWER COMPANY APPROVAL

- .1 Copies of the final report must be submitted to the power company for their review and approval. Approved copies of the report shall be submitted to the Consultant.

### 3.2 FIELD SETTINGS

- .1 The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, and protective device coordination study.
- .2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.
- .3 At the completion of the project, configure settings and install equipment labels. On company letterhead, the contractor is to prepare a certification letter indicating at minimum:
  - .1 project
  - .2 date
  - .3 device designation
  - .4 certification of correct settings
  - .5 certification of correct device labels
  - .6 certification of arc flash hazard equipment labels
  - .7 digital image of each breaker indicating final settings and placement of labels

### 3.3 ARC FLASH WARNING LABELS

- .1 The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- .2 The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD", and shall include the following information:
  - .1 Location designation
  - .2 Nominal voltage
  - .3 Flash protection boundary
  - .4 Hazard risk category
  - .5 Incident energy
  - .6 Working distance
  - .7 Personal Protection Equipment (PPE) level
  - .8 Engineering report number, revision number and issue date.
- .3 Labels shall be machine printed, with no field markings.
- .4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - .1 For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.
  - .2 For each motor control center, one arc flash label shall be provided.
  - .3 For each low voltage switchboard, one arc flash label shall be provided.

- .4 For each switchgear, one flash label shall be provided.
- .5 For medium voltage switches one arc flash label shall be provided

**.5 Labels shall be field installed by the firm providing the Arc Flashing Hazard Analysis.**

### **3.4 SERIES RATING LABELS**

- .1 Provide lamacoid labels where recommended by study. **Labels for series rating with panelboards or equipment shall be indicated on feeder breaker as "SERIES RATING BREAKER" and at the panelboard or equipment as "SERIES RATING EQUIPMENT". Refer to section 26 24 16.**

### **3.5 ACCEPTABLE TESTING FIRMS**

- .1 MVA Engineering (519) 668-4698
- .2 GT Woods (905) 272-1696
- .3 Brosz & Associates (905) 472-6660
- .4 K-Tek Electro-services Ltd. (905) 640-0660 ext. 228

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS**

- .1 Submit shop drawings for each system in Conformance with The Electrical General Requirements Section.

**1.2 PRODUCT/MAINTENANCE DATA**

- .1 Submit product/maintenance data for each system for inclusion in maintenance manual conforming to The General Electrical Requirements Section.

**1.3 SCOPE**

- .1 The scope of this Section will include the following systems.
  - .1 Hand dryers.
  - .2 Cable management hangers.
  - .3 Auxiliary systems rough-in.
  - .4 Security and access control rough-in.
  - .5 Telecommunication network system rough-in.
  - .6 Digital time switch.
  - .7 Photocontrol switch.
  - .8 Line voltage power packs and low voltage occupancy sensors.

**Part 2 Products**

**2.1 HAND DRYERS**

- .1 Hand dryers where noted on the drawings are to be supplied and installed by this Division with the following features:
  - .1 Surface mounting.
  - .2 Fixed nozzle.
  - .3 White finish with automatic activation.  
Final finish selection by owner/architect.
  - .4 Rating of 1000 W at 120 V.  
Dyson Cat. #HU02-XX (no equals)

**2.2 CABLE MANAGEMENT HANGERS**

- .1 Hangers where noted are to be complete with the following features:
  - .1 Approximately 150 mm (6") high by 80 mm (3¼") protrusion.
  - .2 Constructed from 5 mm (3/16") x 20 mm (3/4") flat steel bar and formed to resemble the letter "G".
  - .3 Seven 6 mm (1/4") diameter mounting holes are to be provided around the hanger perimeter.

- .4 Matte black finish.
- .5 Suitable for wall or suspended mounting.
- .6 Acceptable Manufacturers:
  - .1 EMF Cat. #H-533-S
- .7 Manufacturer Contact:  
Electron Metal Fabricators Inc.  
2160 Dagenais Boulevard West  
Laval, Quebec  
H7L 5X9  
Phone: 450-625-8064 or 1-800-267-8064  
Fax: 450-625-8004
- .8 Acceptable Alternate:  
Wiremold Cat. #GH030406  
Mono System Cat. # The Hook H-433  
Cablofil Cat. #CSGH-3-4-6  
Eaton Cat. #B-Line

- .2 **As an alternate to the hanger system detailed the contractor may**
  - a) **Use as an equal one run of 50 mm (2") x 150 mm (6") wire mesh cable management system equal to Cablofil Cat. #CF 54/150 EZ complete with Cat. #FAS L 150 universal wall bracket where noted to be wall mounted and Cat. # FAS C 200 where noted to be hung. The hangers are to be installed at intervals as recommended by the manufacturer but no greater than 2.4 m (8' - 0") on centre.**

## **2.3 AUXILIARY SYSTEMS ROUGH-IN**

- .1 Outlets where noted shall be single gang boxes unless specified otherwise.
- .2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
- .3 Coordinate final outlet locations, quantities, etc. with respective system vendor and owner's representative.

## **2.4 SECURITY AND ACCESS CONTROL ROUGH-IN**

- .1 Provide conduit from device and outlet locations to cable management systems as noted on drawings.
- .2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
- .3 Provide grounding of equipment as noted on drawings.
- .4 Security and access control systems installation shall be by Owner's approved vendor as part of separate tender.

## **2.5 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN**

- .1 Outlets where noted shall be single gang flush mounted in wall or surface raceways.



- .2 Outlets if unwired are to be provided with blank coverplates to suit related sections of this specification.
- .3 Provide a #6 insulated green ground conductor from main service ground to voice equipment backboard located on drawings.

## **2.6 DIGITAL TIME SWITCH**

- .1 Supply and install a digital time switch with 40 Amp SPST contacts.
- .2 Unit shall be capable of 20 set points.
- .3 Unit shall repeat the same schedule each day.
- .4 Unit shall have automatic Daylight Savings Time and Leap Year compensation.
- .5 Unit shall program in AM/PM format.
- .6 Unit shall have LCD display.
- .7 Unit shall have permanent schedule retention.
- .8 Unit real time clock shall be retained by supercapacitor for 100 hours in a power failure.
- .9 Unit shall be capable of manual override ON and OFF either to the next scheduled event or permanently.
- .10 Unit shall have a NEMA 3R indoor/outdoor plastic enclosure.
- .11 Unit shall have Load Status indication.
- .12 Unit shall have Power Failure indication.
- .13 Acceptable Manufacturer:  
Tork Cat. #EW/EWZ Series

## **2.7 PHOTOCONTROL SWITCH**

- .1 Supply and install photo control with rating of;
  - .1 (1000, 1800, 2000) Watts,
  - .2 (8.33, 14, 16.6) amperes tungsten at 120Volts.
  - .3 50 to 60 Hz. AC
- .2 Sealed cadmium sulphide photocell operates in temperature range of:
  - .1 -34°C. (-30°F) to 60°C. (140°F)
- .3 Lights switching on/off:
  - .1 On at (1.5, 2, 3) footcandles.
  - .2 Off at (4.5, 10) footcandles.
- .4 Diecast aluminum enclosure, gasketed for maximum weatherproofing.
- .5 Thermal inertia gives minimum time delay of fifteen (15) seconds to prevent false or nuisance switching due to light from vehicles, lightning etc.
- .6 Control to have standard threaded pipe nipple.

- .7 Control to have manually adjustable lever slide.
- .8 Acceptable manufacturers:
  - .1 Paragon Cat. #CW201-00 Series.
  - .2 Tork Cat. #2101 Series.

## **2.8 LINE VOLTAGE POWER PACKS AND LOW VOLTAGE OCCUPANCY SENSORS**

- .1 Line voltage power packs and occupancy sensors shall be one manufacturer throughout the project.
- .2 Line Voltage Power packs shall be provided to match the room lighting load, control requirements, and lighting voltage. Power packs shall have the following features:
  - .1 Mount to standard junction box.
  - .2 Simple replacement. It shall be capable to replace the unit without requiring any configuration or set-up.
  - .3 Plenum rated
  - .4 120VAC or 347V, 60HZ operation.
  - .5 Acceptable materials:
    - .1 Sensorswitch Cat. #PP20 Series
    - .2 Legrand Cat. #BZ-250 Series
    - .3 Greengate Cat. #SP15 Series
- .3 Low voltage / analog occupancy sensors shall be complete with the following features:
  - .1 Coverage pattern to suit room ceiling height.
  - .2 Suitable to detect minor and medium motion patterns within rooms less than 2000 sq. ft.
  - .3 Mount to standard junction box.
  - .4 Simple replacement. It shall be capable to replace the unit without requiring any configuration or set-up.
  - .5 Relays shall not be integrated within the occupancy sensor. Relays shall be provided within separate power pack.
  - .6 Acceptable materials
    - .1 Sensorswitch Cat. #CM-PDT Series
    - .2 Legrand Cat. #CI-205
    - .3 Greengate Cat. #OAC-DT-2000

## **Part 3 Execution**

### **3.1 HAND DRYERS**

- .1 Install and connect hand dryers in conformance with manufacturer's recommendations.
- .2 Hand dryers are to be mounted at a height to suit age of expected users. Unless otherwise noted confirm height with manufacturer, owner, Architect, and/or consultant prior to rough-in.

- .3 Once installed this contractor is to caulk the joint between dryer and wall surface with a bead of clear silicone.

### **3.2 CABLE MANAGEMENT HANGERS**

- .1 Install hangers as per details in configuration noted.
- .2 Prior to installation co-ordinate location with other services within the ceiling space.
- .3 Co-ordinate with noted sub-contractors to install cables noted to be utilizing these hangers. Cables are to be installed such that the maximum sag between hangers does not exceed 25 mm (1"). This electrical contractor is to coordinate.
- .4 **Attaching cable to any T-bar support rods is not acceptable.**

### **3.3 AUXILIARY SYSTEMS ROUGH-IN**

- .1 Provide backboard for each system use as noted complete with ground buss connection as specified.
- .2 Outlets are to be installed complete with minimum 21 mm (3/4") conduit to accessible ceiling space or as otherwise detailed.
- .3 Conduits terminated into ceiling spaces must be within 3m (10') of zone conduits when noted.
- .4 Provide insulated bushings on all conduits terminated in ceiling space.
- .5 Ensure specified zone or riser conduits are installed back to equipment backboard.

### **3.4 SECURITY AND ACCESS CONTROL ROUGH-IN**

- .1 Outlets are to be provided for devices with conduit as detailed on drawings.
- .2 Conduits terminated into ceiling spaces must be within 1m of cable management of tray.

### **3.5 TELECOMMUNICATION NETWORK SYSTEM ROUGH-IN**

- .1 Provide backboard as noted complete with ground connection to main service ground.
- .2 Conduits terminated into ceiling spaces must be within 3m (10') of zone conduits (if applicable).
- .3 Ensure specified zone conduits are installed back to service backboard.
- .4 Outlets are to be installed complete with 25 mm (1") conduit to corridor ceiling space or nearest zone conduit (if applicable).
- .5 Provide insulated bushings on all conduits terminated in ceiling space.

### **3.6 DIGITAL TIME SWITCH**

- .1 Install electromechanical lighting controls as indicated and in accordance with manufacturer's instructions.
- .2 Coordinate with owner's representative and install 'trippers' to suit.

**3.7 PHOTOCONTROL SWITCH**

- .1 Turns photo-initiated controls on at dusk.
- .2 Turns lights on at dusk and off at dawn.
- .3 Install photoelectric controls as indicated and in accordance with manufacturer's instructions on suitable weatherproof junction box.

**3.8 LINE VOLTAGE POWER PACKS AND LOW VOLTAGE OCCUPANCY SENSORS**

- .1 Install power packs in accessible maintenance areas.
- .2 Provide access doors if power packs are installed above drywall ceilings.
- .3 Install sensors in gym where noted on plan at mid height of wall.
- .4 Sensors installed in areas of high abuse shall be complete with wire guards.
- .5 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper coverage within the range of coverage as per the manufacturer's recommendations. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective rooms.
- .6 It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the facility, to verify placement to sensors and installation criteria.
- .7 The contractor shall also provide the on-site training necessary to familiarize the owner's personnel with the operation, use, adjustment and problem solving diagnosis of the occupancy sensing devices systems.
- .8 Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control. Submit commissioning report with closeout documents.
- .9 **All lighting controls shall be provided with functional testing and documentation conforming to Ashrae 90.1, latest adoption. This cost shall be included in the Tender Price.**

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1       Heaters must conform to CSA 22.2 No.46 (latest edition).

**1.2            PRODUCT DATA**

- .1       Submit product data in accordance with the Electrical General Requirements Section.
- .2       Product data to include:
  - .1       Suspension of heating element.
  - .2       Physical size.
  - .3       Thermostat control if integral.
  - .4       Finish.
  - .5       kW rating, voltage, phase.
  - .6       Cabinet thickness.
  - .7       Cabinet surface temperature.
  - .8       Mounting methods.
  - .9       Auxiliary controls.
  - .10      Replacement data for motor element, thermostat, and switch.

**1.3            OPERATION AND MAINTENANCE DATA**

- .1       Provide operation and maintenance data for all heating system components for incorporation into manual as specified in the Electrical General Requirements Section.

**Part 2           Products**

**2.1            BASEBOARD CONVECTORS**

- .1       Heaters shall be standard wattage density with connection box at one end. Element through-type fitted with aluminum convector vanes and resistor wire enclosed in mineral insulation in copper coated steel sheath.
- .2       Element locked to cabinet and supported at additional points throughout length to allow for linear expansion with non-metallic supports.
- .3       Cabinets shall be bottom inlet/outlet front panel 1.6 mm (3/32") thick, finished in baked enamel, (colour to suit architect). Integral air diffusion reflector with wireway at bottom.
- .4       Blank cabinet sections where specified shall be complete with wireway in all sections including splice plates, to match heater cabinets in all respects for continuous baseboard effect as indicated.
- .5       Controls shall be (as indicated) either wall mounted remote thermostats or integral 2 pole thermostats to control load of heater specified.

## **2.2 FORCED AIR WALL HEATERS**

- .1 Forced air wall heaters, wall or ceiling mounted as noted complete with T-bar mounting frame. Heater shall be commercial type as follows:
  - .1 Enclosure:
    - .1 Steel: 18 gauge.
    - .2 Knockouts for 19 mm (3/4") diameter conduit left, right, bottom and rear.
    - .3 Grill and frame finished to suit architect.
  - .2 Elements and Fan:
    - .1 Mineral insulated.
    - .2 Motor: totally enclosed, shaded pole, impedance protected motor.
- .2 Controls:
  - .1 Built-in tamperproof controls. 'On-Off-Fan Only' selector switch and temperature control knob.

## **2.3 THERMOSTATS**

- .1 Line voltage thermostats in finished areas as indicated shall be complete with the following features:
  - .1 Full load rating of maximum 18 A at 208 V
  - .2 Temperature range: 10°C to 27°C (50°F to 80.6°F)
  - .3 Temperature range shall be marked on face of thermostat in 5 degree increments.

## **2.4 APPROVED MANUFACTURERS**

- .1 Approved manufacturers shall be:
  - .1 Ouellet
  - .2 Stelpro
  - .3 Westcan

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install baseboard convector heaters, blank sections, and controls. When wireway is used, remove knock-outs and insert insulating bushing between each unit. Install grounding wire to maintain ground integrity between heating, blank, and auxiliary sections.
- .2 Install force flow heaters as indicated.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Electrical General Requirements Section.
- .2 Ensure that heaters and controls operate correctly.

- .3 On fan powered units:
  - .1 Test cut-out protection when air movement is obstructed.
  - .2 Test fan delay switch to assure dissipation of heat after element shut down.
  - .3 Test unit cut-off when fan motor overload protection has operated.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Dry type transformers must conform to CSA C22.2 No.47 and C9 (latest edition).
- .2 **Dry type transformers must conform to CSA C802 (latest edition).**
- .3 **Dry type transformers must be in accordance with Ontario Green Energy Act 2018 (NRCan 2018) DOE 2016.**

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with Electrical General Requirements Section.

**Part 2 Products**

**2.1 TRANSFORMERS**

- .1 Transformers to be of one manufacturer throughout project.
- .2 Ratings and characteristics shall be as indicated on riser diagrams.
- .3 Aluminum winding.
- .4 Transformers are to be ventilated dry type style with 4-2½% taps (2 F.C.B.N. and 2 F.C.A.N.)
- .5 Maximum permissible sound levels shall be as follows:

Transformer Rating (KVA)	Sound Level (dBA)
≤50	45
51 to 150	50

- .6 Transformer enclosure shall be EEMAC/NEMA 3R ventilated complete with removable front panel.
- .7 Provide vibration isolators equal to Korfund R series, Mason ND-B, or approved equal. "Colour" of vibration isolators shall be based on weight of transformers.

Transformer Weight (lbs)	Approximate Rating	Colour (Korfund)
540	15 – 75 kVA	Blue (RD2)
680	112.5 kVA	Black (RD2)

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.



- .2 Label must indicate:
  - .1 transformer "tag" as per riser diagram
  - .2 primary and secondary voltage and phase.

**2.3 ACCEPTABLE MANUFACTURERS:**

- .1 Acceptable manufacturers are as follows:
  - .1 Hammond
  - .2 Rex
  - .3 Delta
  - .4 Acme
  - .5 Bemag

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Primary and secondary feeders are to be connected using flexible conduit.
- .2 Transformers with a rating up to and including 75 KVA are permitted to be wall mounted provided mounting method is a suitably sized angle iron frame secured to structure (i.e. masonry wall, steel columns, etc. NOT metal siding).
- .3 The above rating of transformers may also be suspended from **structure only** on a unistrut trapeze as detailed.
- .4 Transformers above 75 KVA must be floor mounted.
- .5 Floor mounted transformers are to be mounted/secured to a concrete pad suitably sized to suit the transformer. This pad is the responsibility of this contractor and must be provided in conformance with the standard of Division 1 specifications for poured in place concrete.
- .6 All transformers must be mounted on vibration isolators selected based on transformer weight.
- .7 Ensure adequate clearance around transformer for ventilation as per the Electrical Safety Code.
- .8 Loosen isolation pad bolts until no compression is visible.
- .9 Install transformers in level upright position.
- .10 Remove shipping supports only after transformer is installed and just before putting into service.
- .11 Make primary and secondary connections in accordance with wiring diagram.
- .12 Energize transformers after installation is complete.

**END OF SECTION**

**Part 1            General**

**1.1            PRODUCT DATA**

- .1      Submit product data in accordance with Electrical General Requirements Section.
- .2      Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**Part 2            Products**

**2.1            PANELBOARDS**

- .1      Panel boards must conform to CSA C22.2 No. 29 (latest edition).
- .2      Panelboards: product of one manufacturer.
- .3      Install circuit breakers in panelboards before shipment.
- .4      In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand. **Series rating is acceptable – submit information with shop drawings. Provide lamicaid label on feeder breaker. Lamicaid label to state "Series Rating Breaker." Lamicaid label to be size 2.**
- .5      Bus and breakers must be rated for 10,000A (symmetrical) interrupting capacity or as indicated.
- .6      Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .7      Panelboard mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .8      Two keys for each panelboard and key panelboards alike.
- .9      Aluminum bus with neutral of same ampere rating as mains.
- .10     Mains must be suitable for bolt-on breakers. Provide main (if applicable) and branch breakers as bolt-on style.
- .11     Trim with concealed front bolts and hinges.
- .12     Trim and door finish must be baked grey enamel.
- .13     All panels regardless of voltage and amperage must be provided with a lockable door.
- .14     Branch circuit panelboards (250 AMP or smaller) must be one of the following:
  - .1      Eaton Cat # POW-R-LINE-C PRL-1 or PRL-2
  - .2      Schneider Electric Cat # NQ Series for up to 240V or NF Series for up to 600V
  - .3      Siemens Cat #Sentron P1 Series

## **2.2 BREAKERS**

- .1 Breakers: to Moulded Case Circuit Breakers Section.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on devices for fire alarm, exit and night light circuits.

## **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.
- .2 Nameplate for each panelboard size 4 engraved description as indicated. In finished areas install label on inside of panel, and in service areas install label on exterior of panel.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved "name of load" as indicated.
- .4 Complete circuit directory with typewritten legend showing location of each circuit.  
**Include a copy of the directories in the maintenance manuals.**

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard. Plywood shall be 21mm (3/4") fire rated or painted with intumescent fire block paint having a minimum of 1h rating, unless noted otherwise.
- .3 Mount panelboards to height specified in Electrical General Requirements Section or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus.
- .6 Install series rating lamicoids adjacent to all breakers utilized to achieve series ratings.

**END OF SECTION**

**Part 1            General**

**1.1            PRODUCT DATA**

- .1       Submit product data in accordance with Electrical General Requirements Section.

**Part 2            Products**

**2.1            BREAKERS GENERAL**

- .1       Moulded case circuit breakers must conform to CSA C22.1 No.5.1-M91 (latest edition.)
- .2       Bolt-on moulded case circuit breaker quick-make, quick-break type, for manual and automatic operation.
- .3       Common-trip breakers: with single handle for multi-pole applications.
- .4       Unless otherwise indicated moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

**Part 3            Execution**

**3.1            INSTALLATION**

- .1       Install circuit breakers as indicated complete with all necessary mounting hardware and filler panels if necessary.
- .2       Provide lamicon labels for series rating breakers. Lamicon label to state "Series Rating Breaker." Lamicon to be size 2.

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Electrical General Requirements Section.

**Part 2 Products**

**2.1 SWITCHES**

- .1 Line Voltage Wall Switches
  - .1 AC switches must conform to CSA C22.2 No. 111 (latest edition).
  - .2 AC Switches of one manufacturer throughout project.
  - .3 Occupancy sensor switches shall be dual technology style (PIR and Ultrasonic) where noted on the drawings.
  - .4 Acceptable Materials:
    - .1 Motor Rated: Hubbell Cat. #HBL1221PL
    - .2 Single Pole (Decora): Hubbell Cat #HBL2101
    - .3 Three Way (Decora): Hubbell Cat #HBL2103
    - .4 Single Relay Occupancy Sensor includes:
      - .1 Legrand Cat. #DW-100
      - .2 Greengate Cat. #ONW-D-1001
      - .3 Sensorswitch Cat. #WSXA Series
    - .5 Dual Relay Occupancy Sensor includes:
      - .1 Legrand Cat. #DW-200
      - .2 Greengate Cat. #ONW/VNW-D-1001-DMV-N
      - .3 Sensorswitch Cat. #WSXA Series
  - .5 Acceptable toggle switch alternate manufacturers include:
    - .1 Pass & Seymour
    - .2 Leviton.

**2.2 RECEPTACLES**

- .1 Receptacles, plugs, and other similar wiring devices must conform to CSA 22.2 No 42 (latest edition).
- .2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features (20A where noted):
  - .1 Urea molded housing (Colour by architect).
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.

- .5 Triple wipe contacts and rivetted grounding contacts.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable materials:
  - .1 Decora Style Devices
    - .1 Decora Style: Surge duplex receptacle: Hubbell Cat. #HBL5260SA
    - .2 Ground fault protected T-slot receptacles: Hubbell Cat. # GF20L A
    - .3 USB charger duplex receptacles: Hubbell Cat. # USB15X2 XX
    - .4 USB charger T-slot receptacles : Hubbell Cat. #USB20X2 XX
    - .5 Decora style duplex receptacle: Hubbell Cat. # HBL2152
    - .6 Decora T-slot receptacle: Hubbell Cat. # HBL2162
    - .7 Decora tamper resistant receptacle: Hubbell Cat. #DR15TR
    - .8 Decora tamper resistant T-slot receptacle: Hubbell Cat. #DR20TR
  - .2 Tamper resistant
    - .1 Tamper resistant ground fault protected receptacle: Hubbell Cat. #GFTR15
    - .2 Tamper resistant ground fault protected T-slot receptacle: Hubbell Cat. #GFTR20
    - .3 Tamper resistant duplex receptacle complete with dual USB ports: Hubbell Cat. #USB15XXX
- .6 Acceptable alternate manufacturers include:
  - .1 Pass & Seymour
  - .2 Leviton
- .7 Residential grade equivalents for materials noted above for use within residential dwelling units.

## **2.3 COVER PLATES**

- .1 Cover plates from one manufacturer throughout project.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, brushed, 1 mm (1/32") thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof cover plates complete with gaskets and "heavy-duty in use" covers in conformance with the Electrical Safety Authority. Provide product equal to Intermatic Cat. #WP5100C.
- .6 Provide p-touch labels on cover plates for all receptacles. Labels shall include source panel and branch circuit, including switch leg indicator as applicable for automatically controlled receptacles.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height specified in Electrical General Requirements Section or as indicated.
- .2 Occupancy sensors:
  - .1 Occupancy sensors shall be set to 5 minutes "delay to off" unless otherwise noted.
- .3 Occupancy sensors and dimmers:
  - .1 Switches with occupancy sensors and dimmers shall be programmed as follows:
    - .1 5 minutes "delay to off" unless otherwise noted.
    - .2 "Auto on" to 50% dimming level.
- .4 Cover plates:
  - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA C22.2 No.248.12/94, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).
  - .2 CSA C22.2 No. 106-M92 (latest edition).

**1.2 MAINTENANCE MATERIAL**

- .1 Three spare fuses of each type and size installed.

**1.3 DELIVERY AND STORAGE**

- .1 Ship fuses in original containers.
- .2 Store fuses in original containers in moisture free location.

**Part 2 Products**

**2.1 FUSES GENERAL**

- .1 Fuses: product of one manufacturer for entire project .
- .2 Fuses specified below must conform to CSA C22.2 No. 106 (latest edition). Fuses conforming to standard C22.2 No. 106-1953 will be rejected.
- .3 Fuses must provide a fully co-ordinated system for both overload and fault conditions.

**2.2 FUSE TYPES**

- .1 Class J fuses (formerly HRCI- J).
  - .1 Time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2 Fast acting as noted.

**2.3 ACCEPTABLE PRODUCTS**

- .1 Service Entrance:
  - 1-600 A: Mersen Type CJ
- .2 Motor Protection:
  - 1-600 A: Mersen Type AJT
- .3 Other acceptable manufacturers:
  - .1 GEC
  - .2 Little Fuse



**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Install fuses in mounting devices immediately before energizing circuit.
- .2            Ensure correct fuses fitted to physically matched mounting devices.
  - .1            Install Class R rejection clips for HRCI-R fuses.
- .3            Ensure correct fuses fitted to assigned electrical circuit.

**END OF SECTION**

**Part 1 General**

**1.1 PRODUCT DATA**

- .1 Submit product data in accordance with Electrical General Requirements Section.

**Part 2 Products**

**2.1 DISCONNECT SWITCHES**

- .1 Enclosed manual air break switches must conform to CSA C22.1 No.4 (latest edition).  
.2 Fuseholder assemblies must conform to CSA C22.2 No.39 (latest edition).  
.3 Fusible, and/or non-fusible, horsepower rated disconnect switches, size as indicated.  
.4 Provision for padlocking in off switch position by three locks.  
.5 Mechanically interlocked door to prevent opening when handle in ON position.  
.6 Fuses: size as indicated, to Fuses - Low Voltage Section.  
.7 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.  
.8 Quick-make, quick-break action.  
.9 ON-OFF switch position indication on switch enclosure cover.  
.10 Service entrance rated with fault bracing, fusing and barrier as required.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.  
.2 Indicate name of load controlled on size 4 nameplate.

**2.3 ACCEPTABLE MANUFACTURERS**

<u>Manufacturer</u>	<u>General Purpose</u>	<u>Weather Proof</u>
Eaton	IHD Series	3HD Series
Schneider Electric	Type A Series	Type R Series
Siemens	ID Series	NFR/FR Series

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

**Part 1 General**

**1.1 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Electrical General Requirements Section.
- .2 Indicate:
  - .1 Mounting method and dimensions.
  - .2 Starter/contactator size and type.
  - .3 Layout of identified internal and front panel components.
  - .4 Enclosure types.
  - .5 Wiring diagram for each type of starter.
  - .6 Interconnection diagrams.

**1.2 OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for incorporation into manual specified in Electrical General Requirements Section.
- .2 Include operation and maintenance data for each type and style of starter/contactator.

**1.3 MAINTENANCE MATERIALS**

- .1 Provide maintenance materials in accordance with Electrical General Requirements Section.
- .2 Provide listed spare parts for each different size and type of starter:
  - .1 1 operating coil.
  - .2 3 fuses.
  - .3 10% indicating lamp bulbs used.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Starters: must conform to CSAC22.2 No. 14 (latest edition) and EEMAC E14-1.
- .2 Control transformers must conform to CSAC22.2 No. 66 (latest edition).
- .3 Auto-transformers must conform to CSAC22.2 No 47 (latest edition).
- .4 Contactors must conform to CSA C22.2 No. 14 (latest edition).
- .5 Half size starters will not be accepted. NEMA and IEC rated starters are acceptable.

**2.2 MANUAL MOTOR STARTERS**

- .1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  - .1 Switching mechanism, quick make and break.
  - .2 One or Three overload heaters, manual reset, trip indicating handle.

- .3 Toggle switch: standard duty labeled "on"/"off".
- .4 Indicating light: standard duty type and red colour.
- .5 Locking tab to permit padlocking in "ON" or "OFF" position.

## 2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3 Wiring and schematic diagram inside starter enclosure in visible location.
  - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Independent locking of enclosure door.
  - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
  - .1 Pushbuttons Selector switches standard duty labeled as indicated.
  - .2 Indicating lights: standard duty type and color as indicated.
  - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
  - .4 1 red pilot light for "stop" or "off" and 1 green light for "start" or "on".

## 2.4 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as indicated and secondary voltage to suit remote control device, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

## 2.5 CONTACTORS

- .1 Electrically held and controlled by pilot devices as indicated and rated for type of load controlled.
- .2 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .3 Mount in CSA Enclosure 1 unless otherwise indicated.
- .4 Include following options in cover:
  - .1 Red indicating lamp.
  - .2 Hand - Off - Auto selector switch.
- .5 Control transformer: mounted in contactor enclosure.

- .6 Contactors must be definite purpose.

## **2.6 FINISHES**

- .1 Apply finishes to enclosure in accordance with Electrical General Requirements Section.

## **2.7 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Electrical General Requirements Section.
- .2 Manual starter designation label: black plate, white letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label: black plate, white letters, size 2, engraved as indicated.
- .4 Contactor designation label:  
black plate, white letters, size 4, indicating name of load controlled.

## **2.8 ACCEPTABLE MANUFACTURERS**

- .1 The acceptable manufacturers are as follows:
- .1 Allen Bradley
  - .2 Eaton
  - .3 Siemens
  - .4 Group Schneider
  - .5 Klockner Moeller

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Electrical General Requirements Section.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- .5 Install contactors and connect auxiliary control devices.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE C62.41- 1991, Recommended Practices for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM F1137- 88 (1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .3 United States of America, Federal Communications Commission (FCC)
  - .1 FCC (CFR47) EM and RF Interference Suppression.
- .4 IESNA LM-79-08, IES Electrical Method for the Electrical and Photometric Measurements of Solid State Lighting Products.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Electrical General Requirements Section for all light fixtures supplied under this contract.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Consultant.
- .3 Photometric data to include: VCP Table spacing criterion.

**1.3 SCOPE**

- .1 This contractor is responsible to supply and install all lighting fixtures as scheduled and/or indicated including lamp and those accessories required for a complete lighting system. This contractor must coordinate lighting installations with all other Divisions of this project.
- .2 All fixtures must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.

**1.4 GUARANTEE**

- .1 Guarantees for materials replacement shall be as follows from date of ready for takeover.
  - .1 LED fixtures, and driver: 5 years.
- .2 The labour required to replace these ballasts, lamps or drivers must be included in the above guarantee, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

**Part 2 Products**

**2.1 FIXTURE CONSTRUCTION**

- .1 Fixtures must be constructed of 20 gauge (minimum) cold rolled steel. All metal edges require smooth finish.
- .2 Light leaks must be prevented by providing gasketting, stops, and barriers.
- .3 Fixtures must be finished in high reflective baked white enamel. This surface must have a reflectance of not less than 85%.

**2.2 FIXTURE LENS**

- .1 Unless otherwise noted fixture lenses shall be as follows:
  - .1 Lens thickness: 3.2 mm (1/8")
  - .2 Material: injection moulded clear prismatic virgin acrylic
  - .3 Frame: hinged, latched, steel.

**2.3 LED FIXTURES**

- .1 Fixture LED's must be tested in conformance with IESNA LM80 standard.
- .2 LED's must be selected using a binning algorithm to ensure colour and lumen output of a given fixture are consistent, as well as meet or surpass ANSI C78.377 specification for the rated lifetime of the fixture. Colour accuracy between products must be within a 2-step MacAdam ellipse.
- .3 Luminaires must be tested to IESNA LM79 by an independent approved laboratory.
- .4 Luminaires must be tested prior to shipping.
- .5 Luminaires must be ULC certified and approved for use in Canada.
- .6 Fixtures must maintain a minimum of 90% of their initial light output for 60,000 hours. Submit test results upon request.
- .7 Lumen values indicated for fixtures in the project documents are to be considered as "absolute" or "delivered" values.
- .8 Other than for specialty fixtures, and unless otherwise indicated, the maximum driver current is to be 750 mA.

**2.4 STANDARD EXIT LIGHTING UNITS**

- .1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).
- .2 Housing: extruded aluminum housing, white finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps: 2W LED.
- .5 Operation: 25 year.
- .6 Units are to be provided with three (3) pictogram legends indicating "left from here", "straight from here", and "right from here".
- .7 Face plate to remain captive for relamping.

**2.5 SELF-POWERED COMBINATION EXIT/EMERGENCY LIGHTING UNITS**

- .1 Exit lighting units must conform to CSA C860, CSA 22.2 No. 141 (latest edition).
- .2 Housing: extruded aluminum housing. White Finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps 2W LED (EXIT).
- .5 Operation: 25 year life.
- .6 Units are to be provided with three (3) pictogram legends indicating "left from here", "straight from here", and "right from here".
- .7 Face plate to remain captive for relamping.
- .8 Supply voltage: as noted on drawings.
- .9 Output voltage: 12 V DC.
- .10 Battery: sealed maintenance free 10 year life.  
  
Note: Battery must be capable of supplying the wattage indicated for a minimum of 30 minutes.
- .11 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
- .12 Solid state transfer circuit.
- .13 Signal lights: "AC Power On" condition and "charging" condition.
- .14 Lamp heads: integral on unit, 345° horizontal and 180° vertical adjustment. Lamp type: minimum 4 watt LED.
- .15 Mounting: suitable for universal mounting directly on junction box and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .16 Cabinet: finish: white.
- .17 Auxiliary equipment:
  - .1 Test switch.

**2.6 EMERGENCY LIGHTING UNITS**

- .1 Emergency lighting units must conform to CSA C22.2 No 141 (latest edition).
- .2 Supply voltage: as noted on drawings.
- .3 Output voltage: 12 V DC.
- .4 Battery: sealed, maintenance free, 10 year life.  
  
Note: Battery units must be capable of supplying the wattage indicated for a minimum of 30 minutes.
- .5 Charger: solid state, multi rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .6 Solid state transfer circuit.



- .7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .8 Signal lights: "AC Power ON" condition and "charging" condition.
- .9 Lamp heads: integral on unit, 345° horizontal and 180° vertical adjustment. Lamp type: minimum 4 watt LED.
- .10 Cabinet suitable for direct of shelf mounting to wall and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .11 Auxiliary equipment:
  - .1 Test switch.
  - .2 Ac input and DC output terminal blocks inside cabinet.
  - .3 Shelf.
  - .4 Cord and plug connection for AC.

## 2.7 REMOTE EMERGENCY LIGHTING FIXTURES

- .1 Remote emergency lighting fixtures must conform to CSA C22.2 No141 (latest edition).
- .2 Fixtures shall be small "micro" size or recessed style as indicated in the Light Fixture Schedule.
- .3 Fixtures must be adjustable type heads with canopy.
- .4 Fixtures are to be provided with protective lexan cube when specified in the Light Fixture Schedule.
- .5 Unless otherwise indicated surface mounted fixtures in washrooms, locker rooms, changerooms, and gymnasiums must be provided with wire guard.

## 2.8 ACCEPTABLE LIGHTING MANUFACTURERS

- .1 Refer to the light fixture schedule as indicated on drawings.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Locate and install luminaires as indicated. Luminaires are not to be supported from the roof deck. Provide additional unistrut support channel and/or support from structure. Co-ordinate with consultant on site.
- .2 Ball align hangers must be provided for rod suspended fixtures.
- .3 Fixtures surface mounted to suspended ceilings must be secured through ceiling assembly to cross member supports. These supports are to be steel channels or angles independently secured **to structure** using # 12 "jack" chain. Each chain must be secured so no fixture weight is added to the ceiling assembly.
- .4 Plaster frames/flange kits must be provided by this Division for fixtures recessed in plaster and/or drywall ceilings.

- .5 Where specified, fixtures to be chain hung shall be hung using "jack" chain with a capacity to suit the fixture weight. Branch circuit wiring feeding these fixtures shall be AC90 cable "ty-wrapped" at 900mm (36") intervals along length of drop. Final appearance must be neat and professional.
- .6 Install exit lighting units with illuminated faces and chevrons/arrows indicating path(s) of exit as indicated. Unless otherwise noted install exit fixtures at 2400 mm (8' 0") above finished floor.
- .7 Install emergency lighting units and associated remote mounted fixtures as indicated.
- .8 Direct "heads" on units and remote mounted fixtures to illuminate path(s) of exit.
- .9 Install emergency lighting units and remote fixtures at 300mm (12") below finished ceiling, unless indicated otherwise.
- .10 Provide a 15 A 120 V duplex receptacle (connected to circuit indicated) adjacent to unit. **This receptacle connection is to be no lower than 8' 0" (2400 mm) AFF.**
- .11 **Special installation: Secure fixtures to structure to conform to the Electrical Safety Code using "jack chain" NOT ceiling suspension wire. Where coreslab is used, suspension point must be independent of the one used for suspension of the ceiling assembly. As an alternate to jack chain the contractor may use a pre-manufactured aircraft cable suspension and fastening system as manufactured by Gripple (Gripple Cat. #HF02-10F2). Provide minimum 2 per fixture.**
- .12 All battery units are to be provided with a visible lamicoid label indicating the unit number as per drawings.

### 3.2 WIRING

- .1 Connect luminaires to lighting circuits as indicated.
- .2 Connect exit fixtures to exit lighting circuits and unit equipment (if applicable).
- .3 Connect unit equipment to circuits as indicated.
- .4 All wiring of remote emergency fixtures shall be minimum #10 T90 for each circuit and run in conduit. Wiring must be sized in conformance with manufacturer's recommendations for distances required.

### 3.3 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

### 3.4 DELIVERIES

- .1 Fixtures are to be completely assembled at the manufacturer's plant and delivered to the project site in original unitized containers. Ensure that a dry, protected and secure space is available for proper storage before scheduling delivery of fixtures.

**3.5 TESTING/CERTIFICATION**

- .1 At the completion of the project and in the presence of the consultant, test all exit and emergency fixtures. On company letterhead, the contractor is to prepare a chart indicating:
  - .1 Project
  - .2 Date
  - .3 Equipment type
  - .4 Certification of correct connection
  - .5 Certification of correct operation
  - .6 Duration of test in minutes (minimum 30)
  - .7 Actual period of testing (time of day)

**3.6 ADDITIONAL INSTALLED EXIT SIGNS**

- .1 The electrical contractor is to include in their bid the cost to add two (2) additional standard exit lighting units to be installed and tested in locations as directed by the consultant. Note: This installation and test will be occurring after the initial testing/certification testing is complete.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE).
- .2 Underwriter Laboratories of Canada (ULC).
- .3 International Electrotechnical Commission.
- .4 International Organization for Standardization (ISO).
- .5 National Electrical Manufacturers Association (NEMA).

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 01 16.
- .2 Submit composite wiring diagrams and control schedule for each room control circuit type as proposed to be installed. Include load type, sequence of operation, sensor parameters, time delays, sensitivities and daylighting set points.
- .3 Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

**1.3 SCOPE**

- .1 This contractor is responsible to supply and install all equipment and control wiring as specified for the digital occupancy and daylight control systems. This contractor must coordinate these control systems with the lighting fixtures being supplied for the project to ensure intended function as specified.
- .2 Control Intent: Control Intent includes, but is not limited to:
  - .1 Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
  - .2 Initial sensor and switching zones.
- .3 All equipment must be CSA approved or approved at this contractor's expense by the Special Inspection Division of the Electrical Safety Authority.
- .4 Reference section 26 51 13 for Lighting information.
- .5 Reference section 26 05 75 for line voltage occupancy sensors and switches (hard wired analog).

**1.4 SYSTEM DESCRIPTION AND OPERATION**

- .1 The Digital Lighting Control (room level) as defined under this section covers the following equipment:
  - .1 Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay controllers.

- .2 Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
- .3 Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
- .4 Digital Photosensors – Single-zone closed loop sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.
- .5 Configuration Tools – Handheld remote for room configuration provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from an accessible location.

### 1.5 LIGHTING CONTROL APPLICATIONS

- .1 Provide a minimum application of intended lighting control functions as detailed on design drawings and specified herein. Control functions shall include the following:
  - .1 Space Control Requirements – Provide occupancy/vacancy sensors with Manual-ON functionality in all spaces except toilet rooms, storerooms, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors.
  - .2 Bi-Level Lighting – Provide single zone, multi-level controls in any enclosed office, conference room, meeting room, and training room in all enclosed spaces except where variable dimming or multi-zone switching is used.
  - .3 Daylit Areas – All luminaires closest to the daylight source, and zoned separately from other fixtures in the space, shall be controlled separately from luminaires outside of daylit zones. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.

### 1.6 WARRANTY

- .1 Provide a five-year complete manufacturer's warranty on all products to be free of manufacturers' defects.
- .2 The labour required to replace these products must be included in the above warranty, however only for the extent of the contract guarantee and warranty period as noted in Electrical General Requirements.

### 1.7 QUALITY ASSURANCE

- .1 Manufacturer: Minimum 10-years experience in manufacture of lighting controls.

**Part 2 Products**

**2.1 MANUFACTURERS**

- .1 Basis of design product: WattStopper Digital Lighting Management (DLM). Acceptable alternates are subject to compliance and prior approval with specified requirements of this section, as one of the following:
  - .1 Cooper Controls (Greengate).
  - .2 Acuity Controls (nlight).
- .2 Substitutions:
  - .1 All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 7 working days prior to the bid date and must be made available to all bidders.
  - .2 By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

**2.2 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM**

- .1 Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.
- .2 Digital Occupancy Sensors shall provide calibration and electronic documentation for the following features:
  - .1 Digital calibration and pushbutton programming for the following variables:
    - .1 Sensitivity – 0-100% in 10% increments
    - .2 Time delay – 1-30 minutes in 1 minute increments
    - .3 Test mode – Five second time delay
    - .4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - .5 Walk-through mode
    - .6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
  - .2 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
  - .3 Device Status LEDs including:
    - .1 PIR Detection
    - .2 Ultrasonic detection
    - .3 Configuration mode
    - .4 Load binding
  - .4 Manual override of controlled loads.
  - .5 One or two RJ-45 port(s) for connection to DLM local network.

- .3 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

## **2.3 DIGITAL WALL SWITCHES**

- .1 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5, and 8 button configuration; colour per architect, compatible with wall plates with decorator opening. Wall switches shall include the following features:
  - .1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
  - .2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
- .2 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
- .3 The following switch attributes may be changed or selected using a wireless configuration tool:
  - .1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
  - .2 Individual button function may be configured to Toggle, On only or Off only.
  - .3 Individual scenes may be locked to prevent unauthorized change.
  - .4 Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
- .4 Two RJ-45 ports for connection to DLM local network.
- .5 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
- .6 WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101.

## **2.4 DIGITAL POWER PACKS (ROOM CONTROLLERS)**

- .1 Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:
  - .1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
  - .2 Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

- .3 Device Status LEDs to indicate:
  - .1 Data transmission
  - .2 Device has power
  - .3 Status for each load
  - .4 Configuration status
- .4 Quick installation features including:
  - .1 Standard junction box mounting
- .5 Plenum rated
- .6 Manual override and LED indication for each load
- .7 120 VAC, 60 Hz operation.
- .8 Zero cross circuitry for each load.
- .2 On/Off Room Controllers shall include:
  - .1 One or multiple relay configuration to suit control details
  - .2 Efficient 150 mA switching power supply
  - .3 Sufficient sensor connection points to suit indicated function without the requirement for additional hardware
  - .4 Discrete model listed for connection to receptacles, for schedule-based control of plug loads within the space.
    - .1 One relay configuration only.
    - .2 Automatic-ON/OFF configuration.
    - .3 Optional Network Bridge for BACnet MS/TP communications
  - .5 Three RJ-45 DLM local network ports.
  - .6 WattStopper product numbers: LMRC-101, LMRC-102, LMPL-101, LMPL-201.
- .3 On/Off Room/Dimming enhanced Room Controllers shall include:
  - .1 One or multiple relay configuration to suit control details.
  - .2 Efficient 250 mA switching power supply.
  - .3 One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
  - .4 The following dimming attributes may be changed or selected using a wireless configuration tool:
    - .1 Establish preset level for each load from 0-100%.
    - .2 Set high and low trim for each load.
    - .3 Set lamp burn in time for each load up to 100 hours.
  - .5 Four RJ-45 DLM local network ports.
  - .6 Optional Network Bridge for BACnet MS/TP communications.
  - .7 WattStopper product numbers: LMRC-211, LMRC-212, LMRC-213, LMPL-201, LMRC-311, LMRC-312, LMRC-313.



## 2.5 DIGITAL PHOTO SENSORS

- .1 Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone.
- .2 Digital photosensors include the following features:
  - .1 An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
  - .2 Sensor light level range shall be from 1-10,000 footcandles (fc).
  - .3 The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
  - .4 For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling after they turn off.
  - .5 For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
  - .6 Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.
  - .7 Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
  - .8 Configuration LED that blinks to indicate data transmission
  - .9 Status LED indicates test mode, override mode and load binding.
  - .10 Recessed switch to turn controlled load(s) ON and OFF.
  - .11 One RJ-45 port for connection to DLM local network.
  - .12 An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.
- .3 Closed loop digital photosensors include the following additional features:
  - .1 An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.
  - .2 Automatic self-calibration, initiated from the photosensor, or a wireless configuration tool.
  - .3 Automatically establishes setpoints following self-calibration.
  - .4 A sliding setpoint control algorithm for dimming daylight harvesting with a "Day Setpoint" and the "Night Setpoint" to prevent the lights from cycling.

- .5 WattStopper Product Number: LMLS-400.

## **2.6 DIGITAL ROOM CONTROL SYSTEMS**

- .1 Digital occupancy and daylight control system designed to control a small area of a building (room level). Digital devices connect to the room controller(s) using CAT 5e cables (LMRJ) with RJ-45 connectors which provide both data and power to room devices. Features of the system shall include:
  - .1 Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
  - .2 Simple replacement of any device in the system with a standard off the shelf unit without requiring commissioning, configuration or setup.
  - .3 Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices which are part of the local system.
  - .4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

## **2.7 CONFIGURATIONS TOOLS**

- .1 A configuration tool facilitates optional customization of digital lighting control system featuring infrared communications.
- .2 Features and functionality of the wireless configuration tool shall include:
  - .1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
  - .2 Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
  - .3 Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.
- .3 WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- .2 When using wire for connections other than the DLM local network (LMRJ Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements.

- .3 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
  - .1 Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.
- .4 Install power packs in accessible maintenance areas unless noted otherwise. Provide access doors if power packs are installed above drywall ceilings.
- .5 Install sensors in gym where noted on plan at mid-height of wall.
- .6 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper coverage within the range of coverage as per the manufacturer's recommendations. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective rooms.
- .7 Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
  - .1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - .2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  - .3 Load Parameters (e.g. blink warning, etc.)
- .8 Re-commissioning – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.

### **3.2 FACTORY COMMISSIONING**

- .1 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
- .2 The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.
- .3 Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.
- .4 Factory commissioning shall include functional testing and documentation of the control system conforming to the "Functional Testing" requirements included in the current ASHRAE standard. This cost shall be included in the Tender Price.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CAN/ULC-S524 (latest edition), Installation of Fire Alarm Systems.
- .2 ULC-S525 (latest edition), Audible Signal Appliances for Fire Alarm Systems.
- .3 CAN/ULC-S526 (latest edition), Visual Signal Appliances, Fire Alarm.
- .4 CAN/ULC-S527 (latest edition), Control Units, Fire Alarm.
- .5 CAN/ULC-S528 (latest edition), Manual Pull Stations.
- .6 CAN/ULC-S529 (latest edition), Smoke Detectors.
- .7 CAN/ULC-S530 (latest edition), Heat Actuated Fire Detectors, Fire Alarm.
- .8 CAN/ULC-S536 (latest edition), Inspection and Testing of Fire Alarm Systems.
- .9 CAN/ULC-S537 (latest edition), Verification of Fire Alarm Systems.
- .10 OBC-2012, Ontario Building Code.

**1.2 DESCRIPTION OF SYSTEM**

- .1 System includes:
  - .1 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
  - .2 Trouble signal devices.
  - .3 Power supply facilities.
  - .4 Addressable manual alarm stations.
  - .5 Addressable and conventional automatic alarm initiating devices.
  - .6 Audible and visual signal devices.
  - .7 End-of-line devices.
  - .8 Annunciators.
  - .9 Ancillary devices.
  - .10 Interface and zone modules.
  - .11 Remote trouble indicator.

**1.3 REQUIREMENTS OF REGULATORY AGENCIES**

- .1 This system is subject to review by local building department officials, local fire department officials. **Therefore, submission of verification certificate and field technician device verification sheets is required prior to inspection by these officials. Schedule accordingly.**

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Electrical General Requirements Section.
- .2 Include:
  - .1 Layout of equipment.
  - .2 Zoning.
  - .3 Complete wiring diagram.

**1.5 OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Electrical General Requirements Section.
- .2 Include:
  - .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
  - .2 Technical data - illustrated parts lists with parts catalogue numbers.
  - .3 Copy of approved shop drawings.
  - .4 List of recommended spare parts for system.

**1.6 MAINTENANCE MATERIALS**

- .1 Include:
  - .1 10% spare glass rods for total number of manual pull box stations if applicable.

**1.7 TRAINING**

- .1 Arrange and pay for on-site demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system. **Obtain written receipt of training session and include in maintenance manual.**

**1.8 SYSTEM OPERATION**

- .1 The system shall be configured for single stage operation as outlined on the design drawings. Refer to Fire Alarm Sequence of Operation for specific fire alarm sequence functions which generally include the following:
  - .1 Activation of audible and visual signal devices.
  - .2 Cause alarm and supervisory zone of alarm device to be indicated on control panel and remote annunciator(s).
  - .3 Cause system trouble indications.
  - .4 Activate auxiliary functions.
  - .5 Transmit signal to fire department via monitoring station.
  - .6 Log the alarm in the historical alarm log file.
  - .7 System silence parameters.
  - .8 System reset parameters.

## **1.9 PERFORMANCE CRITERIA**

- .1 These specifications describe the minimum functional requirements for an electronically supervised, microprocessor based, fully integrated system. The initial installation shall include all the necessary electronic hardware, software and memory for a completely operable system in accordance with these specifications.

## **1.10 QUALITY ASSURANCE**

- .1 Each and all items of the fire alarm system shall be listed as the products of a single manufacturer under the appropriate category by the Underwriter's Laboratories of Canada and shall bear the "U.L.C." label.
- .2 Each and all items of the fire alarm system shall be covered by a one year parts and labour warranty covering defects resulting from faulty workmanship and materials. The warranty shall be deemed to begin on the date the system is accepted by the Project Manager on issuance of the substantial performance certificate for the project.
- .3 All control equipment must have Transient Protection Devices to comply with U.L.C. requirements.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 The fire alarm system shall be an addressable, single stage, zoned, non-coded, indicating, fully integrated fire alarm.
- .2 The fire alarm control panel shall allow for loading or editing of special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate expansion, and changes required by local codes. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
- .3 The ability to selectively program input/output control functions based on ANDing, ORing, NOTing, Timing and Special Coded Operations is also to be incorporated in the resident software programming of the system.
- .4 The system shall have the ability to manually disable and enable any device/circuit individually for maintenance or testing purposes.
- .5 It shall be possible to reprogram selected or all smoke detector initiating zones for alarm verification.
- .6 It shall be possible to program an adjustable time delay circuit for each waterflow initiating circuit to prevent false alarms that may be caused by erroneous pressure surges in the sprinkler system.
- .7 All on site programming changes to the fire alarm system shall be password protected.
- .8 Wiring to any remote annunciator shall be supervised for open and ground conditions. A separate annunciator trouble indicator must be provided at the control panel, which shall illuminate, and an audible trouble signal shall sound at the control panel upon the detection of an open or ground condition.

- .9 All Control Panels and Remote Annunciator Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable. The green coloured grounding loop shall be a minimum #14 AWG insulated copper conductor run in conduit. The ground loop shall be connected to building water supply to the line side of the water meter. Ground wire must not be run in the same conduit as the Fire Alarm wiring.

## 2.2 POWER REQUIREMENTS

- .1 The control panels shall receive 120 VAC power via a dedicated overcurrent protected circuit. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel and the remote annunciator. A green 'Power On' LED shall be displayed continuously while incoming power is present.
- .2 Control Panel output power supply shall have the following operating characteristics:
- .1 Rated for five Amps continuous duty
  - .2 24 VDC filtered and regulated
  - .3 Power limited with a range of 20.4 VDC to 32 VDC.
  - .4 Automatic "Brownout" transfer to standby batteries when supply voltage falls to 102 VAC
- .3 The system shall be provided with sufficient standby capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four hours with two hours of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.
- .4 The system batteries shall be supervised so that a low battery condition or disconnection of the batteries shall be audibly and visually annunciated at the control panel.
- .5 Battery charger shall have the following operating characteristics:
- .1 Ability to charge a range up to 33 AH to 70% of their capacity within 12 hours.
  - .2 Compatible with either lead acid or nicad batteries.
- .6 All circuits requiring system operating power shall be individually fused at the control panel.
- .7 The system shall be modular in design to allow future expansion with a minimum of hardware additions and system interruptions.

## 2.3 FIRE ALARM CONTROL PANEL

- .1 The fire alarm control panel construction shall be modular in design with solid state microprocessor based electronics. An 80 character Liquid Crystal Display shall indicate alarms, supervisory service conditions and any troubles. The panel shall include but not be limited to the following:
- .1 80 character LCD display
  - .2 Local Energy, Shunt Master Box, or Reverse Polarity Remote Station Connection
  - .3 Form C Trouble Contact
  - .4 Earth Ground Supervision Circuit

- .5 Basic 8 A power supply
  - .6 Automatic Battery Charger
  - .7 Standby Batteries
  - .8 Resident non-volatile programmable operating system memory for all operating requirements.
  - .9 Five Programmable Multi-Function keys with status LED's
  - .10 Red Alarm LED and Acknowledge Button
  - .11 Yellow Supervisory Service LED and Acknowledge Button
  - .12 Yellow Trouble LED and Acknowledge Button
  - .13 Green Power on LED
  - .14 Alarm/Signal Silence Button
  - .15 System Reset Button
  - .16 Operator Interface Keypad for Manual Control and System Information Access
  - .17 Addressable Interface Control Card
  - .18 Supervised Annunciator Circuit
- .2 The control Panel shall be capable of chronologically logging and storing 300 events in an alarm log and 300 events in a trouble log. The historical logs shall be stored in the CPU's memory and shall be protected by a lithium battery that is supervised for a low battery condition. Each recorded event shall include the time and date of that event's occurrence. The alarm log file must be separate from the trouble log file. It shall be possible for the user to generate a report of both logs upon request.
- .3 All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.
- .4 Signal Circuits shall be independently supervised and fused such that a fault on one circuit shall not affect the operation of any of the other circuits. All signal circuits shall be configured as follows:
- .1 Class "B" wiring, current limited.
  - .2 Rated at two Amps of continuous power.
  - .3 Capable of powering polarised 24 VDC audible and visual signalling appliances.
- .5 Provide dry contact auxiliary control circuits as follows:
- .1 Central Station alarm output.
  - .2 Central Station trouble output.
  - .3 SPDT Form C relays fused at 2 A @ 24 VDC.
- .6 System Expansion Modules connected by ribbon cables shall be supervised for module placement. Should a module become disconnected the system trouble indicator must illuminate and audible trouble signal must sound.
- .7 The Fire Alarm Control Panel shall be capable of supporting RS-232-C I/O ports. CPU data output to the I/O ports shall be in a parallel ASCII format at field adjustable baud rates of 220, 300, 1200, 2400 and 4800.
- .8 A walk test feature must be provided.



- .9 All system controls shall be housed in a surface wall mounted steel cabinet. Finish shall be according to the manufacturer's standards.
- .10 All modules shall be secured behind hinged locked door with a full viewing tempered plastic window. The hinged locked doors shall give access to all the operating controls but shall not expose live connections.
- .11 All internal wiring, control circuits, connections and terminals shall only be accessible behind a removable metal retainer plate.
- .12 All Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable.
- .13 The system must provide communication with addressable initiating devices. All of these devices will be annunciated on the control panel's main LCD display. Annunciation shall include the following conditions for each point:
  - .1 40 Character Zone/Device Location
  - .2 Type of Device
  - .3 Detector Status (Normal/Alarm/Trouble)
  - .4 Device Missing/Failed
- .14 The communication format must be a completely digital poll/response protocol to allow tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
- .15 Each addressable device must be uniquely identified by an address code entered on each device base at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
- .16 It shall be possible for the owner's representative to change a smoke detector without any special tools or programming.
- .17 The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions. Systems, which cannot support 100% of their point capacity in alarm simultaneously, cannot assure appropriate system response and are not acceptable.
- .18 **The appropriate quantity of isolator modules shall be installed so that a wiring fault (short, open or ground) within one floor area shall not prevent the normal operation of other addressable devices on other floor areas.**
- .19 The system shall maintain the sensitivity level set, for each sensor, over time by automatically compensating for environmental factors such as dust and dirt accumulations in a smoke sensor's chamber. The smoke sensor shall be a smoke density measuring device having no self-contained set-point. **The control panel shall determine the alarm decision for each sensor.**
- .20 The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value a 'Dirty Sensor' trouble condition shall be audibly and visually indicated at the control panel for the individual sensor.

- .21 All data transmissions, **including the analogue value**, between the smoke sensors and the control panel shall be digitally transmitted and incorporate parity and checksum digital data checks of each transmission.
- .22 An operator from the control panel, having a proper access level, shall have the ability to:
  - .1 Manually access and print the following information for each sensor in a report format that can be easily understood by the user:
    - .1 Primary Status
    - .2 Device Type
    - .3 Present Average Value
    - .4 Present Sensitivity Selected
    - .5 Highest Peak Detection Values
    - .6 Sensor Chamber Status (Normal, Almost Dirty, Dirty, Excessively Dirty)
  - .2 Manually control the following of each sensor:
    - .1 Clear Peak Detection Values
    - .2 Enable or Disable the Point
    - .3 Clear Verification Tally
    - .4 Control a Sensor's Relay Driver Output
- .23 It shall be possible to program the control panel to **automatically** change the sensitivity settings of each sensor based on **time-of-day** and **day-of-week**.

## 2.4 ADDRESSABLE MANUAL ALARM STATIONS

- .1 Manual alarm stations shall be addressable, single action, non-coded, semi-flush mounted type. Pull stations shall be break-glass style. Contacts are to activate when the handle is pulled down.
- .2 Addressable pull station electronics shall be mounted to the back plate of the station. The station's address will be set at the time of installation. Device addressing shall be accomplished by either an electrical or mechanical means.

## 2.5 INTELLIGENT DETECTORS-GENERAL OPERATION

- .1 Addressable devices shall use simple to install and maintain decade, numbered 0 to 9, address switches. Detectors that have expanded addressing will have decade switch numbered from 0 to 15 for the most significant digit to allow detector addressing from 1 to 250.
- .2 Device addressing shall be accomplished by either an electrical or mechanical means.
- .3 Detectors shall be intelligent (analog) and addressable and shall connect with two wires to the fire alarm control panel signalling line circuits.

- .4 Addressable smoke detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
- .5 The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
- .6 Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance.
- .7 The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
- .8 The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
- .9 Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (PHOTO, THERMAL).
- .10 Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
- .11 Detectors shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LEDs shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
- .12 Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
- .13 The sensors shall be of a low profile design and ULC listed for both ceiling and wall mount applications.
- .14 Automatic smoke sensors shall be equipped with a dust cover, which shall be removed at the time of verification to prevent dust and dirt entering the smoke chamber during construction.
- .15 A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

## **2.6 INTELLIGENT MULTI-DETECTOR**

- .1 The intelligent multi-detector shall be an addressable device, which is designed to monitor photoelectric, ionization, and thermal technologies in a single sensing device. This detector shall utilize advanced electronics which react to smaller products of combustion found in fast flaming fires (ionization), slow smouldering fires (photoelectric), and heat (thermal) all within a single sensing device.
- .2 The multi-detector shall include two bicolor LEDs, which flash green in normal operation and turn on steady red in alarm.
- .3 Detectors are to be provided with relay base where noted on the drawings.
- .4 Separately mounted photoelectric ionization and heat detectors in the same location are not acceptable alternatives.

## **2.7 FIXED TEMPERATURE HEAT DETECTOR**

- .1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the/ time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. The heat detector shall have a nominal alarm point rating of 57°C (135°F). The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

## **2.8 FIXED TEMPERATURE / RATE OF RISE HEAT DETECTOR**

- .1 These heat detectors shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm, The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 57°C (135°F) and a rate-of-rise alarm point of 9°C (15°F) per minute. The heat detector shall be rated for ceiling installation at a minimum of 21.3m (70') centres and be suitable for wall mount applications.

## **2.9 PHOTOELECTRIC SMOKE DETECTOR**

- .1 The intelligent photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging, and humidity. The photo detector shall be rated for ceiling installation at a minimum of Soft (Olin) centres and be suitable for wall mount applications.

- .2 The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:
  - .1 Temperature: 0°C to 49°C (32°F to 120°F)
  - .2 Humidity: 0-93% RH, non-condensing
  - .3 Elevation: no limit
- .3 Detectors are to be provided with relay base where noted on the drawings.

## **2.10 STANDARD DETECTOR MOUNTING BASES**

- .1 Provide standard detector mounting bases suitable for mounting on North American 1-gang, 85mm (3 ½ ") or 100 mm (4") octagon box and 100 mm (4") square box. The base shall, contain no electronics, support all detector types and have the following minimum requirements:
  - .1 Removal of the respective detector shall not affect communications with other detectors.
  - .2 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

## **2.11 CONVENTIONAL AUTOMATIC ALARM INITIATING DEVICES**

- .1 Thermal fire detectors: fixed temperature, non-restorable, rated 57°C (135°F) or 88°C (194°F) as indicated.
- .2 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C (135°F) or 88°C (194°F), rate of rise 8.3°C (15°F) per minute.

## **2.12 AUDIBLE/VISUAL SIGNAL DEVICES**

- .1 Mini Horns: flush mounted temporal mini horn, 24Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10'), white or red coverplate, FM and ULC listed. Suitable for mounting on a single gang box.
- .2 Strobe: semi-recessed, 24Vdc operation, complete with selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe, red finish, FM and ULC listed. Suitable for mounting on a single gang box.
- .3 Mini Horn/Strobe: flush mounted temporal combination mini horn/strobe, 24 Vdc operation, selectable HIGH/LOW setting 94.5 dBA (high)/89.8 dBA (low) at 3 m (10') selectable 15/30/75/110 candela output (unless otherwise noted set at 75 cd), synchronized strobe white or red coverplate, FM and ULC listed. Suitable for mounting on a single gang box.

### **NOTES:**

- .1 Signal devices with integral strobe lights in high abuse areas (i.e. gymnasium, change rooms, etc.) must be provided with protective wireguards.
- .2 Any surface mounted signal devices must be provided with suitable backboxes supplied by the manufacturer.
- .3 Provide synchronization modules to suit signal devices (if required by manufacturer).

**2.13 END OF LINE RESISTORS**

- .1 End-of-line resistors for signalling circuits shall be sized to ensure the correct supervisory current flows in each circuit.
- .2 End-of-line resistors shall be mounted on a stainless steel plate for mounting on a standard single gang box and bear the ULC label.

**2.14 REMOTE ANNUNCIATOR PANELS**

- .1 Each remote panel in the installed system shall include remote control display annunciators. These annunciators shall have integral membrane style, tactile push-button control switches for the control of system functions, and LED-s with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events.
- .2 The remote control display annunciators shall provide the system with individual zone and device annunciation.
- .3 Annunciator must be keyed similar to control panel.

**2.15 GRAPHIC DISPLAY (PASSIVE)**

- .1 Black and white layout of facility showing all zones as specified/indicated.
- .2 Display is to be found behind Plexiglas, approximate size: 500 mm x 500 mm (20" x 20").
- .3 Finish frame to architects direction.

**2.16 INTELLIGENT MODULES – GENERAL OPERATION**

- .1 The modules shall have a minimum of 2 diagnostic LED's mounted behind a finished coverplate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes, which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
  - .1 Temperature: 0°C to 49°C (32°F to 120°F).
  - .2 Humidity: 0-93% RH, non-condensing.

**2.17 MONITOR MODULE**

- .1 The monitor modules shall have the following operating characteristics:

A flashing LED indicates that the module is in communication with the control panel. The LED latches steady on alarm (subject to current limitations on the loop).

- .2 The monitor modules shall have the following features:

Nominal operating voltage: 15 to 32 VDC.  
Maximum current draw: 5.1 mA (LED on)  
Average operating current: 400 uA (LED flashing)  
EOL resistance: 47K ohms.  
Temperature range: 0°C to 49°C (32°F to 120°F)  
Humidity range: 10% to 93% noncondensing  
Dimensions: 114.3mm (4.5") high x 101.6 mm (4") wide x 31.75 mm (1.25") deep. Mounts to a 101.6 mm (4") square x 53.975 mm (2.1/8") deep box.

## **2.18 ISOLATOR MODULE**

- .1 Fault isolator modules shall be provide to automatically isolate wire-to-wire short circuits on an SLC loop. The fault isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop. If a wire-to wire short occurs, the fault isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the fault isolator module shall automatically reconnect the isolated section of the SLC loop. The fault isolator module shall not require any address-setting, and its' operations shall be totally automatic. It shall not be necessary to replace or reset a fault isolator module after its normal operation. The fault isolator module shall mount in a standard 10.16 cm (4") deep electrical box, in a surface-mounted backbox, or in the fire alarm control panel. It shall provide a single LED which shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

## **2.19 CONTROL MODULE**

- .1 Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
- .2 The control module NACs may be wired for Style Z or Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% or all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
- .3 The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 Amps at 30 VDC.

## **2.20 DOOR HOLD OPEN DEVICES**

- .1 Units to be complete with the following features:
- .1 Wall mounted style.
  - .2 Long life electromagnet.
  - .3 Low current operation.
  - .4 Completely silent operation.

- .5 25 lbf (111N) minimum holding force.
- .6 Adjustable swivel contact plate.
- .7 Brushed zinc finish.
- .8 Maintenance free operation.
- .9 Water resistant design.
- .10 ULC, CSA, and FM approved.

## 2.21 SYSTEM WIRING

- .1 The system wiring must be FSA rated in conformance with the Electrical Safety Code to suit the type of installation.
- .2 Wiring shall be minimum #18 AWG twisted shielded pair in conduit. "Securex 2" armoured cable will be permitted to be used for "drops" to devices on accessible ceilings.
- .3 As indicated on system riser diagram initiating device wiring shall be run in a loop with a home run from the last device to the control panel (Class 'A' configuration). Wiring from the "loop" module to conventional devices must be supervised, run in conduit, and conform to the standards of the Electrical Safety Code.
- .4 Signal wiring is to be cross connected in a class 'B' configuration.
- .5 Install isolator modules and end of line resistors in service rooms no higher than 2.4 M AFF. Provide location of these devices at the time of shop drawing submission.
- .6 **These are the basic wiring requirements for system operation. Prior to tender close manufacturer and contractor are to confirm all necessary wiring specifications and requirements.**

## 2.22 APPROVED EQUIPMENT

<u>DEVICE</u>	<u>NOTIFIER</u>	<u>EDWARDS</u>	<u>SIMPLEX</u>	<u>MIRCOM</u>
<b><u>Control Panel</u></b>				
	NFS2-3030 1-10 loops 318 add/loop	EST 4 or EST 3X	4010-ES -2 loop -250 add	FX-4000 Series
<b><u>Intelligent Devices</u></b>				
Manual Alarm Stations 1-Stage	NBG 12LX	SIGA-270	4099-9001	MS-401AD



Addressable Multi-Sensor	FSP-851TA	SIGA2-PS		MIX-2251TB
Addressable Base	B710LPA	SIGA-SB	4098-9792	B210LPA
Addressable Base c/w Relay	B224RBA	SIGA-RB	4098-9791 c/w 2098-9737	B224RBA
Heat Sensor	FST-851RA	SIGA2-HRS or SIGA2-HFS	4098-9733	MIX-5251RBA Series
Smoke Detectors	FSI-851A	SIGA-PS	4098-9714	MIX-2251BA
Monitor Module	FMM-1A	SIGA-CT Series	ZAM-Monitor 4090-9001	MIX-M500MA
Control Module	FCM-1 or FRM-1	SIGA-CR	ZAM-Control 4090-9002	MIX-M500RA
Isolator Module	ISO-XA	SIGA-IM	4090-9116	M500XA
Annunciator	ACM-32 AEM-32 ACM-32AY	EST3-6ANN	4603-9101 (GEO-7000 Series flush enclosure)	RAX-LCD RAM-1032TZ/RAM- 1016TZ RAX-1048
<b><u>Conventional and Auxiliary Devices</u></b>				
Thermal Detectors	CR Series	280-PL Series	4255-51/54	5600 Series
Mini Horn	MHRA (System Sensor)	Genesis G1R-HD	4901-9858	FH-340R
Door Holder	FMM Series	1500 Series	2088 Series	DH Series
Mini Horn complete with strobe	P2RA (System Sensor)	Genesis G1R-HDVM	4906-9127	FHS-340R
Strobe	SRA (System Sensor)	G1R-VM	4906-9101	FS-340R

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 The entire system shall be installed in accordance with CAN/ULC-S524 (latest edition) and approved manufacturers manuals and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation, All wiring shall be of the type recommended by the Electrical Safety Code, approved by local authorities having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout.
- .2 Install main control panel and connect to ac power supply.
- .3 Locate and install manual alarm stations and connect to alarm circuit wiring.
- .4 Locate and install detectors and connect to alarm circuit wiring. **Do not mount detectors within 1 m (39") of air outlets.** Maintain at least 600 mm (24") radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .5 Connect alarm circuits to main control panel.
- .6 Locate and install signal devices and connect to signalling circuits.
- .7 Connect signalling circuits to main control panel.
- .8 Install end-of-line devices at end of applicable alarm and signalling circuits.
- .9 Install remote annunciator panels and connect to annunciator circuit wiring.
- .10 Locate and install door releasing devices.  
**Note: Door holders must release by way of local smoke detector and signal from main control panel. Provide additional relays to suit.**
- .11 **Connect smoke damper integral detector outputs to monitor modules for alarm condition and for monitoring of AC power to smoke damper as trouble condition at fire alarm panel based on module address.**

**3.2 PROTECTION**

- .1 Contractor is to ensure all fire protection system detectors are protected from dust, dirt, humidity, and water at all times during construction. This applies to detectors installed, stored on site or stored in storage containers. Any detectors that are damaged or dirty shall be replaced at the contractor's expense.

**3.3 FIELD QUALITY CONTROL**

- .1 The system shall be installed and fully tested under the supervision of trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

**3.4 ACCEPTABLE INSTALLER**

- .1 The fire alarm / life safety system specified herein shall be installed by an Authorized Electrical Contractor who is CFAA certified.

### 3.5 EXAMINATION

- .1 Prior to the commencement of any of the work detailed herein, an examination and analysis of the area(s) where the Fire Alarm / Life Safety System and all associated components are to be installed shall be made.
- .2 Any of these area(s) which are found to be outside the manufacturers' recommended environments for the particular specified products shall be noted on a Site Examination Report which shall be given to the Building Owners Representative, and the Consultant.
- .3 Any shorts, opens, or grounds found on existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.

### 3.6 DEMONSTRATION

- .1 Each of the intended operations of the installed Fire Alarm / Life Safety System shall be demonstrated to the Building Owners' Representative and the Consultant.

### 3.7 SYSTEM TEST

- .1 Perform tests in accordance with General Electrical Requirements Section and CAN/ULC-S537-(latest edition) Standard for the Verification of Fire Alarm Systems.
- .2 Fire alarm system:
  - .1 Test each device and alarm circuit to ensure noted devices transmit alarm to control panel and actuate general alarm and ancillary devices.
  - .2 Check annunciator panels to ensure zones are shown correctly.
  - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
  - .4 Class A circuits.
    - .1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
    - .2 Test each conductor on all circuits for capability of providing alarm signals during ground-fault condition imposed near middlemost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
  - .5 Class B circuits
    - .1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
- .3 The control panel shall continuously perform as automatic self-test routine on each sensor, which will functionally check the sensor electronics and ensure the accuracy of the valves being transmitted to the control panel.
- .4 Automatic testing will occur at a rate of one sensor every four minutes.
- .5 The sensor's average analogue value is the average of the last 2000 recorded analogue entries of its chamber.

- .6 Any sensor that fails this test shall indicate a '**SELF-TEST ABNORMAL**' trouble condition with the sensor's address at the control panel.
- .7 The system shall automatically indicate when an individual sensor needs cleaning. When the sensor's average value reaches a predetermined value, a '**DIRTY SENSOR**' trouble condition shall be audibly and visually indicated at the local control panel for that sensor. IF a '**DIRTY SENSOR**' indication is left unattended and its average value increases to a second predetermined value, an '**EXCESSIVELY DIRTY SENSOR**' trouble condition shall be indicated at the local control panel for that sensor. To prevent false alarms, these '**DIRTY**' conditions shall in no way decrease the amount of smoke obscuration necessary to generate an alarm condition.
- .8 An operator having a proper access level, shall have the capability to manually access the following information from the control panel:
  - .1 Primary Status
  - .2 Device Type
  - .3 Present Average Value
  - .4 Present Sensitivity Selected\*
  - .5 Highest Peak Detection Values (HVP)\*
  - .6 Sensor Range (Normal, Dirty, Excessively Dirty)\* Values shall be in 'percent of smoke obscuration' format so that no interpretation is required by the operator.
- .9 **Provide "Integrated Testing" of this life safety system in conformance with the noted specification section. Include all associated costs in tender.**

### 3.8 AUDIBILITY TESTING

- .1 Audibility Testing:
  - .1 The contractor is to coordinate an audibility test prior to occupancy of the facility. The test is to be performed by the representatives of the fire alarm manufacturer in the presence of the consultant. The test report is to be in chart form indicating:
    - .1 Project
    - .2 Date of test
    - .3 Room name and number
    - .4 Ambient dB level
    - .5 Alarm dB level
    - .6 Name of testing technician
  - .2 The test results are to be submitted to the consultant for review prior to issuing to owner's representatives and/or authorities having jurisdiction.

**3.9                    ADDITIONAL INSTALLED FIRE ALARM SYSTEM COMPONENTS**

- .1        The electrical contractor is to include in their bid the cost to add five (5) additional signaling devices to be installed and verified in locations as directed by the consultant.  
Note: This installation and verification and subsequent audibility test will be occurring after the initial audibility testing is complete.
- .2        The electrical contractor is to include in their bid the cost to add three (3) additional fire detection devices (heat or smoke detectors) to be installed and verified in locations as directed by the consultant.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 General**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Sections**

- .1 Section 02 41 13 Selective Site Demolition  
.2 Section 31 23 10 Excavating, Trenching and Backfilling

### **1.3 References**

- .1 Ontario Provincial Standards (OPS)  
.1 OPSD 219.130 Heavy Duty Silt Fence Barrier (November 2006)  
.2 OPSS 805 Temporary Erosion and Sediment Control Measures (November 2015)

## **PART 2 PRODUCTS**

### **2.1 Materials**

- .1 Silt fence shall be prefabricated heavy duty geotextile, Mirafi Envirofence or equivalent with the following physical properties:

<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>Minimum Average Roll Values</b>
Grab Tensile Strength (machine direction)	ASTM D4632	N (lbs)	550
Grab Tensile Strength (cross-machine direction)	ASTM D4632	N (lbs)	550
Grab Tensile Elongation	ASTM D4632	%	15/15
Mullen Burst Strength	ASTM D3786	kPa	2060
Trapezoid Tear Strength	ASTM D4533	N	290
Permittivity	ASTM D4491	sec	0.10
Water Flow Rate	ASTM D4491	l/min/m <sup>2</sup>	405
Ultraviolet Stability	ASTM D4355	%	70

- .2 Fence shall be prefabricated with 1.2 cm nominal square hardwood posts at 2.5 metre spacing.

## **PART 3 EXECUTION**

### **3.1 Examination**

- .1 Prior to commencement of Work, meet with Owner and Consultant on site for review of layout and items to be retained and protected on site.  
.2 Examine drawings including reference drawings and investigate fully site conditions. Report any adverse conditions to the Consultant.

### **3.2 Preparation and Protection**

- .1 Maintain control devices throughout the duration of construction in good repair and to the satisfaction of the Owner, Consultant, Ministry of the Environment and Local Conservation Authority.

- .2 Environmental protection measures are to be installed in advance of any work performed. Environmental protection measures are to be constructed and maintained to the satisfaction of the Owner and the Local Conservation Authority.
- .3 Install and maintain new construction fencing in location determined by Contractor and approved by Owner. Refer to Section 01 56 00 – Temporary Barriers and Enclosures.
- .4 Prepare all required temporary access routes and driveways. Ensure entrances are designed to safely support all imposed loads.
- .5 Protect trees and vegetation to remain during construction against flooding and sediment deposit. Tree protection barriers shall be in accordance with OPSD 220.010.
- .6 Obtain locates of all underground services prior to commencement of any work on site.
- .7 Locate and stake all buried services. Be responsible for protection of services including sub-drainage systems.
- .8 Ensure that all pedestrian access and exit routes from site are in place and protected from construction operations.
- .9 Maintain and protect existing fire access routes. Provide access to municipal fire hydrants at all times.
- .10 Provide and maintain temporary drainage structures as required.

### 3.3 Sedimentation Control

- .1 Ensure that sedimentation control as specified and as indicated on the drawings and required by authorities are in place and are in proper repair prior to commencement of the Work.
- .2 Sedimentation control shall be in accordance with OPSS 805, and local authorities.
- .3 Maintain and/or repair sedimentation control at all watercourses and catch basins to prevent contamination by excavated fill.
- .4 Refer to details and notes on site development drawings.
- .5 Install additional sedimentation control as required and obtain Consultant's approval prior to commencement of site works.

### 3.4 Clearing and Grubbing

- .1 Remove and dispose of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth. Remove all evidence of their presence from the surface including sticks and branches greater than 25 mm in diameter or thickness. Remove and dispose of trash piles and rubbish.
- .2 After clearing, remove and dispose of wood or root matter including stumps, trunks, roots, or root systems greater than 25 mm in diameter.

**3.5**     Stripping Topsoil

- .1 Remove topsoil down to full depth where it contacts non-organic soil from locations of new structures and where adjustment to grades is necessary.
- .2 Do not handle wet or frozen topsoil.
- .3 Stockpile clean non-contaminated topsoil approved by the Geotechnical Engineer, on site, for reuse if space permits. Piles shall not exceed 2000 mm in height.
- .4 Protect stockpiled material from contamination and erosion.
- .5 On completion of work, remove all unused stockpiled material from the site, and dispose of in accordance with applicable legislation.

**3.6**     Removal

- .1 Remove all items as indicated on site plans and dispose of in a legal manner.
- .2 Sawcut and remove existing asphalt pavement at limits shown and as necessary.
- .3 Break out and remove existing concrete sidewalk and asphalt where indicated and required.
- .4 Remove and dispose of all signage, sign posts, barriers, and the like within work area limits.
- .5 Remove and dispose of fences, gates, posts and their foundations completely, as indicated or as required by the Consultant.

**3.7**     Cleaning

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

End of Section



## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 30 00 Cast-In-Place Concrete
- .2 Section 07 21 13 Building Insulation
- .3 Section 31 10 00 Site Clearing
- .4 Section 32 92 23 Sodding

### 1.3 References

- .1 ASTM International (ASTM)
  - .1 ASTM D698-12(2021) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
  - .2 ASTM D1557-12(2021) 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
  - .2 OPSS 180 General Specification for the Management of Excess Materials
  - .3 OPSS 206 Construction Specification for Grading
  - .4 OPSS 1010 Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material
- .3 Ontario Provincial Standard Details (OPSD)
  - .1 OPSD 219.130 Heavy Duty Silt Fence Barrier
  - .2 OPSD 805 Temporary Erosion and Sediment Control Measures
- .4 The Occupational Health and Safety Act.
- .5 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings of shoring and bracing required in connection with excavation. Drawings to show clearly procedural sequence to be followed.

### 1.5 Definitions

- .1 Earth: Site excavated material, including shale, rubble rock, building debris, shrub and tree roots and soil.
- .2 Soil: Site excavated material, free from shale, rubble rock, building debris, shrub and tree roots.
- .3 Fill: Approved materials, other than earth, clay and unapproved soil. Approved soil may be used only with approval of the Consultant in writing.
- .4 Rock: All solid rock in ledges, stratified deposits, unstratified masses, and all conglomerate deposits or any other material so firmly cemented by process of nature as to present all the characteristics of solid rock, being so hard or firmly cemented that it cannot be excavated and removed with a power shovel except after thorough and continuous drilling and blasting.

.5 Backfilling: The operation of supplying and installing fill and approved soil materials.

.6 Engineered Fill: Approved material used to build-up to design elevations.

#### 1.6 Examination

.1 Examine the building site and determine the nature and extent of the materials to be removed or the additional fill required to provide depths and levels indicated on drawings. Field check the site to review existing conditions. Verify locations of all existing utilities and services that will affect the work.

.2 Refer to drawings for all building and site development details.

#### 1.7 Geotechnical Report

.1 Refer to "Geotechnical Investigation Mill Courtland Community Centre Renovation and Addition 216 Mill Street, Kitchener, Ontario" dated July 5, 2024 and prepared by Chung and Vander Doelen Engineering Inc.. The report is available for review at the office of the Owner and Consultant.

.3 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).

.4 The use of this information is entirely at the risk of the Contractor.

.5 During examination of the site, carry out such investigations as necessary to determine subsurface conditions to be encountered in constructing the Works.

.6 Notify the structural engineer and the inspection and testing company when excavation work commences for inspection and verification of soil conditions.

#### 1.8 Setting Out Work

.1 The drawings indicate the building components location and proposed and final grades. Be responsible to construct the work according to levels and locations shown on the drawings. Report any errors or discrepancies to the Consultant before commencing work.

.2 Commencement of any part of the work shall constitute acceptance of drawings as being correct.

.3 Employ a competent instrument man and provide all lines and levels, limit lines and boundary stakes for the execution of the work as required. All benchmarks shall be carefully protected.

.4 Provide and be responsible for, all lines, levels and dimensions which trades require to relate their work to the work of other trades. All trades shall be notified that all such levels and dimensions must be obtained from the Contractor.

#### 1.9 Existing Underground Utilities

.1 Arrange underground locates of all utility assets prior to excavating. Do not commence excavation in a location prior to utility members marking the location of their utilities or indicating that none exist within the outlined excavation limits. Where necessary, employ the services of a private utility locator to ensure that all utilities are located in a timely manner.

.2 Verify the location and elevation of all existing utilities within the limits of the Work. Observe the

locations of the stake outs, prior to commencing the Work. In the event there is a discrepancy between the locations of the stake outs and the locations shown on the Contract Documents, that may affect the Work, immediately notify the Consultant and the affected utility companies, in order to resolve the conflict.

- .3 All existing buried utilities located within the excavation zone and any other facilities adjacent to the excavation shall be carefully supported and protected from damage as a result of the Contractor's operations. Be responsible for repairing any damaged underground utilities, as a result of actions during the course of the work at no extra cost to the Owner.
- .4 All costs associated with this work shall be considered incidental to all related items of work in the Contract. No separate payment will be made for costs incurred in obtaining utility locates.

#### 1.10 Protection of Existing Services

- .1 Notify the Owner, Public Utility or Municipal authorities in advance of planned excavations adjacent to their services.
- .2 Take care not to damage or displace encountered known and unknown services.
- .3 When such services are encountered during the execution of work, immediately notify the Consultant and protect, brace and support active services. Where repairs to these services become necessary use the following procedure:
  - .1 Known services, repair at no expense to the Owner.
  - .2 Unknown services, forward to the Consultant a complete breakdown of the estimated cost of such work. Proceed only upon written authorization.
- .4 In the case of damage to, or cutting off of an essential service, notify Consultant, the Owner, and Public Utility or Municipal authorities immediately and repair the service under the Consultant's direction.

#### 1.11 Inspection and Testing

- .1 Provide proper and sufficient samples, ample opportunity and access at all times for the Consultant or Testing Agency to inspect materials, operations and completed works carried out under this Section.
- .2 Sample and test excavated material prior to shipping to landfill off the site in accordance with the requirements of O. Reg. 406/19. Samples shall be tested for compliance of acceptable material for landfill. Furnish to the Owner the results of all testing and location of landfill site used. This testing will not be undertaken by the Owner's Inspection and Testing Agency.
- .3 Provide 24 hours notice to inspection laboratory and request tests as follows:
  - .1 Sieve Analysis: Proposed fill materials will be tested to confirm stability for intended use and conformity with specifications.
  - .2 Density Test: Tests will be conducted on compacted fill, to ASTM D698.
  - .3 Frequency Test: Excavated Surfaces: When existing compacted fill surface is being prepared, make a series of three tests of surface for each 500 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 each 30 metres of wall being backfilled at depth increments of 610 mm.

1.12 Standards

- .1 Carry out all work in accordance with the applicable OPSS, OPSD and site drawings. The applicable Ontario Provincial Standard Specifications are listed hereafter.
- .2 The following shall apply:
  - .1 OPS 180 Management and Disposal of Excess Material
  - .2 OPS 206 Grading, Nov. 2005
  - .3 OPS 314 Untreated Granular Subbase, Base, Surface, Shoulder and Stockpiling
  - .4 OPS 408 Adjusting or Rebuilding Maintenance Holes, Catch Basins Ditch Inlets and Valve Chambers
  - .5 OPS 805 Temporary Erosion and Sediment Control Measures

1.13 Shoring and Bracing

- .1 Shoring and trench timbering, in addition to requirements of local authorities, shall be carried out in accordance with the requirements of The Occupational Health and Safety Act, "November 1992 Ontario Regulation 213/91" and Regulations for Construction Projects by Ontario Ministry of Labour and to Construction Safety Association brochure "Trenching Safety April 1994".
- .2 Erect necessary shoring for excavations in such a manner that:
  - .1 Whenever a trench or excavated face is necessary, shore and brace to prevent failure. Engage a registered Professional Engineer fully qualified in this line of work to design, stamp shop drawings and assume responsibility for the shoring and bracing. Submit shop drawings to the Consultant.
  - .2 It will properly retain the banks of the excavations and prevent caving-in or displacement or damage to surrounding or adjacent buildings or other property.
  - .3 All other work in connection with this Contract, including the Mechanical and Electrical Trades, may be carried out while it is still in place if necessary.
  - .4 It will be entirely free of footings, foundation walls or other such work so that it may be removed entirely or in sections when it is no longer required or when directed, without causing any damage or injury to the structural work that has been completed.

1.14 Sedimentation Control

- .1 Maintain and/or repair sedimentation control at all watercourses and catch basins to prevent contamination by excavated fill.
- .2 Sedimentation control shall be in accordance with the Ontario Provincial Standard Specifications, OPSS 805 and local authorities.
- .3 Refer to details and notes on site development drawings.
- .4 Install additional sedimentation control as required and obtain Consultant's approval prior to commencement of site works.

1.15 Dewatering

- .1 Keep excavations and backfill dry at all times.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- .1 Type A Fill: Class "A" material conforming to OPSS1010, latest edition.
- .2 Type B Fill: Class "B" material conforming to OPSS 1010, latest edition.
- .3 Sand Fill: Clean, well graded compactable sand to OPSS 1010, Granular "M" fill.
- .4 Engineered Fill: fill placed below Type A and Type B fill to bring excavation to the design elevations. To be Type B fill or approved fill, approved in writing by the Consultant.
- .5 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.
- .6 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. Remove all concrete, masonry, rubble or other construction debris encountered during the work.
- .3 Unauthorized Excavation - Excavation to greater than required depth shall be corrected by the Contractor at his own expense in a manner as directed by the Consultant. Fill over-excavated areas under structure bearing surfaces and footings with concrete as specified for foundations.
- .4 Keep excavation free of water by bailing, pumping or a system of drainage as required and provide pumps, suction and discharge lines or well points of sufficient capacity and maintain until such time as the permanent drainage system is installed or until the Consultant's approval of removal of equipment is obtained. Take all necessary measures to prevent flow of water into the excavation.

- .5 Protect the bottom and sides of excavated pits and trenches from freezing. Protect also from exposure to the sun and wet weather to prevent cave-ins and softening of the bed upon which concrete or drains rest.
- .6 Excavations must not interfere with the normal 45 degree plane of bearing from the bottom of any footing.
- .7 Keep bottoms of excavations clean and clear of loose materials levelled and stepped at changes of levels with exception of excavations made for drainage purposes and those to slope as required.
- .8 If the excavations reveal seepage zones, springs or other unexpected sub-surface conditions which may necessitate revisions or additions to any drainage system, inform the Consultant immediately so that remedial action can be taken.
- .9 If removal of earth causes displacement of adjacent earth, the earth so disturbed shall be removed at no additional cost to the Owner.
- .10 Conditions of Excavated Surfaces
  - .1 Excavate to a depth sufficient to expose firm undisturbed subsoil, free of organic matter and to the Testing Agency's approval.
  - .2 Remove soft, wet or unconsolidated ground and organic material encountered in excavating.
  - .3 Should the nature of the sub-soil at the depths shown prove to be unsatisfactory to the Consultant for the placing of the concrete work, then upon the Consultant's written order, the Contractor shall excavate to greater depth until a satisfactory bottom is reached.
- .11 Tolerances: General excavation shall be to the elevations shown on the drawings, plus or minus 25 mm.

### 3.3 Hydro Excavation

- .1 Utilize hydro excavation services when working near and around known utilities to avoid damage.

### 3.4 Backfilling

- .1 Proceed promptly with backfilling as the building progresses, and as work to be backfilled has been inspected and approved by the Consultant. The backfill in areas where settlement cannot be tolerated, e.g. service and footing trenches under the floor slab, should be compacted to at least 100 per cent of its Standard Proctor Maximum Dry Density. The backfill should be placed in lifts not greater than 200 mm thick in the loose state, each lift being compacted with a suitable compactor to the specified density.
- .2 Do not commence backfilling operations until mechanical and electrical services, site drainage systems, perimeter and underslab insulation has been inspected and approved by Consultant and authorities having jurisdiction. Existing floor subgrade must be proof rolled before backfilling.
- .3 Withdraw shoring material during backfill. Lumber left in place without the Consultant's approval will not be paid for by the Owner.
- .4 Backfill evenly on both sides of foundation walls to avoid unequal fill pressures on walls.

- .5 Place fill around foundation walls and footings so that footings will have a minimum of 1200 mm coverage, measured at an angle of 45 degrees from bottom of footing to protect against frost until final grading is complete.
- .6 Where fill is placed adjacent to structures or vulnerable building components or in restricted areas, the fill shall be compacted to the same degree as specified by suitable equipment approved by the Consultant. Avoid damage to or displacement of walls, columns, piers, underground services, and process/ production equipment.
- .7 Add water in amounts required only to achieve the optimum moisture content, in accordance with ASTM D1557.
- .8 Backfill shall be free of snow and ice, topsoil, construction debris and oversized boulders greater than 150 mm.

### 3.5 Rough Grading

- .1 Preparation and Layout
  - .1 Establish extent of grading by area and elevation.
  - .2 Prior to commencement of grading work, establish location and extent of all underground utilities occurring in work areas. Maintain, reroute or extend as required. Pay all costs for this work, except costs borne by utilities companies.
  - .3 Slope grade away from building as indicated on drawings.
  - .4 Cut temporary drainage swales and create containment ponds and structures for temporary surface run-offs, until storm sewer system is installed.
  - .5 Regrade all areas that retain or pond water.
  - .6 Rough grade all areas to tolerance of plus or minus 50 mm.

### 3.6 Fills 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 Engineered Fill: All fill locations up to the underside of Type B fill and where required to fill up to design elevations.
- .5 Topsoil: at all areas to receive sod or hydraulic seeding, and in planting beds. Minimum 100 mm thickness unless noted otherwise.
- .6 Site excavated material: as backfill to exterior side of foundation walls only when permitted and approved by the Geotechnical engineer and below all sodded or seeded areas up to underside of topsoil, but not within 600 mm of foundation walls or structures.

### 3.9 Water on Prepared Surfaces

- .1 Promptly remove, by approved methods, water rising from seeping of the soil or resulting from rainfall wherever such water is on the surface of sub-grade soil and compacted fill.
- .2 Where proper drainage and pumping is not carried out as specified herein, and any prepared sub-grade soil for under structural work, and any compacted fill for under concrete slabs, is softened or disturbed by water due to improper drainage and pumping, the Contractor shall remove the unsatisfactory soil and fill, and bear all incidental costs in connection with additional excavation and placing and compacting of granular fill under floor slabs.



3.10 Adjustments

- .1 All manhole frames and covers, catch basin frames and covers, drains and valves including those existing scheduled to remain, shall be adjusted and set flush with finished elevation.
- .2 Adjustments to manholes and catch basins shall be done using concrete adjustment units as per OPSS 408 and OPSD 704.010

3.11 Surplus Soil Disposal

- .1 Surplus soil and excavated material shall be promptly removed and disposed of off the site at legal dump sites. Conform to local bylaw requirements for trucking and disposal.
- .2 Comply with the requirements of Ontario Regulation O. REG 406/19, "On-Site and Excess Soil Management", for the importation of new soils and fill materials and the exportation, removal and disposal off-site, of excavated materials. Complete testing of imported and exported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

3.12 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 As excavation proceeds, keep roads and aisles clean of dirt and excavated material.
- .3 Clean up and wash down to remove all dirt and excavated materials caused by the work of this section daily.

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 03 10 00 Concrete 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 D698-12(2021) 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-A23.1:19/ CSA-A23.2:19 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: Premoulded, 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 References

- .1 ASTM International (ASTM)
  - .1 ASTM C109/C109M-21 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
  - .2 ASTM C260/C260M-10a(2016) Standard Specification for Air-Entraining Admixtures for Concrete
  - .3 ASTM C330/C330M-17a Standard Specification for Lightweight Aggregates for Structural Concrete
  - .4 ASTM C494/C494M-19e1 Standard Specification for Chemical Admixtures for Concrete
  - .5 ASTM C827/C827M-16 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
  - .6 ASTM C939/C939M-22 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
- .2 CSA Group (CSA)
  - .1 CSA A23.1-14/A23.2:19 Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
  - .2 CSA A23.4-16 (R2021) Precast Concrete - Materials and Construction
  - .3 CSA A3000:18 Cementitious Materials Compendium
  - .4 CSA G30.18:21 Carbon Steel Bars for Concrete Reinforcement

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit manufacturer's product data sheets.

### 1.4 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

### 1.5 Waste Management and Disposal

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

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Portland Cement: to CSA A3000.
- .2 Water: to CAN/CSA-A23.1.
- .3 Aggregates: to CAN/CSA-A23.1.
  - .1 Coarse aggregates to be normal density.
  - .2 Low density aggregate for lightweight concrete: to ASTM C330.

- .4 Air entraining admixture: to ASTM C260.
- .5 Chemical Admixtures: to ASTM C494. Use of accelerating or set retarding admixtures for cold and hot weather placing to approval of Consultant.
- .6 Supplementary cementing materials: to CSA-A23.5.
- .7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and elasticizing agents.
  - .1 Compressive strength: 32 MPA at 28 days.
  - .2 Consistency:
    - .1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 s.
    - .2 Flowable: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portion) 125 to 145%.
    - .3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125%.
  - .3 Dry pack: to manufacturer's requirements.
- .8 Reinforcing Steel: to CSA G30.18, Grade 400R.
- .9 Curb Anchors: steel dowels or pins to CAN/CSA-G30.18, minimum 16 mm diameter x 610 mm length.

## 2.2 Concrete Mixes

- .1 Proportion concrete in accordance with CSAA23.1, Alternative 1, to meet manufacturer's standard specifications for Class C-2 exposure.

## 2.3 Fabrication

- .1 Fabricate: to CSA A23.4
- .2 Parking Bumper curbs to be 280 mm wide x 150 mm high x 2440 mm long.
- .3 Finish: standard grade.
- .4 Fabricate 2 holes per unit, as indicated, to permit securing with curb anchors.

## 2.4 Product

- .1 Parking Bumper Curbs: Prefabricated steel reinforced curb weighing 220 kg as manufactured by Brooklin Concrete Products Ltd.

## PART 3 EXECUTION

### 3.1 Installation

- .1 Install curbs as indicated.
- .2 Secure curbs in position by driving curb anchors into pavement with top of anchor no higher than top of curb.

.3 Replace damaged and defective units as directed by Consultant.

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 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 29 Tactile Warning Surfacing

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM C171-20 Standard Specification for Sheet Materials for Curing Concrete
  - .2 ASTM C309-19 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM D698-12(2021) 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 A23.1:19/A23.2:19 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete.
  - .2 CSA A3000-18 Cementitious Materials Compendium
- .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 Submittals**

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

### **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 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: Pre-moulded, 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 29.
- .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

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 References

- .1 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 710 Construction Specification for Pavement Marking
  - .2 OPSS 1716 Water-Borne Traffic Paint
  - .3 OPSS 1750 Traffic Paint Reflectorizing Glass Beads
- .2 United States Federal Standards
  - .1 Federal Standard 595B, Colors Used in Government Procurement
- .3 The Accessibility for Ontarians with Disabilities Act, 2005 (AODA)

### 1.3 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit manufacturer's product data.
- .3 Submit following material sample at least 4 weeks prior to commencing work.
  - .1 Paint colour selection.
  - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, reference specification number and formulation number and batch number.

### 1.4 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

### 1.5 Waste Management and Disposal

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

## PART 2 PRODUCTS

### 2.1 Materials

- .1 Paint:
  - .1 To OPSS 1716.
  - .2 Colour: Federal Standard FS Federal 595B, Yellow 33538.
    - .1 Provide H.C. Blue (Pantone 293 C) to OPSS standards for accessible parking spaces.
  - .3 Paint shall be non-slip.
- .2 Glass beads: Overlay type: OPSS 1750 Traffic Paint Reflectorizing Glass Beads.

### PART 3 EXECUTION

#### 3.1 Equipment

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.
- .2 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

#### 3.2 Condition of Surfaces

- .1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

#### 3.3 Application

- .1 Lay out pavement markings.
- .2 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 B117-19 Standard Practice for Operating Salt Spray (Fog) Apparatus
  - .2 ASTM C501-21 Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
  - .3 ASTM D543-21 Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
  - .4 ASTM D570-98(2018) Standard Test Method for Water Absorption of Plastics
  - .5 ASTM D638-22 Standard Test Method for Tensile Properties of Plastics
  - .6 ASTM D695-15 Standard Test Method for Compressive Properties of Rigid Plastics
  - .7 ASTM D696-16 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer
  - .8 ASTM D790-17 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
  - .9 ASTM D1037-12(2020) Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
  - .10 ASTM D2486-17 Standard Test Methods for Scrub Resistance of Wall Paints
  - .11 ASTM D5420-21 Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
  - .12 ASTM E84-23d Standard Test Method for Surface Burning Characteristics of Building Materials
  - .13 ASTM G155-21 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
- .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 two (2) tile samples minimum 610 x 610 mm of the kind proposed for use.
- .4 Shop drawings showing fabrication details, composite structural system, tile surface profile, sound on cane contact amplification feature, plans of tile 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 in the specifications. All tests shall be conducted on a Cast In Place Detectable/Tactile Warning Surface Tile system 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 Warning Surface Tile and accessory as required for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00-Closeout Submittals.

#### 1.5 Quality Assurance

- .1 Provide Cast in Place Warning tiles and accessories as produced by a single manufacturer with a minimum of three years' experience in the manufacturing of Cast in Place Warning tiles.
- .2 Installer's Qualifications: Engage an experienced installer certified in writing by Cast in Place Warning tile manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for the project.
- .3 Provide Cast in Place Warning tiles which are in compliance with the following standards (or most recent):
  - .1 Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA Standards for Accessible Design, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces).
  - .2 Accessibility for Ontarians with Disabilities Act

#### 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 In Place Detectable/Tactile Warning Surface Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile 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 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 Manufacturer

- .1 The Vitrified Polymer Composite (VPC) Cast-in- Place Detectable/Tactile Warning Surface Tile and Directional Detectable Wayfinding Bars specified are based on Armor-Tile manufactured by Engineered Plastics Inc. and distributed by Kinesik Engineered Products, 2213 North Sheridan Way Mississauga, Ontario L5K 1A3
- .2 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 Cast In Place Detectable/Tactile Warning Surface Tile

- .2 Vitrified Polymer Composite (VPC) Cast in Place Warning tiles shall be an epoxy polymer composition with an ultra-violet coating employing aluminum oxide particles in the truncated domes; "Armor Tile" as distributed under license by Engineered Plastics or equivalent product approved prior to project award.
- .3 Dimensions:
  - .1 Warning Tile shall incorporate an in-line pattern of truncated domes measuring nominal 5.08 mm height, 22.86 mm base diameter, 11.43 mm top diameter spaced center-to-center 60 mm as measured on a diagonal and 42 mm as measured side by side in-line.
  - .2 Directional Detectable Wayfinding Tile shall incorporate an in-line pattern of guidance bars measuring nominal 5.08 mm height, 33.8 mm base width, and 22.1 mm top width, spaced center-to-center 74.7 mm (+/- 1.27 mm) as measured side by side.
- .4 For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 11.43 mm high, per 25 mm square. Cast in Place Warning tiles shall be held within the following dimensions and tolerances:

Type	Part No.	Size
Warning Tiles	ADA-C-2448	610 X 1220 mm
Directional Detectable Wayfinding Tiles	ADD-503	305 x 305 mm

- .5 Product Data: Vitrified Polymer Composite (VPC) Cast in Place Warning tiles and Wayfinding Tiles shall meet or exceed the following test criteria:

ASTM Reference	Test Description	Value
ASTM D695	Compressive Strength	≥ 28,000 psi
ASTM D790	Flexural Strength	≥ 25,000 psi
ASTM D638	Tensile Strength	≥ 19,000 psi
ASTM D5420	Impact Resistance	≥ 550 in-lbf/in
ASTM D696	Coefficient of Thermal Expansion	2.78 x 10 <sup>-6</sup> /oF
ASTM E84	Flame Spread Index	≤ 25
ASTM D570	Water Absorption	≤ 0.05%
ASTM C501	Abrasive Wear Index lw	≥ 500
ASTM D2486	Abrasive Scrub Test	≤ 0.06
ASTM B117	Salt Spray (300 hrs)	No Failure
ASTM D1037	Accelerated Aging Cycle Testing	No Failure

ASTM D543	Chemical Resistance	No Failure
ASTM G155	Accelerated Weathering	$\Delta E < 3$

- .6 Colour: Yellow conforming to Federal Colour No. 33538. Colour shall be homogeneous throughout the tile.

### PART 3 EXECUTION

#### 3.1 Installation

- .1 During Cast In Place Detectable/Tactile Warning Surface Tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- .2 Prior to placement of the Cast In Place Detectable/Tactile Warning Surface Tile system, review manufacturer and contract drawings prior to construction and refer any and all discrepancies to the Consultant.
- .3 The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast In Place Detectable/Tactile Warning Surface Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as 2 concrete blocks or sandbags (25 lb) shall be placed on each tile.
- .4 The concrete pouring and finishing operations require typical mason's tools, however, a 1220 mm long level with electronic slope readout, 25 lb. weights, and a large non-marring rubber mallet are specific to the installation of the Cast In Place Detectable/Tactile Warning Surface Tile system. A vibrating mechanism may be employed, if desired. The vibrating unit should be fixed to a soft base such as wood, at least 300 mm square.
- .5 The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.
- .6 When preparing to set the tile, no concrete shall be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Holes in the tile perimeter allow air to escape during the installation process. Concrete will flow through the large holes in each embedment flange on the underside of the tile. This will lock the tile solidly into the cured concrete.
- .7 The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Cast In Place Detectable/Tactile Warning Surface Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting which can result in air voids under the tile surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
- .8 In cold weather climates it is recommended that the Cast In Place Detectable/Tactile Warning Surface Tiles be set deeper such that the top of domes are level to the adjacent concrete on the



top and sides of ramp and that the base of domes to allow water drainage. This installation will reduce the possibility of damage due to snow clearing operations.

- .9 Immediately after placement, the tile elevation is to be checked to adjacent concrete. 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 tile is flush with the surrounding concrete and back of curb so that no ponding is possible on the tile at the back side of curb.
- .10 While concrete is workable, a 10 mm radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile.
- .11 During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile that may rock the tile causing a void between the underside of tile and concrete.
- .12 Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Two suitable weights of 25 lb each may be required to be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.
- .13 Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.
- .14 If desired, individual tiles can be bolted together using ¼ inch or equivalent hardware. This can help to ensure that adjacent tiles are flush to each other during the installation process. Tape or caulking can be placed on the underside of the bolted butt joint to ensure that concrete does not rise up between the tiles during installation. Any protective plastic wrap which was peeled back to facilitate bolting or cutting, should be replaced and taped to ensure that the tile surface remains free of concrete during the installation process.
- .15 Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.
- .16 Any sound-amplifying plates on the underside of the tile, which are dislodged during handling or cutting, should be replaced and secured with construction adhesive. The air gap created between these plates and the bottom of the tile is important in preserving the sound on cane audible properties of the Armor-Tile system as required in various jurisdictions.

### 3.2 Protection

- .1 Protect tiles against damage during construction period to comply with Tactile Tile manufacturer's specification.
- .2 Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

### 3.3 Cleaning

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

- .2 Clean Tactile Tiles not more than four days prior to date scheduled for inspection intended to establish date of Substantial Performance in each area of project. Clean Tactile Tile by method specified by manufacturer.
- .3 Comply with manufacturers maintenance manual for cleaning and maintaining tile surface and it is recommended to perform annual inspections for safety and tile integrity.

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

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM A53/A53M-22 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - .2 ASTM A90/A90M-21 Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
  - .3 ASTM A121-22 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
  - .4 ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - .5 ASTM A153/A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .6 ASTM A392-11a(2022) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
  - .7 ASTM A817-12(2017) Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcellled Tension Wire

### **1.4 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.

### **1.5 Waste Management and Disposal**

- .1 Refer to Section 01 74 10 – Cleaning.

## **PART 2 PRODUCTS**

### **2.1 Materials**

- .1 Line Posts: Tubular steel pipe, 60 mm outside diameter, 4.46 kg/m galvanized.
- .2 Corner Posts: Tubular steel pipe, 89 mm outside diameter, 11.3 kg/m galvanized.
- .3 Top Rail Braces, and Centre Rail: Tubular steel pipe, 42 mm outside diameter., 1.86 kg/m galvanized.
- .4 Connection Sleeves: Malleable iron, galvanized
- .5 Fabric: Chain link, 50 mm mesh of 3.0 mm diameter steel wire, hot dipped galvanized after fabrication or electrically galvanized before weaving. Fabric shall conform to the requirements of ASTM A392 and shall have a Class 2 zinc coating.

- .6 Reinforcing Wire: 4.0 mm diameter steel wire, hot dipped galvanized.
- .7 Tie Wire: 3.0 mm diameter steel, hot dipped galvanized or aluminum alloy wire.
- .8 Fittings and accessories including nuts, bolts, etc. steel or malleable iron, hot dipped galvanized. Provide projection with clips or recess to hold 3 strands of barbed wire at 100 mm on centre.
- .9 Turnbuckles to be drop forged.
- .10 Concrete for post foundations, 25 Mpa, air entrained, as specified in Section 03 30 00.

### **PART 3 EXECUTION**

#### **3.1 Fencing**

- .1 Erect fencing accurately located with posts vertical, fencing and post tops parallel to contour of finished grade, with space between bottom of bottom rail and ground not less than 38 mm and no more than 76 mm.
- .2 Excavate for posts using 254 mm diameter auger for line post and 305 mm diameter auger for corner posts as required. Set posts 1080 mm into 1200 mm deep concrete footings, rough cast in the ground and domed above grade to shed water.
- .3 Remove boulders or other subsurface obstructions as required. In such cases, where the size of hole exceeds the minimum dimensions of the footings either place the footing against undisturbed soil or backfill the hole with suitable earth material compacted to a density of 95% of maximum dry density and then bore a hole to the required minimum dimensions.
- .4 Install line posts spaced between corner posts (maximum 3.0 m on centre).
- .5 Install top rail continuous, passing through line post caps, secured to each corner post. Use pipe coupling sleeves to provide for expansion at intermediate joints.
- .6 Install bottom rail continuous around enclosure secured to corner and line posts.
- .7 Fasten post caps securely to corner and line posts.
- .8 Stretch bottom tension wire tight and securely fasten to corner posts with turnbuckles and tension bar bands.
- .9 Fence fabric shall not be installed until the concrete footings have cured for a period of at least 5 days.
- .10 Place fence fabric on the outside of the posts.
- .11 Securely fasten fabric to corner posts using tension (stretcher) bars with bar bands spaced 300 mm on centre.
- .12 Securely fasten fabric to the top, brace and bottom rails with tie wires at 460 mm on centre and to line posts with tie wires at 300 mm on centre.

- .13 All abraded and damaged galvanized surfaces shall be cleaned and painted. Damaged areas shall be thoroughly wire brushed and all loose and spelter coating removed, after which the cleaned area shall be painted with two coats of zinc rich paint.

### 3.2 Cleaning

- .1 Proceed in accordance with Section 01 74 10 – Cleaning.
- .2 Thoroughly clean all areas where work has occurred. Remove from the site excess material, debris and rubbish.
- .3 Take all precautions to protect completed work. Immediately repair or replace all damaged areas due to tire ruts, erosion, compaction failure, etc. Keep all erosion control measures intact.

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
- .2 Section 32 92 23 Sodding

### 1.3 References

- .1 Canadian Nursery Landscape Association (CNLA)
  - .1 Canadian Nursery Stock Standard (2017)
- .2 International Society for Horticultural Science (ISHS)
  - .1 The International Code of Nomenclature for Cultivated Plants (ICNCP, Cultivated Plant Code)

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit samples of specified mulches and plant accessories when required by Consultant. Keep approved samples on site, in an approved and protected location until work has been inspected, approved, and accepted.

### 1.5 Quality Assurance

- .1 All planting work shall be carried out by experienced workmen, under the direction and supervision of an experienced, qualified plant person.
- .2 Topsoil shall be tested for N.P.K., atrazine, and minor elements, as well as for clay and organic matter content, and acidity (pH range). Topsoil shall be tested, written test reports submitted and approved by Consultant, before using topsoil on site.

### 1.6 Inspections

- .1 All plant materials shall be available for inspection on site by Consultant prior to planting. Give timely notice of availability of the material for inspection.
- .2 The Consultant has the right to inspect plants upon arrival at the site and reject plants which have been damaged, are in poor condition, or otherwise do not conform to the Specifications.

### 1.7 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Deliver all materials in their original containers, with all labels intact and legible. Containers with fertilizers, peatmoss, bonemeal, shall clearly indicate contents, weight, analysis, and manufacturer's name.
- .3 All materials which are subject to deterioration from weather, shall be stored in a dry, protected weatherproof area.

- .4 Plants shall be protected from damage, and drying out from the time they are dug and during transportation, until planting on the site.
- .5 Plants which cannot be planted immediately after arrival on the site shall be properly heeled in and protected and kept moist until they can be planted.

1.8 Waste Management and Disposal

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

1.9 Warranty

- .1 All plants accepted shall be guaranteed for a period of two years from date of Substantial Performance or date of planting, whichever is later.
- .2 All plants shall be inspected at the end of the guarantee period. Plants which, at that time, are not in a healthy vigorous growing condition, to Consultant's approval, shall be replaced at no extra charge.
- .3 Replacements shall be supplied and planted in strict accordance with Drawings, Plant List, and the specifications and shall be subject to the specified guarantee periods.
- .4 Replacements shall be planted as soon as possible, but during the proper planting season, in accordance with accepted horticultural practice.
- .5 All replacement trees shall be clearly marked in a visible manner.
- .6 Notify Owner and Consultant, in writing, when replacements are to be planted.
- .7 Replacements required because of vandalism, theft, or other causes beyond the Contractor's control, are not part of this Contract.

PART 2 PRODUCTS

2.1 Topsoil

- .1 Clean topsoil, imported material approved by the Consultant, and free from admixtures of subsoil, clay lumps, stones or roots over 25 mm diameter, free of toxic substances or any other foreign matter which would inhibit growth. Minimum 500 mm thickness at all planting beds.
- .2 Except where different mix is indicated on Drawings, provide the following planting soil mixture:
  - .1 Thoroughly mix 5 parts of topsoil and 1 part manure and shred to a fine, even texture.
  - .2 Add bonemeal at 8.0kg./m<sup>3</sup>. of soil and add fertilizer in accordance with soil analysis report.

2.2 Manure

- .1 Well-rotted, un-leached cattle manure not less than 8 months and not more than 2 years old, free of harmful chemicals and injurious substances, containing maximum 25% straw, leaves, and other foreign matter.

2.3 Peatmoss

- .1 Partially decomposed, fibrous or cellular stems of Sphagnum Mosses with a porous to spongy fibrous texture and with a pH ranging from 4.5 to 6.0. Peatmoss shall be supplied in bales, which shall be free of decomposed colloidal residue, wood, sulphur and iron and shall be finely shredded into particles not larger than 6 mm.

**2.4 Bone Meal**

- .1 Commercial, clean bone meal, finely ground and analyzing to a minimum 5% nitrogen and 20% phosphoric acid.

**2.5 Fertilizer**

- .1 Organic. Fertilizers containing chemicals are strictly prohibited.

**2.6 Plant Materials**

- .1 All plants shall be No. 1 Grade, nursery-grown stock of a grade and quality conforming to the horticultural standards and grown under proper cultural practices as adopted by the Canadian Nursery Landscape Association (CNLA).
- .2 Nursery stock shall be transplanted and/or root pruned regularly, but not later than nine months prior to arrival on projects site.
- .3 Plants shall conform to all regulations requiring inspection for disease and insect control. Plants which require chemical treatment as ordered by Agriculture and Agri-Food Canada shall be prohibited.
- .4 All plants shall be true to name in accordance with Plant List, with botanical names conforming to the International Code of Nomenclature for Cultivated Plants.
- .5 Plants shall be tagged with name and size of plants. Labels shall not be removed until after final inspection at end of maintenance period.
- .6 Substitutions for the specified plants are not allowed unless approved by Consultant in writing.
- .7 Any plants dug from native stands, wood lots, and which have not received proper cultural maintenance as advocated by the CNLA, shall be designated as "Collected Plants".
- .8 The supply and planting of "Collected Plants" will not be permitted unless approved, in writing, and subject to inspection by Consultant at the original growing location. Be responsible for all costs related to such inspection.
- .9 The guarantee period for approved "Collected Plants" shall be one year longer than the specified guarantee period for nursery-grown plants.
- .10 Plants shall be supplied from nurseries located within the same hardiness zone, and grown in the same soil conditions as the project site, and in accordance with the Plant List, unless otherwise approved.
- .11 Plants shall be freshly dug and be in healthy vigorous condition upon arrival at the site. Heeled-in plants or plants from cold storage are not allowed.



- .12 Plants shall be sound, healthy and well-branched, free of disease and insects, and possess all the characteristics of the specified species, headers shall be straight and intact and stems and trunks free of sun scalds, frost cracks, abrasions and other damages.
- .13 Old injuries shall be completely callused over with pruning wounds showing vigorous bark on all edges and all parts showing live, green Cambium tissue when cut.
- .14 Plants shall be measured when the branches are in their normal position, with height and spread dimensions referring to the main body of the plant.
- .15 Trees are specified by caliper which is the diameter of the trunk measured at 150 mm above grade.
- .16 Root balls shall contain at least 75% of the fibrous roots and shall conform to the size specifications in the Guide Specification for Nursery Stock of the Canadian Nursery Landscape Association.
- .17 Root balls shall be supplied, wrapped in burlap as follows:
  - .1 Root Ball Diameter:
    - .1 Up to 450 mm: 5 oz. Hessian burlap
    - .2 450 to 760 mm: double burlap
    - .3 larger than 760 mm: double burlap and drum laced with 6mm rope at 200 mm spacing.

## **2.7 Accessories**

- .1 Wrapping material for tree trunks shall be burlap, or other material approved by Consultant, at least .3 kg./m<sup>2</sup> in weight and ranging in width from 150 to 250 mm.
- .2 Stakes for support of small trees and large shrubs shall be as detailed, painted with two (2) coats of dark brown stain.
- .3 Supports for large trees, as detailed, shall consist of zinc-coated guy cables, eye bolts and turnbuckles, or approved equal. Cables shall be used for trees 150 mm in caliper and over.
- .4 Wires for tree supports shall be 3.891 mm galvanized steel wire, encased in new black, two ply 13 mm diameter rubber hose.
- .5 Anti-desiccant, where required, shall be "Wilt-Pruf" or similar product approved by Consultant.

## **2.8 Mulch**

- .1 Mulch in planting areas and tree saucers, shall be approved shredded pine bark mulch. Composed mulch will not be accepted.
- .2 Pine bark mulch shall be pieces not larger than 50 mm and shall be free of sticks and chopped or broken branches.
- .3 Provide sample of mulch for approval by Consultant and Owner prior to delivery to site.

## PART 3 EXECUTION

### 3.1 Site Preparation

- .1 Excavate to the specified depth, as detailed, or, where not indicated, in accordance with the following schedule:
  - .1 Any deep rooted vegetation which may be planted at the site shall be planted within a zone of soil which meets the recommended phytotoxicity benchmarks of electrical conductivity (EC) and sodium absorption ratio (SAR).
  - .2 Where deeper rooted vegetation such as shrubs and trees are planted, a depth of at least 1 meter of clean soil (i.e. meets table 3 standards) shall be provided around the root ball and 30 centimeters of clean soil on the surface extending out to the mature tree drip line.
- .2 Stake out the locations of all tree pits and planting areas to Consultant's approval before planting.
- .3 Scarify subgrade in tree pits and planting areas to minimum depth of 150 mm. Remove all construction debris from planting areas prior to placement of soil. In areas originally paved, ensure that all granular base is removed from planting areas.

### 3.2 Installation

- .1 Plant during periods suitable with respect to climatic conditions, locally accepted practice and to Consultant's approval.
- .2 Plants shall be installed to give the best appearance as directed by Consultant.
- .3 Plants shall be set plumb in the centre of pits and at the same relationship to grade as in their original growing locations.
- .4 Remove ropes, wires, and pull away burlap from top 1/3 of rootball.
- .5 Backfill in 150 mm layers, firmly tamping each layer around the roots, and taking care not to leave air pockets.
- .6 Thoroughly water when planting pit is half full and again when completely filled.
- .7 Allow each plant and tree to be about 50 mm above surrounding grade to permit natural settlement.
- .8 Surround each plant, except when planted in a bed, with an earth saucer as large as planting pit, in order to retain water. Remove saucer at end of maintenance period.
- .9 Thoroughly water all planting areas and trees immediately after planting.
- .10 Place specified mulch around all trees and in all planting beds to a depth of 75 mm.

### 3.3 Tree Wrapping

- .1 Wrap all tree trunks prior to shipping with tree wrapping material. Tie with cord to keep wrapping snug and neat. Prior to applying wrapping, spray trunks with a wettable powder of long residual insecticide. Remove wrapping prior to final inspection.

### 3.4 Tree Support

- .1 Install tree supports as detailed. Tighten guys without placing undue strain. Encase wires in rubber hose at points of contact with bark.
- .2 Remove all tree supports after the 1 year warranty period.

### 3.5 Pruning

- .1 Prune all plants as necessary to remove dead and broken branches and to compensate for the loss of roots as a result of transplanting and digging in nursery.
- .2 Preserve the natural character; do not remove leader or small branches along trunks.
- .3 Use clean, sharp tools and make cuts clean and flush without leaving stubs.
- .4 Cut back to living tissue all cuts, scars and bruises, shaped so as not to retain water.

### 3.6 Maintenance

- .1 Maintain all plants and planting areas immediately after installation until all project work has been inspected, approved and accepted. Further, maintain all plant material for the duration of the warranty period.
- .2 Maintenance shall include all necessary measures to establish and maintain plants in a healthy, vigorous growing condition and planting areas are neat and tidy.
- .3 Maintenance shall include, but not be limited to the following work:
  - .1 Maintenance, repair and replacement, where necessary, of all accessories, such as tree guys, stakes, turnbuckles and removal of such after first year.
  - .2 Regular inspection of all plants and control of insects and diseases.
  - .3 Fertilizing, watering and pruning as necessary.
  - .4 Removal of debris, broken branches, to keep planting areas in neat and tidy condition at all times.
- .4 All plants shall be free of diseases and insect infestations in a healthy, good, growing condition, and planting areas free of weeds and freshly cultivated, at time of final inspection.
- .5 The use of chemicals for fertilization or pest control is strictly prohibited.

### 3.7 Cleaning

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

End of Section

## PART 1 GENERAL

### 1.1 General

- .1 Conform to the requirements of Division 1.

### 1.2 Related Sections

- .1 Section 31 23 10 Excavating, Trenching and Backfilling
- .2 Section 32 90 00 Planting
- .3 Section 32 92 23 Sodding

### 1.3 References

- .1 Government of Canada
  - .1 Seeds Act R.S.C., 1985, c. S-8
- .2 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management.

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit statements of guarantee and/or certifications from vendors who supply seed, mulches, tackifiers, and fertilizers.
- .3 Furnish a signed statement certifying that the seed furnished is from a lot that has been tested by a recognized laboratory for seed testing within six months prior to the date of delivery.
- .4 Seed container labels shall be submitted at the completion of Project.
- .5 Submit the manufacturers guaranteed chemical analysis, name, trade name, trademark, and conformance to state law of all fertilizers and herbicides.
- .6 Submit compost sample for approval.

### 1.5 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 All materials shall be supplied in original manufacturers shipping bags or containers and remain in these bags or containers until they are used. Materials shall be stored in a manner that will prevent them from coming into contact with precipitation, surface water, or any other contaminating substance.
- .3 Fertilizer shall be delivered in original, unopened containers, unless provisions are made and approved by Consultant for bulk deliveries to the site of the Work.
- .4 Herbicide shall be delivered in original, unopened containers. All herbicides will be stored in a manner that satisfies local, Provincial and Municipal Guidelines for Herbicide Storage.

### 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 General

- .1 All materials used shall be new and without flaws or defects of any type and shall be the best of their class and kind. Seeds shall be prepared for sale during the year of installation. All materials and equipment shall be free of noxious weeds.
- .2 Any materials that have become wet, moldy, or otherwise damaged in transit or in storage shall not be used.

### 2.2 Seed

- .1 All seed shall be mixed by a wholesale seed supplier in order to obtain the specified mixture and application rate required by Consultant. No species substitutions shall be permitted without prior approval of the Consultant.
- .2 All seed shall conform to all current Federal regulations.
- .3 Seed and seed mixes shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the common, scientific, and variety name(s) of the seed(s), the lot number, point of origin, net weight, percent of weed content, and the guaranteed percentage of purity and germination.
- .4 All seed shall be guaranteed for purity and germination, free of noxious weed seed and supplied on a Pure Live Seed (PLS) basis.

### 2.3 Fertilizer

- .1 Fertilizer shall be as shown on the drawings. All fertilizer shall be a standard commercial product of uniform composition, free flowing and conforming to applicable Provincial laws.

### 2.4 Mulch

- .1 The type of mulching material to be used shall be crimped weed-free straw. At least seventy percent (70%) of the mulch by weight shall be 250 mm or more in length. Mulch shall not contain any noxious weed, must, mold, cake, or decay. No hay may be used on the project unless approved in advance by the Consultant.

### 2.5 Organic Tackifier/Binder

- .1 Organic tackifier/binder shall be applied as shown on the drawings.

### 2.6 Erosion Control Netting, Blankets, Mats, Fabrics

- .1 Erosion control blankets, mats, or other commercial products for stabilizing land disturbed areas may be required in certain areas. If so, the type, manufacturer, and installation method for these products shall be specified by Consultant.

### 2.7 Water

- .1 Potable

## 2.8 Topsoil

- .1 As specified in Section 31 23 10.

## PART 3 EXECUTION

### 3.1 General

- .1 Locate and protect all utilities, structures, roadways, parking areas, fences, survey markers, and existing vegetation on sites. Any damage caused by Contractor shall be immediately repaired or corrected by Contractor at no expense to Owner.
- .2 Seeding shall be completed as soon as practical after the completion of final grading. Coordinate the actual start of the seeding operation with Consultant.
- .3 All work is to be performed by personnel thoroughly familiar with proper and accepted methods for soil preparation, herbicide applications, fertilizing, seeding, and mulching. All work is to be performed under the direct supervision of Contractor's superintendent.

### 3.2 Preparation

- .1 All ripping and tilling operations shall be done in a direction which follows the natural contour of the land on slopes of 3:1 or less. Soils on slopes greater than 3:1 shall be prepared for planting in a manner specified by Consultant. Any irregularities in the ground surface resulting from soil preparation operations shall be corrected and sloped to drain.
- .2 Limit subgrade preparation to areas that shall be planted in the immediate future.
- .3 Prior to spreading salvaged topsoil and seeding, thoroughly till or rip to a depth of 300 mm at all areas compacted by access, staging, or construction traffic. Till all remaining areas to a depth of 150 mm. Channel bottom areas are to be ripped to a depth of at least 300 mm on approximately 600 – 1200 mm centers. The soils shall be worked until no clods greater than 50 mm in diameter remain, unless directed otherwise by Consultant. Remove rocks and other objects 76 mm or greater in any dimension.
- .4 Spread topsoil to depth required to meet grades and elevations shown on Drawings after light rolling and natural settlement.
- .5 Either mix soils with soil amendments and fertilizers before spreading or apply soil amendments or fertilizers on surface of spread topsoil and till thoroughly into top 100 mm before planting. Mix soil amendments at the rate that is indicated on the Drawings. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.
- .6 Organic Compost Soil Amendment shall be applied at a rate of 3m<sup>3</sup> per 90 m<sup>2</sup> or as shown on the Drawings. Organic Compost shall only be applied if required and designated on the drawings.
- .7 Prior to seeding, grade the areas to be seeded to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Soils shall meet grades and elevations shown on drawings after light rolling and natural settlement. Limit fine grading to areas that can be planted in the immediate future.

- .8 Moisten prepared areas to be seeded prior to planting when soils are dry. Water thoroughly and allow surface to dry before seeding. Do not create muddy conditions. Restore prepared areas if eroded or disturbed after fine grading and before planting.

### 3.3 Seeding

- .1 Broadcast seed using hand-operated "cyclone-type" seeders or rotary broadcast equipment attached to construction or revegetation machinery. All machinery shall be equipped with metering devices. Broadcasting by hand shall be acceptable on small, isolated sites. Prior to hand broadcast seeding, divide the seed required into two portions. Apply the first half of the seed and then follow up by applying the second portion to ensure complete coverage by seed. When broadcast seeding, passes shall be made over each site to be seeded in a manner to ensure an even distribution of seed. When using hopper type equipment, seed shall be frequently mixed within the hopper to discourage seed settling and uneven planting distribution of species.
- .2 Broadcast seeding shall take place immediately following the completion of final seedbed preparation techniques and upon inspection and approval of Consultant. Broadcast seeding should not be conducted when wind velocities would prohibit even seed distribution.

### 3.4 Fertilization

- .1 Any fertilizers shall be applied and mixed with the soil as specified in Preparation. All fertilizers shall be applied using standard application equipment at rates indicated by required soils tests, or in some cases as specified by Consultant.

### 3.5 Mulching

- .1 Straw mulch shall be applied immediately after seeding has been completed with a mechanical spreader at a rate not less than 1-1/2 tons per acre, and not more than 2 tons per acre. Straw mulch shall then be anchored to the soil with a standard commercial crimper which shall crimp the fiber 100 mm or more into the soil. Failure to apply designated mulch at the specified rate may result in the Consultant requiring the Contractor to remobilize and complete the specified Work at no additional cost to the Owner.

### 3.6 Erosion Control Netting

- .1 Slopes over 3:1, concave areas on slopes, drainage swales, areas along the edges of hard surfaces (trails and roads), and any other areas which may rill, shall be mulched with jute netting or other erosion control fabric as specified in Drawings. Fabrics shall be installed only after the installation area is graded smooth. All clods or rocks shall be removed from the area, so that the fabric will lie flat on the surface of the soil and not bridge over it. The edges of the fabric shall be secured by 600 mm wooden stakes installed 610 mm on center along all edges and seams. Seams shall overlap 300 mm and the body of the fabric shall be further secured to the soil surface on 900 mm centers. The fabric shall not be stretched tight.

### 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 31 10 00 Site Clearing
- .2 Section 31 23 10 Excavating, Trenching and Backfilling

### 1.3 References

- .1 Nursery Sod Growers Association of Ontario (NSGA)
- .2 Ontario Regulation O Reg 406/19 On-Site and Excess Soil Management

### 1.4 Submittals

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit grass seed mix.
- .3 Submit name and address of sod farm.

### 1.5 Quality Assurance

- .1 Topsoil from each source, native and imported, shall be tested for N.P.K., atrazine, minor elements, as well as clay and organic matter contents and acidity (pH) range. Topsoil shall be tested, written test report submitted and approved by Consultant, prior to delivery to site.

### 1.6 Shipping, Handling and Storage

- .1 Refer to Section 01 61 00 – Common Product Requirements.
- .2 Protect sod during transportation, for delivery to the site in a fresh and healthy condition.
- .3 Install sod immediately, no later than 48 hours after arrival on site. Keep moist and fresh until installation.
- .4 Handle sod carefully to prevent breaking or tearing. Immediately remove damaged and dried-out sod from the site.

## PART 2 PRODUCTS

### 2.1 Topsoil

- .1 Clean topsoil imported material approved by the Consultant, and free from admixtures of subsoil, clay lumps, stones or roots over 25 mm diameter, free of toxic substances or any other foreign matter which would inhibit growth. Minimum 150 mm thickness.
- .2 Comply with the requirements of Ontario Regulation O. REG 406/19, "On-Site and Excess Soil Management", for the importation of new soils. Complete testing of imported materials as required. Unless noted elsewhere, costs for such testing is the responsibility of the contractor and is not



included in any allowances. Maintain and submit to authorities having jurisdiction all required test reports, certificates and documentation.

## 2.2 Sod

- .1 Sod shall be a Certified No. 1 sod, grown and sold in accordance with the latest specifications of the Nursery Sod Growers Association of Ontario (NSGA), composition of 50% Kentucky Blue Grass and 50% Merion Blue Grass.
- .2 At the time of delivery, sod shall have a strong, fibrous root system, be free of disease, stones, burned or bare spots, with a healthy green colour and containing not more than 1% twitch grass and other weeds.
- .3 Sod shall be cut and rolled in sections of max. 1.0 m<sup>2</sup> in area and approximately 30 mm thick as specified by the NSGA.

## 2.3 Wooden Pegs

- .1 Hardwood pegs, 25 x 25 mm square and at least 250 mm long, or longer as required for satisfactory anchorage of sod.

## 2.4 Fertilizer

- .1 Commercial type having a 10-10-10 ratio and shall be applied such that actual nitrogen is 9.0 kg/10 m<sup>2</sup>.

# PART 3 EXECUTION

## 3.1 Preparation

- .1 Adjust subgrade to allow the placing of topsoil to minimum depths specified.
- .2 Scarify subgrade to at least 75 mm deep and remove debris and all stones 50 mm in diameter and larger.
- .3 Arrange for inspection of finished subgrade by Consultant.
- .4 Spread and grade topsoil evenly over approved subgrade. Provide minimum 150 mm thick topsoil. No less will be accepted.
- .5 Finished sodded area top surface shall be uniform and evenly graded between elevations indicated, free of bumps, ridges and depressions. Remove all stones and lumps over 25 mm in diameter and foreign materials.
- .6 Unless recommended otherwise on soil analysis report, apply a 10-10-10 fertilizer at the rate of 9.0 kg/10 m<sup>2</sup>.
- .7 Work fertilizer well and uniformly into the topsoil within 48 hours before laying sod.
- .8 Fine grade, rake and roll surface until smooth and firm against foot prints, and free of depressions, lumps and irregularities.

### 3.2 Installation

- .1 Place sod closely knit together, so that no open joints are visible, and pieces are not overlapping.
- .2 Install sod to blend tightly and uniformly with adjoining grass areas and, unless otherwise detailed, to be flush with paving, top of curbs.
- .3 On slopes of 3:1 and steeper, place sod perpendicularly to the slope and stake every row with wooden pegs at maximum 600 mm intervals. Drive pegs flush with sod.
- .4 Immediately after installation, water with sufficient amount to saturate sod and underlying topsoil.
- .5 As soon as sod has dried sufficiently to prevent damage, roll with roller to ensure a good bond between sod and topsoil and to remove minor depressions and irregularities.

### 3.3 Maintenance

- .1 Maintain all sodded areas, from date of installation and until one full growing season is complete (minimum 6 months). Obtain Consultant's approval at end of maintenance.
- .2 Maintenance shall include all necessary measures to establish and maintain grass in a healthy, vigorous growing condition, for one full growing season.
- .3 Maintenance shall include, but not be limited to the following work:
  - .1 Mow grass areas at regular intervals as required to maintain grass height between 50 mm and 60 mm. Not more than  $\frac{1}{3}$  of grass blade shall be cut during one mowing. Hand clip where necessary and keep edges neatly trimmed. Remove heavy clippings immediately after mowing and trimming.
  - .2 Control weeds by cutting. Use of chemicals is strictly prohibited.
  - .3 Fertilize not less than once per season (Spring, Summer, Fall).
  - .4 Water when necessary, with sufficient quantities of water to prevent sod and underlying soil from drying out.
  - .5 Roll all sodded areas to remove minor depressions and irregularities.
  - .6 Repair all erosion damage resulting from faulty workmanship and/or maintenance.
  - .7 Replace all grass which has deteriorated, or which shows bare spots.
  - .8 Protect all grass areas against damage, including erosion and trespassing, by providing and maintaining proper safeguards. Remove safeguards at end of maintenance period.

### 3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Clean up all areas and remove debris

End of Section