



**Request for Tender # T-1032-2021**

**for**

**Relocation of Oral Health Clinic  
to 200 John Street, Oshawa**

**Appendix D, D-1 and D-2**

**The Deliverables and Material Disclosures**

**Tender Document 4 of 4**

**Electronic submission required**



The Regional Municipality of Durham  
Works Department  
605 Rossland Road East, Whitby ON, L1N 6A3

Relocation of Oral Health Clinic to 200 John Street, Oshawa

Barry Bryan Associates  
201-250 Water Street, Whitby, Ontario L1N 0G5  
BBA No. 20060





These specifications (Divisions 00-31) were prepared under the supervision of the following registered coordinating professionals:

**Written by: C.M. Earle**

**Date: February 17, 2021**

**Checked by: N. Swerdfeger**  
(Consultant Project Manager)

**Date: February 17, 2021**

Architectural	Electrical	Mechanical
 Div 1, 2, 6-11	 Div 26-28	 Div 21-23
Structural		
 Div 3, 5, 31		

**Division 00 Procurement and Contracting Requirements**

- 00 01 07 Seals page
- 00 01 10 Table of contents
- 00 61 14 Bonds, insurance and warranty security
- 00 65 36 One year extension of contract warranty Period.

**Division 01 General Requirements**

- 01 11 00 Summary of work
- 01 14 00 Work restrictions
- 01 21 13 Cash allowances
- 01 29 00 Payment procedures
- 01 31 00 Project management and coordination
- 01 31 14 Interference and coordination drawings
- 01 31 19 Project meetings
- 01 32 00 Construction progress documentation
- 01 33 00 Submittal procedures
- 01 35 29 Health and safety procedures
- 01 41 00 Regulatory requirements
- 01 45 00 Quality control
- 01 50 00 Temporary facilities and controls
- 01 51 00 Temporary utilities
- 01 52 00 Construction facilities
- 01 53 00 Temporary construction
- 01 55 00 Vehicular access and parking
- 01 62 00 Product options
- 01 65 00 Product delivery requirements
- 01 74 00 Cleaning and waste management
- 01 75 19 Testing and balancing
- 01 78 00 Closeout submittals
- 01 78 37 Extended warranties
- 01 79 00 Demonstration and training
- 01 91 00 Commissioning

**Division 02 Existing Conditions**

- 02 41 19 Selective demolition

**Division 03 Concrete**

03 30 00 Cast-in-place concrete

**Division 04 Masonry**

04 21 13 Brick Masonry

**Division 05 Metals**

05 12 23 Structural steel

05 50 00 Metal fabrications

**Division 06 Wood, Plastics, and Composites**

06 10 00 Rough carpentry

06 20 00 Finish carpentry

06 61 16 Solid surfacing

**Division 07 Thermal and Moisture Protection**

07 21 13 Building insulation

07 21 29 Sprayed insulation

07 24 00 Exterior insulation and finish system

07 26 00 Vapour retarders

07 27 13 Modified bituminous sheet air barriers

07 46 13 Preformed metal siding

07 54 23 TPO roofing

07 62 00 Sheet metal flashing and trim

07 84 00 Firestopping and smoke seals

07 92 00 Sealants

**Division 08 Openings**

08 11 00 Metal doors and frames

08 14 16 Flush wood doors

08 50 00 Aluminum doors and screens

08 70 00 Hardware

08 71 13 Automatic door operators

08 80 00 Glazing

08 87 20 Decorative window films

08 88 13 Fire resistant glazing

**Division 09 Finishes**

- 09 21 16 Gypsum wallboard
- 09 30 00 Tiling
- 09 51 13 Acoustic ceilings
- 09 65 00 Resilient flooring and accessories
- 09 65 36.13 Static dissipative resilient flooring
- 09 65 43 Linoleum flooring
- 09 90 00 Painting

**Division 10 Specialties**

- 10 21 13 Compartments and cubicles
- 10 28 13 Washroom accessories
- 10 51 23 Phenolic lockers
- 10 80 00 Miscellaneous specialties

**Division 11 Equipment**

- 11 73 13 Patient lifts

**Division 12 to 14**

Not used

**Division 21 Fire Suppression**

- 21 00 01 General Conditions
- 21 00 50 Basic materials and methods
- 21 00 55 Work in existing buildings
- 21 05 29 Bases, hangers and supports
- 21 05 53 Identification for Fire-Suppression Piping and Equipment
- 21 13 00 Sprinkler systems

**Division 22 Plumbing**

- 22 00 01 General conditions
- 22 00 50 Basic materials and methods
- 22 00 55 Work in existing buildings
- 22 05 14 Electrical wiring
- 22 05 23 Plumbing valves
- 22 05 29 Bases, hangers and supports
- 22 05 47 Vibration isolation
- 22 05 53 Identification for plumbing piping and equipment

22 05 76	Facility Drainage Piping Cleanouts
22 05 93	Testing, balancing and adjusting
22 07 00	Plumbing insulation
22 11 16	Domestic water piping
22 11 19	Domestic water piping specialties
22 13 16	Sanitary waste and vent piping
22 13 19	Sanitary waste piping specialties
22 33 00	Electric domestic water heaters
22 34 00	Gas fired domestic water heaters
22 40 00	Plumbing fixtures

**Division 23 Heating, Ventilating, and Air Conditioning (HVAC)**

23 00 01	General requirements
23 00 50	Basic materials and methods
23 00 55	Work in existing buildings
23 05 14	Electrical wiring
23 05 29	Bases, hangers and supports
23 05 48	Vibration isolation
23 05 53	Identification for HVAC piping and equipment
23 05 93	Testing, balancing and adjusting for HVAC
23 07 00	HVAC insulation
23 09 00	Instrumentation and control for HVAC
23 11 23	Natural gas system
23 30 13	Ductwork and accessories
23 34 00	Fans
23 35 00	Air Control Valve
23 36 00	Air terminal units
23 37 13	Diffusers, registers and grilles
23 41 00	Air filters
23 51 00	Breeching Chimneys and Stacks
23 83 13	Steam humidification system
23 83 33	Electric heaters

**Division 25 Integrated Automation**

Not used

**Division 26 Electrical**

26 05 00	General requirements
26 05 01	Common work results – electrical
26 05 20	Wire and box connectors (0-1000V)
26 05 21	Wires and cables
26 05 27	Grounding
26 05 29	Hangers and supports for electrical systems
26 05 31	Splitter, junction, pull boxes and cabinets
26 05 32	Outlet boxes, conduit boxes and fittings
26 05 34	Conduits, conduit fastenings and conduit fittings
26 27 26	Wiring devices
26 28 13.01	Fuses – low voltage
26 28 23	Disconnect switches – fused and non-fused
26 60 02	Testing and commissioning of electrical systems

**Division 27 Communications**

27 05 00	Communications
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**Division 28 Electronic Safety and Security**

28 13 00	Access control
28 31 00.02	Fire alarm system

**Division 31 Earthwork**

31 23 10	Excavating, trenching and backfilling
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**Division 32 to Division 48**

Not used

**End of Table of Contents**

## 1 General

### 1.1 Scope

- .1 This Section specifies requirements for the bonds, insurance and warranty security holdback.

### 1.2 Reference standards

- .1 Appendix B – Supplementary Conditions to CCDC 2 General Conditions
- .2 CCDC 2 General Conditions

### 1.3 Surety bonds

- .1 Provide a performance bond in an amount equal to fifty per cent (50%) of the tendered price for the faithful performance of the Contract, including all obligations during the warranty period. The warranty period will be extended if known deficiencies are incomplete upon expiration of the two (2) year period. In any case, the performance bond shall continue until the final acceptance certificate has been issued by the Owner in accordance with General Conditions. The Region's standard performance bond form shall be used.
- .2 Provide a labour and material payment bond in an amount equal to fifty per cent (50%) of the tendered price for the faithful payment of all labour and materials related to this Contract. The Region's standard Labour and Material Payment Bond form shall be used.
- .3 Copies of the Owner's standard performance bond and standard labour and material payment bond forms are provided in Appendix B – Supplementary Conditions as Appendices SC-B and SC-C respectively.
- .4 **Bonds shall not be extended to cover any work beyond the original scope of the Work unless explicitly requested by the Owner.** The Contractor shall not be entitled to claim for bonding on such additional work unless such additional bonding is requested by the Owner. The Owner accepts that all additional work performed by Change Order is not covered by the bonds. The Owner shall not be entitled to a credit related to the bonds if a change in the Work results in a reduction of the Contract Price.



- .5 Any contract progress reports issued by the Contractor's surety company must be issued directly to the Owner or Consultant at the address provided.

#### **1.4 Insurance**

- .1 Provide insurance as required by GC 11.1 of the CCDC 2 General Conditions, as amended by Appendix B – Supplementary Conditions.

#### **1.5 Warranty security holdback**

- .1 A warranty security holdback will be retained progressively, commencing on the first payment certificate, from monies that would otherwise be payable to the Contractor, up to a maximum value of \$90,000.00
- .2 The maximum warranty security holdback will be held commencing on the Substantial Performance Payment Certificate. The amount withheld on payment certificates prior to the Substantial Performance Payment Certificate will be based on the percentage of work completed.
- .3 The retained amount is strictly to be used as a warranty security and is in addition to the regular holdback and finishing holdback retained in accordance with the Construction Lien Act, the Contractor's performance bond and any monies withheld due to known incomplete and/or deficient work.
- .4 Where Change Orders are issued which results in the final contract value exceeding the tendered price, the Owner reserves the right to withhold additional warranty security at the same rate (as is determined by dividing the specified maximum warranty security by the awarded Contract Price) on the value of such additional work. Payment for any additional warranty security costs shall be deemed to be included in the respective Change Orders.
- .5 Except as otherwise provided hereunder, the warranty security, less any deductions made therefrom as provided for in the Contract, shall be released to the Contractor following the issuance by the Owner of the Final Acceptance Certificate at the end of the warranty period.
- .6 No substitute form of security will be permitted.**

## **1.6 Basis of payment**

- .1 Payment for bonds and insurance shall be included in the monthly payment certificate after submission of satisfactory documents.
- .2 Payment for all carrying costs associated with the warranty security holdback, including interest thereon, shall be made under this Section on the appropriate line item in the payment certificate. No other compensation for warranty security holdbacks will be considered. Progress payments will be made as follows:
  - 25% on the first progress payment certificate
  - 25% on the Substantial Performance Payment Certificate
  - 50% on the Final Payment Certificate, together with the release of the warranty security holdback at the end of the warranty period, as may be extended in accordance with the Contract.
- .3 The sum of prices bid for bonds, insurance and warranty security holdback carrying costs shall not exceed 2% of the lump sum tendered price.

## **2 Products – not used**

## **3 Execution – not used**

**End of section**

**1 General**

**1.1 Section includes**

- .1 This Section specifies requirements for an extension of the Contract warranty period.

**1.2 Related requirements**

- .1 CCDC 2 – 2008 General Conditions
- .2 Supplementary Conditions

**1.3 Extension of warranty period**

- .1 Provide extension of warranty period for one (1) additional year (for a total of two (2) years) according to Appendix B – Supplementary Conditions.

**1.4 Basis of payment**

- .1 Payment for this Section shall be made on the Substantial Performance Payment Certificate.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Documents and terminology.
- .2 Associated requirements.
- .3 Work expectations.
- .4 Work by other parties.
- .5 Premises usage.

### **1.2 Related requirements**

- .1 Section 01 21 13 Cash Allowances
- .2 Section 01 32 00 Construction Progress Documentation
- .3 Section 01 78 00 Closeout Submittals
- .4 CCDC 2 – 2008 Agreement, Definitions and General Conditions
- .5 Appendix B Supplementary Conditions.

### **1.3 References – words, terms and definitions**

- .1 Refer to and acknowledge other words, terms, and definitions in CCDC 2 Definitions.

### **1.4 Complementary documents**

- .1 Drawings, Specifications, and schedules are complementary each to the other and what is called for by one to be binding as if called for by all. Should any discrepancy appear between documents which leave doubt as to the intent or meaning, abide by Precedence of Documents article below or obtain direction from the Consultant.
- .2 Drawings indicate general location and route of conduit and wire/conductors. Install conduit or wiring/conductors and plumbing piping not shown or indicated diagrammatically in schematic or riser diagrams to provide an operational assembly or system.
- .3 Install components to physically conserve headroom, to minimize furring spaces, or obstructions.

- .4 Locate devices with primary regard for convenience of operation and usage.
- .5 Examine all discipline Drawings, Specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional work beyond work described to be brought to attention of Consultant.

### **1.5 Location**

- .1 The Place of the Work is located at 200 John Street, Oshawa to relocate Oral Health Clinic.
- .2 The materials and/or services shall be delivered FOB Destination(s), Prepaid.

### **1.6 Description of the Work**

- .1 Work of this Contract comprises Relocation of Oral Health Clinic to 200 John Street in Oshawa.
- .2 Division of the Work among Subcontractors, suppliers and vendors is solely the Contractor's responsibility. Neither the Region of Durham nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.
- .3 Refer to the Drawings and Specifications for the required Work.
- .4 Division 01 General Requirements, of the Specification generally specify work and coordination of the work that is the direct responsibility of the Contractor but shall not be interpreted to define absolutely the limits of responsibility that must be established between the Contractor and their Subcontractors by their separate agreements.
- .5 Ensure that Subcontractors understand that the General Conditions of the Contract as amended by the Supplementary Conditions, and Division 01 General Requirements, apply to Sections of the Specification governing their work.
- .6 Ensure that the work includes all labour, equipment and products required, necessary or normally recognized as necessary for the proper and complete execution of the work of each trade.

- .7 The Work also includes the examination of the site, submission of samples, scheduling and coordination, project meetings, protection of the existing facility, repair and preparation of surfaces, quality control, inspection reports, project cleanliness, maintenance of data, preparation of as-built drawings, final cleaning and warranty.

### **1.7 Contract method**

- .1 Construct Work under a single CCDC 2, 2008, Stipulated Price Contract as amended by the Supplementary Conditions.
- .2 Refer to Section 01 21 13 for cash allowance amounts applicable to assignable contracts.
- .3 Assume responsibility for assigned contracts as Subcontracts forming part of the Work.
- .4 Contract Documents were prepared by Barry Bryan Associates. Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. Barry Bryan Associates and the Region of Durham accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions based on the Contract Documents.

### **1.8 Documents provided**

- .1 Owner will supply the Contractor with additional sets of Contract Documents for construction purposes. Refer to Supplementary Conditions for number of copies to be provided.

### **1.9 Performance of the Work**

- .1 Refer to Appendix B – Supplementary Conditions for the Contract Time.

### **1.10 Discrepancies and clarifications**

- .1 Advise Consultant of discrepancies discovered in requirements of the Contract Documents and request clarification from Consultant in written form.
- .2 Advise Consultant when clarifications are required pertaining to meaning or intent of requirements of Contract Documents and request clarification from Consultant in written form.

- .3 Do not proceed with related work until written clarification is provided by Consultant.
- .4 Failure to notify Consultant shall result in Contractor incurring responsibility for resulting deficiencies and expense at no additional cost to the Owner.
- .5 Written instructions issued by Consultant for clarification, implicitly supersede applicable and relevant aspects of the Contract Documents irrespective of whether these documents are explicitly or specifically cited in clarification requests or clarification instructions.

#### **1.11 Work performed under separate contracts**

- .1 Work not to be included in the Contract, as noted "NIC" or "By Others" on the Drawings, shall be governed by GC 3.2, Construction by Owner and Other Contractors, of the General Conditions.
- .2 Work performed under separate contracts and related to this project include:
  - .1 T-1011-2021 Equipment Tender. The General Contractor shall work with the dental equipment supplier for the placement of manufacturer templates for service rough ins.
  - .2 Q303-2016-A-019 Quotation for Demolition of Existing dental Clinic & offices, 1615 Dundas Street E, Whitby,

#### **1.12 Work by Owner**

- .1 Permit the Owner and/or their other contractors to inspect the work at any reasonable time, and to perform such work and install such equipment as the Owner may require.

#### **1.13 Items supplied by Owner**

- .1 Certain items will be supplied by the Owner for installation in, and as part of, the Work. Refer to the relevant technical specification for installation of such items.
- .2 Install items supplied by Owner during the Work.
- .3 Coordinate shipping with the Owner. Items supplied by the Owner will be made available from 1615 Dundas Street East in Whitby, Ontario.

Contractor to arrange and pay cost of pick-up and shipping to the Place of the Work. Location of Owner's storage facility may change through the course of the Work to another nearby facility.

- .4 Store items supplied by Owner at the Place of the Work and protect from damage in the same manner as items supplied by the Contractor.
- .5 Install completely, and leave in full operating condition, in accordance with manufacturer's directions.
- .6 Items to be supplied by the Owner for installation by the Contractor as part of the Work include:
  - .1 Toilet tissue dispensers (refer to Section 10 28 13)
  - .2 Wall mounted soap dispensers (refer to Section 10 28 13)
  - .3 Automatic paper towel dispensers (refer to Section 10 28 13)
  - .4 Vertical skylight shades.
  - .5 Appliances.
- .7 Salvage and reuse all site furnishings and fixtures which are identified to be relocated on the site. The Consultant shall approve condition of all salvaged site furnishings and fixtures.

#### **1.14 Basis of payment**

- .1 **There shall be no payment for this Section as no actual Work is specified herein.**
- .2 All payment for the Work of the Contract shall be included, properly balanced, in other Sections in Appendix C – Pricing Form as agreed by the Owner prior to commencing the Work.

#### **1.15 Qualifications of Contractor**

- .1 The General Contractor for this Contract shall have the following experience:
  - .1 Substantially performed at least three (3) projects of similar and related scope in the past five (5) years. Similar and related project scope includes interior and exterior renovations of buildings similar in size and scope to project requirements, including medical or dental offices.



- .2 Acted in the role of General Contractor on two of the three referenced projects.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Contractor's use of site.
- .2 Connecting to existing services.
- .3 Site access.
- .4 Continuity of existing service.
- .5 Working hours.
- .6 Special scheduling requirements.

### **1.2 Related requirements**

- .1 Section 01 32 00 Construction Progress Documentation
- .2 Section 01 33 00 Submittal Procedures.
- .3 Section 01 50 00 Temporary Facilities and Controls.
- .4 Section 01 53 00 Temporary Construction.
- .5 Section 01 55 00 Vehicular Access and Parking.
- .6 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Contractor's use of site**

- .1 Accept full responsibility of assigned work and storage areas from the time of Contract award until completion of the Work.
- .2 Do not unreasonably encumber site with materials or equipment.
- .3 Use of site is limited to areas indicated on drawings.
- .4 Do not obstruct entrances, stairs or fire exits.
- .5 Do not prop open any doors.
- .6 Maintain free access route for emergency vehicles, waste disposal trucks and delivery vehicles.
- .7 Provide for all vehicular and pedestrian traffic.
- .8 Parking will be permitted on site. Refer to Section 01 55 00.

- .9 The placement of a refuse bin will be allowed in an area agreed by the Owner.
- .10 Repair all damage to paving, grass, walkways, curbs, trees, planting beds, and any other areas, caused by the Contractor's operations.

#### **1.4 Existing services**

- .1 Notify Owner and Consultant and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Consultant and Owner, minimum 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work.
- .3 Keep duration of interruptions minimum.
- .4 Perform interruptions after normal working hours of occupants, preferably on weekends.
- .5 Construct barriers in accordance with Section 01 53 00.

#### **1.5 Site access by Contractor**

- .1 Unless stated otherwise, the Contractor will be permitted reasonable access to the site from start of construction until Substantial Performance of the Contract.
- .2 After Substantial Performance of the Contract, the Contractor shall not enter the facility without prior written authorization from the Owner and the Contractor's activities shall be restricted to the work duly authorized by the Owner, including modifications and rectification of deficiencies. If the Contractor proposes to perform additional work other than the authorized work, further written approval must be obtained by the Contractor from the Owner prior to proceeding with such additional work.
- .3 Workers employed on the site shall sign a "Daily Register" provided showing "IN" and "OUT" times and number of hours worked on each shift. Times shall be recorded in 24-hour time (i.e. 00:00 to 23:59).
- .4 All Contractor's workers employed on site shall be orientated by the facility operator prior to start of work.

## **1.6 Continuity of existing service**

- .1 Operation of existing facility shall take precedence over Contractor's operations. Keep existing buildings in operation at all times.
- .2 Arrange Work so that services to the existing buildings will not be unduly interrupted at any time. The time duration for an interruption must be kept to a minimum and must be arranged with the Owner and facility operator.
- .3 Provide at least 48 hours' advanced notice for all required interruptions to utility, heating, cooling, mechanical, electrical and life safety systems.

## **1.7 Working hours**

- .1 Carry out Work between the hours of 7:00 a.m. and 5:00 p.m. local time, Monday through Friday except statutory holidays.
- .2 If the Contractor wishes to complete any work outside of these regular hours, obtain permission from the facility operator through the Owner at least 48 hours prior.
- .3 The Owner will not be responsible for additional costs associated with working after regular hours unless such after-hours work is ordered by the Owner and not specified as a requirement in the Contract Documents.
- .4 The Owner will not be responsible for additional costs associated with working after regular hours if such after-hours work is required for the Contractor to return to the agreed upon construction schedule.

## **1.8 Special requirements**

- .1 Perform painting at Owner-occupied areas:
  - .1 From Monday to Friday from 6:00 p.m. to 7:00 a.m. only.
- .2 Perform noise generating work:
  - .1 From Monday to Friday from 6:00 p.m. to 7:00 a.m.
- .3 Submit schedule of special requirements or disruptions in accordance with Section 01 33 00.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Cash allowances.

### **1.2 Cash allowances**

- .1 Consultant Responsibilities:
  - .1 Consult with Contractor for consideration and selection of Products, suppliers, and installers.
  - .2 Owner and Consultant to select Products.
  - .3 Prepare Change Order.
- .2 Contractor Responsibilities:
  - .1 Assist Consultant in selection of Products, suppliers and installers.
  - .2 Obtain proposals from suppliers and installers and offer recommendations.
  - .3 On notification of selection by Consultant or Owner, execute purchase agreement with designated supplier and installer.
  - .4 Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
  - .5 Promptly inspect Products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- .3 Supply-only cash allowances shall include:
  - .1 Net cost of products
  - .2 Delivery to Site
  - .3 Applicable taxes and duties, excluding HST
  - .4 Supply and install cash allowances shall include:
    - .5 Net cost of Products
    - .6 Delivery to Site
    - .7 Unloading, storing, handling or Products on Site
    - .8 Installation, finishing and commissioning of Products
    - .9 Applicable taxes and duties, excluding HST
  - .10 Inspection and testing allowances shall include:

- .11 Net cost of inspection and testing services
- .12 Applicable taxes and duties, excluding HST
- .4 Include cash allowances in the Contract Price. Differences in costs will be adjusted by Change Order.
- .5 Allowances Schedule:
  - .1 Include a cash allowance of \$180,000.00 for purchase, delivery, and installation of Office Furniture.
  - .2 Include a cash allowance of \$47,000.00 for purchase, delivery, and installation of Security Systems and Services.
  - .3 Include a cash allowance of \$5,000.00 for testing agencies not specified in the contract bid price.

### **1.3 Use of cash allowances**

- .1 Expenditures against cash allowance will be made only upon receipt of written authority from the Owner.
- .2 No expenditure against a cash allowance shall be made or incurred except as instructed by the Owner in writing.
- .3 Submit copies of all invoices for labour, materials and equipment to the Owner to substantiate charges against the allowances.
- .4 Any unused portion of cash allowances will be credited to the Region upon completion of the Work.
- .5 The cash allowances do not include Harmonized Sales Tax (HST)

### **2 Products – not used**

### **3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 This Section specifies scope of work for each Unit Price item listed in the Appendix – Unit Price Schedule.

### **1.2 Related requirements**

- .1 Section 03 30 00 Cast-in-place concrete
- .2 Section 31 23 10 Excavation, trenching and backfilling

### **1.3 Unit price items**

- .1 Excavation
  - .1 Unit price to include excavating by machine and hand, and disposal of surplus material as specified, including dewatering.
- .2 Granular Materials
  - .1 Unit price to include supply, grading and compaction of Granular A to OPSS.MUNI 314 and OPSS.MUNI 1010 and to Section 31 23 10.
  - .2 Unit price to include supply, grading and compaction of sand fill to OPSS.MUNI 314 and OPSS.MUNI 1010 and to Section 31 23 10.
- .3 Concrete
  - .1 Unit price to include supply, placing, curing and dressing of miscellaneous 25 MPa concrete to Section 03 30 00.

### **1.4 Measurement for payment**

- .1 Payment for excavation is based on the measured volume, in cubic metres, excavated within the limits of the excavation only, excluding any over-break or over-excavation.
- .2 Payment for granular material is based on the measured volume, in cubic metres, placed within the limits of the excavation only and not that placed to backfill over-break or over excavation.
- .3 Payment for concrete is based on the measured volume, in cubic metres, actually placed.



**1.5 Basis of payment**

- .1 The unit price for each item in Appendix - Schedule of Unit Prices shall be full compensation for all labour, equipment and materials for compliance with the scope of work specified for that unit price item.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Special procedures for progress payments on Region of Durham Tenders.

### **1.2 Related requirements**

- .1 Appendix B Supplementary Conditions to Stipulated Price Contract CCDC 2 - 2008
- .2 Section 01 33 00 Submittals
- .3 Construction Act

### **1.3 Construction Act Holdback**

- .1 In accordance with the Construction Act, a 10% holdback will be deducted from each progress payment.
- .2 The Owner shall have the right to withhold the 10% Construction Act regular and finishing holdbacks until the Owner is in receipt of the submissions specified in Section 01 33 00, Articles 3.1.1.3 (submissions at Substantial Performance) and 3.1.1.4 (submissions at Completion) as applicable.

### **1.4 Submission of Proper Invoices for payment**

- .1 In accordance with Appendix B – Supplementary Conditions, applications for payment shall be preceded by a payment review meeting to be held no less than five (5) calendar days before the end of the monthly payment period.
- .2 In accordance with Appendix B – Supplementary Conditions, email draft invoices to the Consultant and the Owner at least one (1) business day prior to the scheduled monthly payment review meeting.
- .3 At the payment review meeting, review with Owner and Consultant the Contractor's draft invoice, status of Change Orders and Change Directives, holdbacks and net amount due for that billing period.
- .4 Consultant and Owner will provide a marked-up copy of the Contractor's draft invoice within five (5) business days of the payment review meeting.
- .5 **Submit Proper Invoice by email to the Consultant and the Owner's Project Manager, Ms. Sandra Taylor and Contract Services**

**Coordinator, Ms. Kelly Vecchiarelli** for processing no earlier than seven (7) calendar days after the end of the billing period. **Do not mail a hardcopy.** Ensure Proper Invoice complies with all requirements detailed in Appendix B – Supplementary Conditions. Email title shall include **“URGENT – PROGRESS PAYMENT REQUEST for Contract T-1032-2021”** and be marked as High Priority.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 This Section includes administrative provisions for coordinating construction operations including, but not limited to, the following:
  - .1 General project coordination procedures
  - .2 Coordination of Drawings
  - .3 Administrative and supervisory personnel
- .2 Each Subcontractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to specific Subcontractors by Contractor.

### **1.2 Related requirements**

- .1 Section 01 31 14 Interference and Coordination Drawings
- .2 Section 01 32 00 Construction Progress Documentation
- .3 Section 01 33 00 Submittal Procedures
- .4 Section 01 45 00 Quality Control
- .5 Section 01 78 00 Closeout Submittals
- .6 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Administrative requirements**

- .1 General Coordination: Coordination that generally applies to all components of the Contract Documents as follows:
  - .1 Subcontractor shall coordinate construction activities as required with Contractor's Schedule to ensure efficient and orderly installation of each part of Work.
  - .1 Subcontractors shall notify Contractor where the Subcontractor's installation of one part of Work is dependent on installation of other components.
  - .2 Schedule and coordinate construction activities of other Subcontractors in sequence required to obtain best results. Where availability of space is limited, Subcontractor shall coordinate

installation of different components to assure maximum accessibility for required maintenance, service, and repair.

- .3 Subcontractors shall make adequate provisions to accommodate items scheduled for later installation by other Subcontractors, under separate contract or by Contractor's own forces.

#### **1.4 Quality assurance**

- .1 Designate an on-site party responsible for instructing workers and overseeing the environmental goals for the project.
- .2 Review environmental procedures and status of Waste Management Plan and Environmental Protection Plan at each construction meeting.

#### **1.5 Existing site conditions**

- .1 Existing construction shown has been taken from available information. When specific details are unavailable, assumptions have been made regarding probable construction. Any variance from construction, as shown on the Drawings shall be immediately brought to the attention to the Owner.
- .2 Make careful examination of the site and investigate and be satisfied as to all matters relating to the nature of the Work to be undertaken.
- .3 Check all site dimensions prior to fabrication of materials and construction.
- .4 Confirm the exact location of all outlets with the Owner prior to their installation.
- .5 Report any inconsistencies, discrepancies, omissions and errors between site conditions and Contract Documents to the Consultant prior to the commencement of Work. Ensure that each Subcontractor performing work related to the site conditions has examined it so that all are fully informed on all particulars which affect the Work thereon in order that construction proceeds competently and expeditiously.

#### **1.6 Coordination**

- .1 The Contractor shall cooperate with the Owner's representatives at the place of work in order to minimize disruptions to the building operation and services.

- .2 Coordinate with the Owner's representative regarding access and use of site.
- .3 Coordinate performance and sequencing of the Work with the Owner.

### **1.7 Owner access**

- .1 The building and parking areas, which are not immediately affected by the Work, will remain occupied by the Owner during the Work.
- .2 Ensure adequate access to areas not occupied for the Work.

### **1.8 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Provide interference and coordination drawings in accordance with Section 01 31 14.

### **1.9 Dimensions**

- .1 Do not scale directly from Drawings. Obtain clarification from the Consultant if there is ambiguity or lack of information.
- .2 Details and measurements of any Work which is to fit or to conform with Work installed shall be taken at the Place of the Work.
- .3 Verify dimensions at the Place of the Work before commencing Shop Drawings or other submittals. Before fabrication commences report discrepancies to the Consultant in writing. Incorporate accepted variances on Shop Drawings and as-built records.
- .4 In areas where equipment is scheduled to be installed, check dimensional data on equipment to ensure that the area and equipment, including future known equipment are compatible with necessary access and clearances provided. Equipment supplied shall be dimensionally suitable for space allocation.
- .5 Verify that the Work is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent Work, as set out in accordance with the requirements of the Contract Documents and ensure that Work installed in error is rectified at Contractor's expense before construction continues.

- .6 Owner will accept no claims for extra expense on the part of the Contractor for non-compliance.

#### **1.10 Supervision of the Work**

- .1 Provide all superintendence, labour, equipment, and materials necessary to complete the project in an orderly, competent, and expeditious manner.
- .2 While work is in progress, maintain site superintendence capable of acting competently on-site instructions given by the Owner.
- .3 Maintain good order and discipline among workers engaged on the project.

#### **1.11 Maintenance of documents on site**

- .1 Maintain at the job site, one copy of each of following:
  - .1 Drawings
  - .2 Specifications
  - .3 Addenda
  - .4 Change Orders and Change Directives
  - .5 Shop Drawings and samples
  - .6 Other modifications to the Contract
  - .7 Site instructions
  - .8 Copy of approved work schedule
  - .9 Copy of manufacturer's installation instructions
  - .10 SDS sheets
  - .11 Contractor's health and safety policy
  - .12 Ministry of Labour Notice of Project
  - .13 Building permit
- .2 Maintain documents in a clean, dry, legible condition and make documents available at all times for inspection by the Owner

#### **1.12 Security and protection of construction site and equipment**

- .1 Protect the construction site and equipment from damage. Repair any damage to the construction site or equipment to the satisfaction of the Owner.

- .2 Take precautions to protect the site and equipment until final completion.
- .3 The Owner shall not be responsible for damaged, lost or stolen materials and equipment. Contractor is responsible for all materials and equipment left on site until the work is complete. Provide for proper security or storage of any material or equipment left on site.
- .4 When not at the Place of the Work, ensure that the work area is secured, and that all tools and materials are locked up.

### **1.13 Existing utilities**

- .1 Protect all utilities at the Place of the Work for the duration of the work.
- .2 Maintain all existing services including power and data to the entire building and occupied areas of the suites used by the Region. Any and all shutdowns or disruptions in service are to be approved by the Owner or building Owner.
- .3 Have all utilities located and staked out and provide the Owner with all cable locations supplied by the utilities prior to commencing any excavation or demolition.
- .4 Contact the local municipality, utilities or any other agencies for further information regarding the exact location of all existing utilities, to exercise the necessary care in excavation and demolition operations, and to take such precautions necessary to safeguard the utilities from damage.
- .5 All utilities located within the limits of proposed excavations shall be exposed by hand excavation and carefully supported and protected by the Contractor.
- .6 Removal, relocation, or supporting of existing utilities shall be carried out in consultation with the respective authorities:
  - .1 Bell Canada
  - .2 Oshawa PUC/Veridian/Hydro One Connections
  - .3 Enbridge Gas
  - .4 Rogers Cable
  - .5 any other utility/contractor as required.
- .7 Be responsible for paying charges by the Utilities or Agencies for locating cables and the Contractor shall pay any charges for repairs and lost



revenue if utility equipment, cables, pipes or other assets are damaged and is responsible to make good any ground and surface damages as well.

- .8 Prior to the commencement of demolition, provide a sign-off sheet from the existing water, gas, electrical, telephone, and sewer service providers.
- .9 Verify that services are cut off, capped, diverted and/or removed as required by local regulating authorities. Ensure all services are in the proper state prior to commencing work.
- .10 Ensure all utilities are capped off at the property line and identify the termination locations on reference drawings.
- .11 No claims will be considered which are based on delays or inconvenience resulting from the removal or relocation of services not being completed before the start of this Contract.

#### **1.14 Contact for after-hours or emergency services**

- .1 When after-hours work is permitted by the Owner, provide an after-hours phone or pager number to respond to emergencies or requirements that arise when offices are closed.

#### **1.15 Identification and signs**

- .1 Construction personnel shall wear a legible numbered identification photo tag on their person at all times on which the name of the employer company is clearly identified.
- .2 Display no signs or advertisements without the Owner's approval. When signs are permitted, maintain signs in good condition during the Work and remove signs as directed by the Owner upon completion of the Work.

### **2 Products – not used**

### **3 Execution**

#### **3.1 Coordination**

- .1 Coordinate all construction operations to verify efficient and orderly installation of each part of Work.

- .2 Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation with Subcontractors as follows:
- .3 Scheduling construction operations in sequence required to obtain best results where installation of one part of Work depends on installation of other components, before or after its own installation.
- .4 Coordinating installation of different components with Subcontractors to verify maximum accessibility for required maintenance, service, and repair.
- .5 Making adequate provisions to accommodate items scheduled for later installation.
- .6 Prepare memoranda where necessary, for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings:
- .7 Prepare similar memoranda for Owner where coordination of Owner-installed Work is required.
- .8 Ensure all Subcontractors coordinate scheduling and timing of required administrative procedures with other construction activities, and activities of other contractors and Subcontractors, if any, to avoid conflicts and to verify orderly progress of Work.

### **3.2 General installation provisions**

- .1 Ensure that installer of each major component inspects both substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- .2 Comply with manufacturer's installation instructions and recommendations, to extent that those instructions and recommendations are more explicit or stringent than requirements contained in Quotation Documents.
- .3 Inspect Materials immediately upon delivery and again prior to installation. Reject damaged and defective items and arrange for replacement.

- .4 Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- .5 Supervise all Subcontractor work.
- .6 Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to Contractor for final decision.
- .7 Install each component during weather conditions and project status that will ensure best possible results. Isolate each part of completed construction from incompatible material as necessary to prevent deterioration.
- .8 Coordinate temporary enclosures with required inspections and tests, to minimize necessity of uncovering completed construction for that purpose.
- .9 Install individual components at standard mounting heights recognized within the industry for particular applications indicated where mounting heights are not indicated. Refer questionable mounting height decisions to Contractor for final decision.
- .10 Coordinate construction activities to ensure that no part of Work, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

### **3.3 Layout of Work**

- .1 Be responsible for laying out the work in compliance with the Drawings, Shop Drawings and schedules.
- .2 Rectify any and all errors resulting from failure to follow or verify Products, Drawings or the proper layout of any element of the installation.

### **3.4 Removal, replacement and relocation of existing items**

- .1 Remove and reinstall or permanently relocate all electrical fitments, outlets, telephone outlets, and mechanical equipment the interferes with construction and modify existing surfaces as indicated on Drawings. Provide new enclosures, as required.
- .2 Be responsible for the removal of loose furniture and reinstall unless directed otherwise by the Owner.

### **3.5 Protection of existing facility and personnel**

- .1 Do not endanger in any way the personnel, equipment, offices and existing structures of the Owner. Exercise caution to keep the existing facilities free from damage due to the Contractor's work. If the measures observed by the Contractor are not considered sufficient, the Owner may order additional precautions to be taken.
- .2 Take all necessary precautions to adequately protect the building and property from damage. Make good all damage at no extra cost.
- .3 Erect suitable safety barriers as required for security and to make the site safe for pedestrians.
- .4 Supply and erect temporary hoarding and barricades where required. Provide a temporary hoarding plan.
- .5 Remove the barriers from the site at the completion of the work or when directed by the Owner.
- .6 Adequately protect the Work at all stages and maintain the protection until the Work is completed. Remove and replace any work and materials damaged that cannot be satisfactorily repaired at no extra cost.
- .7 Secure construction area by erecting dust proof barriers, hoarding, as necessary to the approval of the Owner and the building Owner.
- .8 Arrange dust proof partitions in such manner as not to eliminate fire exit-egress ways and provide safety directional signage to Owner's and Authorities approval.
- .9 Protect existing ventilation systems and ductwork interiors from dust contamination from construction area by placing filter media over all duct openings, grilles, diffusers and replacing filters in air handling units upon completion of the work.
- .10 Motorized equipment shall be powered electrically or by battery only. Internal combustion powered equipment shall not be permitted within construction areas unless approved in writing by the Owner.
- .11 All materials shall have a low V.O.C. rating.

### **3.6 Restoration of disturbed areas**

- .1 Fill all holes left from mechanical and electrical services removed or relocated to maintain the required fire separations and to maintain the intended finished appearance of the surface.
- .2 Patch and make good all existing floor, wall and ceiling materials and finishes disturbed by construction work.

### **3.7 Restoration work for uncovered site hazards**

- .1 Make restorations to uncovered or disrupted Mechanical or Electrical services where such services pose a potential health or safety risk. Restorations shall be an extra to the contract only where such work could not have been reasonably foreseen by examination at the time of bidding at the sole opinion of the Owner.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Interference and coordination drawings and documents for effective coordination of mechanical and electrical work and with the work of other Sections, where applicable.

### **1.2 Related requirements**

- .1 Section 01 31 00 Project management and coordination

### **1.3 Requirements**

- .1 Coordinate sequencing of Work, placement of Products and arrangement of services of various Subcontractors and other contractors to assure the best arrangement of pipes, conduits, ducts, equipment, supports and other items in the available space.
- .2 Under no circumstances will any claim for extra cost be allowed due to the failure by the Contractor to coordinate Work.
- .3 Prepare interference and coordination drawings, showing the work of various Subcontractors and submit drawings to the Consultant for approval before commencing Work.
- .4 Take field dimensions relative to this Work.
- .5 Fabricate and erect work to suit field dimensions and field conditions
- .6 Provide all forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the Work and set in place or instruct the related Subcontractors as to their location.
- .7 Pay any extra costs caused by, and make up time lost resulting from, failure to furnish the necessary cooperation, information or items to be fixed-to or built-in, in adequate time.
- .8 Coordinate placement of equipment to ensure that components will be properly accommodated within spaces shown in the Contract Documents prior to commencement of Work.
- .9 In areas where equipment and services are exposed exercise care to organize and layout services in an organized and orderly manner.

- .10 Where possible services run services parallel or at right angles to one another as required.
- .11 Consultant may request that service layout be reconfigured to suit sightline concerns during the interference and coordination drawings review phase. Revise drawings accordingly at no additional cost to the Owner.

#### **1.4 Submittals**

- .1 Submit interference and coordination drawings for installation of mechanical and electrical Work, where applicable and all other applicable Divisions for efficient use of available space, for proper sequence of installation, and to resolve conflicts with the work of all Sections.

### **2 Products – not used**

### **3 Execution**

#### **3.1 Interference and coordination drawings**

- .1 On interference and coordination drawings, show the following minimum information to demonstrate understanding and coordination of Work of various Sections with the Work of:
  - .1 Mechanical (fire suppression, plumbing, HVAC, building automation)
  - .2 Electrical (power distribution and generation, lighting, fire alarm, communications, security & access controls, and facility protection)
  - .3 Piping: indicate sizes, locations and arrangements, including valves, indicating instruments, pumps and other accessories. Allow for thickness of insulation, as specified, for various types of piping.
  - .4 Ductwork: sizes, locations and arrangement including accessories such as dampers (fire, balancing and operating).
  - .5 Conduits: show surface-mounted and embedded conduit pipes, elbows, boxes and other accessories for power distribution, power generation, control wiring, fire alarm system, building controls system and other related systems.

- .6 Equipment:
  - .1 Hydronic specialties, boilers, water heaters, chillers, coolers, radiant panels, fan coil units, air handling units, fans, VAV terminal units, etc.
  - .2 Transformers, power distribution equipment, wiring devices, panelboards, lighting, equipment, fire alarm devices, etc.
- .7 Sleeves: show size and location of penetrations through loadbearing and non-loadbearing elements.
- .8 Inserts: Products or elements of assemblies to be cast into concrete and/or mortared into masonry elements.
- .2 Show cross sections in key areas, as required, and as defined by Consultant. Show re-bar, structural elements, piping, air handling and heating systems distribution, sprinkler system distribution, lighting, wall and ceiling assemblies, acoustical and seismic isolation, Products and systems involving life safety, conveying systems, electrical distribution.
- .3 Resolve areas of conflict or interference in a mutually agreed manner between affected Subcontractors and other contractors and resubmit interference and coordination drawings until such time as accepted by the Consultant.
- .4 Submit interference and coordination drawings electronically in PDF format and AutoCAD “.dwg” files compatible with AutoCAD Architecture 2018.
- .5 Submit interference and coordination drawings in uniform scale, with information assembled on separate layers within the electronic files to allow overlays to be assembled which show all components of various trades. Upon incorporation of details, Drawings shall be submitted jointly to the Consultant for review.
- .6 Ensure that accesses and clearances required by jurisdictional authorities and/or for easy maintenance of equipment are indicated and accommodated in layout of equipment and services.
- .7 Circulate interference and coordination drawings for review and mark-ups by Subcontractors responsible for work portrayed on the drawings.
- .8 Coordinate preparation and submission of interference and coordination drawings with Shop Drawings.



**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Pre-construction meeting
- .2 Regular progress meetings

### **1.2 Related Requirements**

- .1 Section 01 29 00 Payment procedures
- .2 Section 01 32 00 Construction progress documentation
- .3 Section 01 50 00 Temporary facilities and controls

### **1.3 Pre-construction meeting**

- .1 Owner will arrange for a pre-construction meeting. Owner's project team, the Consultant and a representative from the facility user department will participate in the meeting.
- .2 Coordinate and organize attendance at the pre-construction meeting by representatives of major Subcontractors and other parties in contract with the Contractor.
- .3 Owner will arrange attendance of other interested parties not responsible to the Contractor.
- .4 Agenda will include, but not be limited to, the following topics as are pertinent to the Contract:
  - .1 Introduction of key personnel participating in the project
  - .2 Project communications procedures
  - .3 Restrictions on working hours, access, movements on site, etc.
  - .4 Reviewing the approved project schedule
  - .5 Contract administration requirements including submittals, payment procedures, and Change Order procedures
  - .6 Identify any product availability problems and substitution requests and procedures
  - .7 Review Consultant's inspection requirements
  - .8 Schedule for project meetings
  - .9 Temporary services to be provided by the Contractor

- .10 Emergency contact numbers
- .11 Site-specific safety training
- .12 Site security requirements

#### **1.4 Progress meetings**

- .1 Consultant will schedule and administer bi-weekly project meetings throughout progress of Work.
- .2 Provide physical space and make arrangements for meetings.
- .3 Consultant will prepare agenda for meetings.
- .4 Agenda will include, but not be limited to, the following topics as are pertinent to the Contract.
  - .1 Review, approval of minutes of previous meeting.
  - .2 Construction safety
  - .3 Coordination
  - .4 Review of Work progress since previous meeting.
  - .5 Field observations, problems, conflicts.
  - .6 Problems which impede construction schedule.
  - .7 Review of off-site fabrication delivery schedules.
  - .8 Revision to construction schedule.
  - .9 Progress schedule, up to next scheduled meeting.
  - .10 Review submittal schedules: expedite as required.
  - .11 Maintenance of quality standards.
  - .12 Review proposed changes for effect on construction schedule and on completion date.
  - .13 Review site safety and security issues.
  - .14 Requests for information/clarification
  - .15 Contemplated changes
  - .16 Other business.
- .5 Inform the Consultant in advance of meetings regarding any other items the Contractor wishes to be added to be added to the agenda.

- .6 Ensure key project personnel attend regularly scheduled progress meetings to be held on site at times and dates that are mutually agreed to by the Region and Contractor.
- .7 Coordinate and organize attendance of individual Subcontractors and material suppliers when requested. Relationships and discussions between Subcontractor participants are not the responsibility of the Consultant and do not form part of the meetings content.
- .8 Ensure that Contractor representatives in attendance at meetings have required authority to commit Contractor to actions agreed upon. Assign same persons to attend such meetings throughout the contract period.
- .9 Consultant will preside at meetings.
- .10 Consultant will record minutes.
- .11 Consultant will reproduce and distribute copies of minutes within three (3) days after each meeting and transmit to meeting participants and affected parties not in attendance.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Schedules, form, content, submission.
- .2 Critical path scheduling.
- .3 Progress photographs.
- .4 Submittals schedule.

### **1.2 Related requirements**

- .1 Section 01 33 00 Submittal procedures.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 General requirements**

- .1 Be responsible for planning and scheduling of the Work.
- .2 Be responsible for ensuring that Subcontractors plan and schedule their respective portions of the Work within the overall project schedule.
- .3 Owner shall include suggested phasing drawings covering main components for the Contractor including any special provisions and any special time-sensitive provisions.

### **1.4 Schedules**

- .1 Submit schedules as follows:
  - .1 Submittal schedule for Shop Drawings and Product data.
  - .2 Submittal schedule for samples.
  - .3 Submittal schedule for timeliness of Owner-furnished Products, where applicable.
  - .4 Product delivery schedule.
  - .5 Cash allowance schedule for acquiring Products only or Products and installation, or installation only.
  - .6 Shutdown or closure activity.

- .2 Schedule format
  - .1 Prepare schedule in form of a horizontal Gantt bar chart.
  - .2 Provide a separate bar for each major operation and item of work.
  - .3 Split horizontally for projected and actual performance.
  - .4 Provide horizontal time scale identifying first Working Day of each week.
- .3 Schedule submission
  - .1 Submit initial format of schedules within 15 days of receipt of Order to Commence Work.
  - .2 Submit one opaque reproduction, plus two copies to be retained by Consultant.
- .4 Consultant will review schedule and return review copy within 5 days after receipt.
- .5 Resubmit finalized schedule within 7 days after return of review copy.
- .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.
- .8 Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.

## **1.5 Construction progress scheduling**

- .1 Submit initial schedule, in duplicate, within 15 days after date receipt of Order to Commence Work.
- .2 Revise and resubmit as required.
- .3 Submit revised schedules with each application for payment, identifying changes since previous version.
- .4 Schedule Format
  - .1 Prepare schedules in form of a horizontal Gantt bar chart, and provide in PDF format.

- .2 Provide a separate bar for each major operation and item of work.
- .3 Split horizontally for projected and actual performance.
- .4 Provide horizontal time scale identifying first Working Day of each week.
- .5 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- .6 Indicate estimated percentage of completion for each item of Work at each submission.
- .7 Indicate submittal dates required for Shop Drawings, Product data, samples, and Product delivery dates, including those furnished by Owner and required by allowances.
- .8 Indicate projected percentage of completion of each item as of first day of month.
- .9 Indicate progress of each activity to date of submission schedule.
- .10 Indicate 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.
- .11 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.

## **1.6 Critical path scheduling**

- .1 Include complete sequence of construction activities.
- .2 Show projected percentage of completion of each item as of first day of month.
- .3 Indicate progress of each activity to date of submission schedule.

- .4 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.
- .5 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 Progress photographs**

- .1 Digital photography:
  - .1 Submit electronic copy of colour digital photography in \*.jpg format, minimum 6 Megapixel resolution.
  - .2 Identification: Name and number of project and date of exposure indicated.
- .2 Submit digital photographs on a CD, DVD, USB flash drive or other Owner-approved storage media or transfer method.
- .3 Number of viewpoints: Locations of viewpoints determined by Consultant.
- .4 Frequency: Submit monthly with progress statement.

### **1.8 Submittals schedule**

- .1 Include schedule for submitting Shop Drawings, Product data, and samples.
- .2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.
- .3 Allow 5 Working Days for Consultant's review of each submission.

## **2 Products – not used**



### **3 Execution**

#### **3.1 Submission**

- .1 Submit construction schedule in the form of a Gantt chart clearly identifying the critical path and all project milestones.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Shop Drawings and Product data.
- .2 Samples.
- .3 Certificates and transcripts.

### **1.2 Related requirements**

- .1 Section 01 32 00 Construction Progress Documentation.
- .2 Section 01 78 00 Closeout Submittals.
- .3 Other sections requesting submittals.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Administrative requirements**

- .1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to avoid delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be permitted.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present Shop Drawings, Product data, samples and mock-ups in <SI (metric) units.
- .4 Where items or information is not manufactured or produced in SI metric units, converted values within the metric measurement tolerances are acceptable.
- .5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents.

- .6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
- .7 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .11 Keep one reviewed copy of each submission on site.

#### **1.4 Shop Drawings, Product data and engineered submissions**

- .1 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 Drawings and Specifications.
- .2 Shop Drawings shall carefully consider architectural intent and shall be coordinated to ensure items to be exposed in finished work are located to provide best aesthetics as directed or required by the Consultant. Show orientation and relationships between materials where deemed necessary by the Consultant.
- .3 Allow five (5) Working Days for Consultant's review of each submission.
- .4 Adjustments made on Shop Drawings by the Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior, and obtain Consultant's approval prior to proceeding with Work.
- .5 Make changes in Shop Drawings as the Consultant may require, consistent with Contract Documents. When resubmitting, notify the Consultant in writing of any revisions other than those requested.

- .6 Accompany submissions with transmittal letter, containing:
  - .1 Date
  - .2 Make
  - .3 Company
  - .4 Region's project title and tender number.
  - .5 Contractor's name and address.
  - .6 Identification and quantity of each Shop Drawing, Product data and sample.
  - .7 Other pertinent data
  - .8 Submissions shall include:
    - .9 Date and revision dates.
    - .10 Region's project title and tender number.
    - .11 Name and address of:
      - .1 Subcontractor.
      - .2 Supplier.
      - .3 Manufacturer.
- .7 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .8 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.

- .9 After Consultant's review, distribute copies.
- .10 Submit six (6) copies of Shop Drawings for each requirement requested in specification Sections and as Consultant may reasonably request.
- .11 Submit six (6) copies 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.
- .12 Delete information not applicable to project.
- .13 Supplement standard information to provide details applicable to project.
- .14 If upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, two (2) copies will be stamped "reviewed" or "reviewed as modified" and returned and fabrication and installation of Work may proceed. If Shop Drawings are returned stamped "not reviewed", noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .15 The review of Shop Drawings by the Consultant is for sole purpose of ascertaining conformance with general design concept. 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 his responsibility for meeting all requirements of the Contract Documents. The 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 all sub-trades.
- .16 Whenever there's a requirement for the Contractor to submit drawings with the seal of a Professional Engineer, such submissions shall be with the timelines of the project.

## **1.5 Samples**

- .1 When requested by the Consultant, provide samples within 7 working days of such request.

- .2 Submit for review samples as requested in respective Specification Sections. Label samples with origin and intended use.
- .3 Deliver samples prepaid to the Consultant's business address.
- .4 Notify the Consultant in writing, at time of submission, of deviations in samples from requirements of Contract Documents.
- .5 Where colour, pattern or texture is criterion, submit full range of samples.
- .6 Adjustments made on samples by the Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant, and obtain the Consultant's approval prior to proceeding with Work.
- .7 Make changes in samples which Consultant may require, consistent with Contract Documents.
- .8 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

## **2 Products – not used**

## **3 Execution**

### **3.1 Submissions**

- .1 Upon notification of award of this project, submit the following to the Owner:
  - .1 Prior to Commencing Work
    - .1 Performance and Labour and Materials Payment Bonds Insurance.
    - .2 Certificate(s) of Insurance. Use the Owner's Certificate of Insurance form.
    - .3 Clearance Certificate from Workplace Safety & Insurance Board (WSIB)
    - .4 Permits (if required)
    - .5 Workmen Trade Certificates (on request)
    - .6 Construction Schedule and Shop Drawing schedule

- .7 Notice of Project
- .2 During Construction
  - .1 Progress Reports
  - .2 Update of any Insurance Certificates about to expire
  - .3 Current valid WSIB Clearance Certificate
  - .4 Shop Drawings, Product data and samples
  - .5 Minutes of Meetings
  - .6 Inspection Reports
  - .7 Change Orders and Change Directives
  - .8 Requests for Information (RFI)
  - .9 Updated construction drawings
  - .10 Updated construction schedule
- .3 At Substantial Performance, provide originals of:
  - .1 Statutory Declaration
  - .2 Occupancy Permit
  - .3 Substantial Performance Release of Claims Letter
  - .4 Update of any Insurance Certificates about to expire
  - .5 Current Valid WSIB Clearance Certificate
  - .6 Extended Warranties, if applicable
  - .7 Closeout Submittals. Refer to Section 01 78 00.
- .4 At Completion
  - .1 Update of any Insurance Certificates about to Expire
  - .2 Current Valid WSIB Clearance Certificates
  - .3 Completion Release of Claims Letter
  - .4 Region of Durham Standard Form for Property Owner's Release of and used by the Contractor
- .5 At end of Warranty Period
  - .1 Final Release of Claims Letter

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Health and safety administrative requirements for contractors performing work for the Region of Durham.

### **1.2 References**

- .1 Province of Ontario website
  - .1 Construction site health and safety during COVID-19
    - .1 <https://www.ontario.ca/page/construction-site-health-and-safety-during-covid-19>
    - .2 Resources to prevent COVID-19 in the workplace
      - .1 [Prevent Covid-19 at the workplace](#)
  - .2 Canadian Construction Association
    - .1 [COVID-19 - Standardized Protocols for All Canadian Construction Sites](#)

### **1.3 Health and safety policy**

- .1 Obtain copies of all Subcontractors' Health and Safety Policies and Programs prior to such Subcontractor commencing work on the site if and when requested.
- .2 Provide a copy of Contractor's current Health and Safety Policies and Program, to implement that policy prior to the commencement of construction.

### **1.4 Health and safety legislation and requirements**

- .1 Comply with all Federal and Provincial laws relating to Health and Safety including Acts and Regulations as well as Lower Tier Municipality By-Laws.
- .2 Comply with all applicable industry safety standards.
- .3 Comply with 213/91 (Construction Projects) made under the Occupational Health and Safety Act (OHSA) and all amendments thereto. Copies of the Regulations may be obtained from the Ministry of Labour at their



Scarborough office, Publications Ontario at 880 Bay Street, Toronto, Ontario M7A 1N8 (Tel. 416-326-5300).

- .4 Comply with legislative requirements for work performed including, but not limited to, qualifications of workers, training, supervision and use of onsite equipment.
- .5 Provide any and all personal protective equipment for Contractor's own workers where prescribed by legislation.

### 1.5 COVID-19 Health and Safety

- .1 Ensure that all workers comply with the Government of Ontario's guidelines for [Construction Site Health and Safety During COVID-19](#) including but not limited to:
  - .1 washing hands often with soap and water or alcohol-based hand sanitizer
  - .2 sneeze and cough into sleeve
  - .3 avoid touching eyes, nose or mouth
  - .4 avoid contact with people who are sick
  - .5 stay home if you are sick
  - .6 avoid close contact with other people. Close contact includes being within two (2) metres of another person.
- .2 The Contractor shall monitor the latest recommendations from public health officials related to protecting workers from COVID-19 and adjust work procedures and provide personal protective equipment as per those recommendations.
- .3 **All workers attending the Place of the Work shall complete an online COVID-19 pre-screening checklist each day prior to arriving on site. The online pre-screening checklist can be accessed using the following link:**  
[Region of Durham Wellness Screening](#)
- .4 The Contractor is encouraged to follow the latest edition of the Canadian Construction Association's document "[COVID-19 - Standardized Protocols for All Canadian Construction Sites.](#)"

## 1.6 Safety data sheets (SDS)

- .1 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.
- .2 Maintain copies of current SDS at the Place of the Work at a location accessible to all workers, the Consultant, the Owner and the building operators.

## 1.7 List of designated substances at the site

- .1 In accordance with the requirements of Section 30(1) of the Occupational Health and Safety Act, the Contractor is hereby advised that the designated substances as listed hereunder are or may be present on the site and within the limits of this Contract:

Designated Substance	Identified on this Site?	Location
Acrylonitrile	No	N/A
Arsenic	No	N/A
Asbestos	Yes	100 linear feet of presumed asbestos-cement (Transite™).
Benzene	No	N/A
Coke Oven Emissions	No	N/A
Ethylene Oxide	No	N/A
Isocyanate	No	N/A
Lead	Yes	Suspected within solder in domestic water pipes & Lead acid batteries of emergency lighting.

<b>Designated Substance</b>	<b>Identified on this Site?</b>	<b>Location</b>
Mercury	Yes	Suspected in small amounts within fluorescent light tubes. through the site.
Mould	No	Water damage could be an indication of concealed mould growth behind drywall surfaces
Silica	Yes	Likely present in the concrete & mortars at the site.
Vinyl Chloride	No	N/A

- .2 Comply with the governing Ministry of Labour regulations respecting protection of workers, removal, handling and disposition of any Designated Substances encountered in carrying out the Work proposed on this contract.
- .3 Prior to commencement of this work, provide written notification to the Ministry of the Environment, Conservation and Parks at their York-Durham District Office, 230 Westney Rd. S., 5th floor, Ajax, Ontario L1S 7J5, of the location(s) proposed for disposal of Designated Substances. Provide a copy of the notification to the Consultant a minimum of two weeks in advance of such work starting.
- .4 If the Ministry has concerns with any proposed disposal location, provide further notification until the Ministry's concerns have been addressed.
- .5 Should a Designated Substance not herein identified be encountered, immediately notify the Consultant and the Owner of the Contractor's findings. Management of such substance shall be treated as extra work.
- .6 A Designated Substance Survey or Asbestos Survey is provided with the Contract Documents. Review the report for specific designated substances and locations.

## **1.8 Health and safety warnings**

- .1 The Consultant and the Owner shall have the right to document all Contractors for all health and safety warnings and/or to stop any Contractor's work if the Contractor fails to comply with any requirements under this Section.
- .2 Similarly, the Consultant and the Owner shall have the right to issue warnings and/or to stop work for any Contractor violations of the contract including Regional health and safety policy and programs and/or if the Contractor creates a health or safety hazard.
- .3 Written warnings and/or stop work orders shall be given to the Contractor using the Owner's Contractor Health and Safety Warning / Stop Work Order Form.
- .4 If the Contractor fails to adequately respond to the Consultant's or the Owner's order to correct a hazard, the Owner reserves the right to have the hazard corrected by a third party at the Contractor's expense. The Consultant's or the Owner's decision, as the case may be, as to the urgency for such correction shall be final.

## **1.9 Notice of project**

- .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".

## **1.10 Confined space**

- .1 Persons intended to work in confined spaces, as defined by the Owner, must have formal training in performing work in confined spaces.
- .2 Provide proof of valid certificates of such training for all workers prior to entry of such workers into confined spaces.
- .3 Provide all necessary safety equipment for entry into confined spaces.

- .4 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.
- .5 Supply the necessary tools and equipment for workers 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.

#### **1.11 Fire safety requirements**

- .1 Protect persons and properties.
- .2 Maintain operable fire protection equipment.
- .3 Maintain fire fighters' access.
- .4 Provide temporary fire extinguishing equipment.
- .5 Maintain existing and temporary fire exit.
- .6 Where the work requires the Contractor to shut down fire and life safety systems, provide a fire watch for the duration of the shutdown.
- .7 In occupied buildings, schedule the use of flame, such as torches and volatile substances well in advance with the approval of the Owner and the Consultant.
- .8 Maintain a fire watch after all welding operations for a period of not less than seven (7) hours.

## **2 Products – not used**

### **3 Execution**

#### **3.1 Pre-start health and safety**

- .1 Obtain and provide a Pre-Start Health and Safety Review (PSR) report and submit a copy of the report to the Consultant.
- .2 Ensure the Products ordered are compliant with the approved PSR Report.
- .3 The PSR report shall be signed by a Professional Engineer licensed to practice engineering in the Province of Ontario.
- .4 Pay all costs associated with the preparation and completion of the PSR.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Laws, notices, permits and fees.
- .2 Discovery of hazardous materials.
- .3 Codes and standards.
- .4 Regulations.
- .5 Permits.

### **1.2 Related requirements**

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Laws, notices, permits and fees**

- .1 The laws of the Place of the Work shall govern the Work.
- .2 The Owner will obtain and pay for the building permit, permanent easements and rights of servitude.
- .3 The Contractor shall be responsible for obtaining all permits, licenses and certificates necessary for the performance of the Work which were in force at the date of executing the Agreement.
- .4 Provide the required notices and comply with the laws, ordinances, rules, regulations or codes which are or become in force during the performance of the Work and which relate to the Work, to the preservation of the public health and to construction safety.
- .5 Construction of the Work is subject to the approval, inspection, by-laws, and regulations of municipal, provincial and federal authorities and organizations concerned with roads, streets, railways, telephones, electrical supplies, gas supplies and other public services having jurisdiction in respect to any matter in the Contract.

- .6 If the Contractor knowingly performs or allows work to be performed that is contrary to any laws, ordinances, rules, regulations or codes, the Contractor shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations or codes.
- .7 Determine detailed requirements of authorities having jurisdiction.
- .8 Pay all fees associated with applications, permits and inspections required by authorities having jurisdiction.
- .9 Pay construction damage deposits levied by municipality in connection with the issuance of a building permit.
- .10 Keep a copy of all permits on site.

#### **1.4 Hazardous material discovery**

- .1 Asbestos: If material resembling asbestos is encountered which has not been identified in the Contract Documents, immediately stop work and notify the Consultant.

#### **1.5 Codes and standards**

- .1 Perform the Work in accordance with the requirements of the latest editions of the following statutes and codes in force at the time of the Agreement:
  - .1 Ontario Building Code
  - .2 Municipal building and fire codes and by-laws
  - .3 Electrical Safety Authority
  - .4 Ontario Electrical Safety Code
  - .5 National Fire Protection Association
  - .6 National Building Code
  - .7 Ontario Occupational Health and Safety Act
  - .8 Ontario Fire Code
  - .9 Ontario Hydro
  - .10 WHIMS



- .11 Canadian Gas Association CSA/CGA B149.1-10 Natural Gas and Propane Installation Code
- .12 Code book B139 for gas installations as per TSSA requirements.
- .13 Royal College of Dental Surgeons of Ontario
- .14 Infection Prevention and Control Canada (IPAC)
- .2 Comply with any applicable revisions to codes and regulations after the date of the agreement. Costs of such revisions shall be compensated for through a Change Order.
- .3 Complete all required electrical connections and provide Electrical Safety Authority (ESA) approval on such work.
- .4 Be responsible for all variances and submit application to Technical Standards & Safety Authority (TSSA).
- .5 Revise the installation and engineered drawings at no additional cost to the Owner until they meet the requirements and approval of the TSSA, the ESA and City of Oshawa Fire Department. Provide copies of all authority sign-offs.
- .6 Conform to the requirements of the Ontario Ministry of Labour, Training and Skills Development, the Occupational Health and Safety Act, regarding Lead on Construction Projects with respect to the installation of lead sheeting specified in Section 09 21 16.
- .7 Review Contract Drawings and specifications for any conflicts with the above regulations and where there are apparent discrepancies, notify the Owner in writing and obtain clarification before proceeding with the Work.

## **1.6 Precedence of standards**

- .1 Where applicable, ensure that all materials and equipment conform to the applicable standards listed.
- .2 Canadian standards take precedence over American standards in the case of duplication or conflict.

## **2 Products**

### **2.1 Equipment**

- .1 Provide electronically powered equipment, components, and supplies that are CSA and ULC approved.

## **3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Written and electronic reports.
- .5 Equipment and system adjust and balance.

### **1.2 Related requirements**

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Reference standards**

- .1 ISO/IEC 17025-2005 - General Requirements for the Competence of Testing and Calibration Laboratories.
- .2 SCC (Standards Council of Canada).

### **1.4 Review by Consultant**

- .1 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.
- .2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.
- .3 If such Work is found in accordance with Contract Documents, Owner will pay cost of review and replacement.

### **1.5 Quality of Products and materials**

- .1 All materials, fixtures, fittings, appliances and apparatus supplied and installed by the Contractor shall be new, the best of their kind for the application and free from any defects.

## **1.6 Quality control inspection and testing**

- .1 At reasonable times, and giving reasonable notice of at least 24 hours, the Owner may inspect the work site and/or those areas of the Contractor's place of business that are related to the performance of a contract. If the Owner requires an inspection, the Contractor must provide reasonable assistance and arrangements for the inspection to take place.
- .2 Where required by the Consultant, the Contractor shall supply certified copies of all tests upon, all materials to be used in the construction of the works, indicating that materials comply with the Specifications. Such tests shall be made by a testing company which has been approved by the Consultant and shall be at the Contractor's expense.
- .3 Any and all materials or manufactured products, including pipe, may be tested by the Owner. The Contractor shall, at his own expense, supply samples for quality assurance (QA) testing as directed of any and all materials or manufactured products which he is using or proposes to use in the work, and he shall not be entitled to any extra remuneration nor any extension of the time allowed to complete the work, as a result of any delays which may be caused or occasioned as a result of compliance with these Specifications
- .4 Materials whose test specimens fail to meet specified requirements and those materials which are rejected upon inspection shall not be permitted to remain on the site of the work and shall be immediately removed there from by the Contractor at his own expense.
- .5 In addition to the above items, the Contractor shall arrange and pay for the following:
  - .1 Inspection and testing required by law, ordinances, rules, regulations or Authorities having jurisdiction
  - .2 Inspection and testing performed exclusively for the Contractor's convenience
  - .3 Testing, adjustment and balancing of mechanical and electrical equipment and systems.
  - .4 Vibration monitoring
  - .5 Tests specified to be carried out by the Contractor under the supervision of the Consultant

- .6 The cost of all specified testing of piping systems, tanks, etc. shall be included in the cost in the Contract

### **1.7 Receipt and acceptance of materials**

- .1 During the process of unloading any material, etc., it shall be inspected by the Contractor in the presence of the Consultant, for loss or damage in transit. The Contractor shall notify the agent of the carrier of any loss or damage to the shipment.
- .2 All materials supplied by the Contractor and found faulty or defective upon delivery will be rejected by the Consultant and shall be replaced by the Contractor at his own expense, but failure to discover same shall not relieve the Contractor of responsibility for removing all faulty materials supplied by him and replacing same with good materials which he shall supply all at his own cost and expense. The unloading of all equipment shall be carefully done in an approved manner to avoid injury thereto. Ample facilities shall be provided by the Contractor for handling the equipment.

### **1.8 Metric vs. Imperial equipment**

- .1 Notwithstanding the requirements set out in the preceding paragraphs, because not all trades have adopted metric material or in cases of adapting to existing, where metric and Imperial types of equipment are to be installed under the same contract, the Contractor shall ensure that mating of metric and non-metric equipment is possible.
- .2 Supply shop drawings of proposed transition couplings, etc., to the Consultant prior to assembly. The supply and installation of such couplings, adapters, etc., shall be at no additional cost to the Owner.

### **1.9 Quality assurance testing by the Owner**

- .1 The Owner may request any required samples at any reasonable time.
- .2 The Owner will perform quality assurance testing using its own forces which are CSA certified. Alternatively, the Owner may appoint a CSA-certified agency to conduct QA testing on its behalf. quality assurance testing will be at a frequency determined by the Owner.

- .3 The costs of all quality assurance testing, except as noted otherwise, shall be borne by the Owner.
- .4 The Contractor may request that the Owner's, or his agent's, quality assurance equipment be tested for CSA compliance. All costs for such tests shall be at the Contractor's expense where such equipment is found to be in compliance.
- .5 The Contractor shall provide clear access to work areas to be inspected and assist as required by providing safety equipment, ladders, materials, etc., for these inspections, including but not necessarily limited to, welding x-ray inspections, concrete testing, painting inspections and compaction tests.
- .6 Additional testing required to prove the adequacy of construction shall be at the Contractor's expense, where the routine test shows the construction to be inadequate, or where the Contractor's materials and procedures have not been as specified, or when work has proceeded without approval or inspection.
- .7 Where the Owner's quality assurance testing differs from the Contractor's quality control results, the Owner's results shall govern and all additional quality assurance testing shall be billed to the Contractor at a rate of not less than \$250 per re-test except where such re-tests are carried out by the Owner's agency in which case such re-tests shall be billed at a rate of 110% of the invoiced amount.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 The work under this Section includes, but is not limited to, provision of:
  - .1 Access to the site and the work.
  - .2 Temporary facilities building enclosures, storage areas, shelters and sanitary facilities.
  - .3 Temporary controls, including fire protection, first aid, security, traffic control.

### **1.2 Related requirements**

- .1 Section 01 51 00 Temporary Utilities.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 31.

## **2 Products – not used**

## **3 Execution**

### **3.1 General**

- .1 Any disruption of facility operations must be accommodated by temporary facilities to the satisfaction of the Consultant.
- .2 All schedules must indicate contingency and alternate date and times in the event of postponement for any reason, or breakdown of temporary bypass equipment during the shutdown.
- .3 Comply with local Police, Fire Department and EMS requirements regarding notification of all interested parties concerning the construction work and provisions for traffic movement.

### **3.2 Storage of material and equipment**

- .1 Storage areas are defined on the Drawings, or as designated by the Consultant. Store materials to ensure the preservation of their quality and fitness for the work. Store materials on wooden platforms or other hard, clean surfaces off the ground or in a watertight storage shed of sufficient

- size for the storage of materials that might be damaged by storage in the open. Provide the shed with a wood floor raised a minimum of 150 mm clear of the ground.
- .2 Store materials to ensure the preservation of their quality and fitness for the work. Store materials on wooden platforms or other hard, clean surface off the ground. Locate stored materials to facilitate prompt inspection.
  - .3 Provide weathertight heated storage sheds with raised floors for the storage of equipment, as required by the Consultant and/or equipment manufacturers. Supply to the Consultant all storage instructions from equipment suppliers well in advance of the scheduled delivery dates.
  - .4 Handle and store products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions.
  - .5 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 the work.
  - .6 Store products subject to damage from weather in weatherproof enclosures.
  - .7 Store cementitious products clear of earth or concrete floors, and away from walls.
  - .8 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.
  - .9 Store sheet materials, lumber, etc. on flat, solid supports and keep clear of ground. Slope to shed moisture.
  - .10 Store and mix paints in a heated and ventilated room. Remove oily rags and other combustible debris from the site daily. Take every precaution necessary to prevent spontaneous combustion.
  - .11 Remove and replace damaged products to the satisfaction of the Consultant.



- .12 Do not use private property for storage purposes without the written permission of the property owner. Pay rental charges and damages associated with occupying private lands.

### **3.3 Location of temporary facilities**

- .1 Coordinate the location of temporary facilities with the facility operators subject to the satisfaction of the Consultant.

### **3.4 Installation and removal of temporary facilities**

- .1 Provide temporary utilities, facilities and controls to execute the work expeditiously.
- .2 Remove temporary utilities, facilities and controls at the conclusion of Contract, unless otherwise directed by Consultant.
- .3 Site to be left in tidy and clean condition after removal of temporary facilities.

### **3.5 Temporary building enclosures**

- .1 Provide temporary weathertight enclosures and protection for exterior openings until permanent sash and glazing, exterior doors, louvers, etc., are installed.
- .2 Provide temporary enclosures for the work as required for weather protection and heating purposes.
- .3 Erect enclosures to allow accessibility for installation of materials and working inside the enclosure.
- .4 Keep temporary buildings in a clean and sanitary condition at all times and do not permit to become a health hazard or a nuisance to adjoining properties.

### **3.6 Temporary fire protection**

- .1 During the entire construction period provide fire extinguishers in each construction shed and, as well as in other locations reasonably required, and all other fire protection necessary to protect the project and to comply fully with the requirements of insurance underwriters for the project and local, provincial and federal authorities.

### **3.7 Temporary first aid facilities**

- .1 Provide and maintain the necessary first aid items and equipment as required.
- .2 Designate employees who are properly instructed to be in charge of first aid. Ensure that at least one such employee is always available on the site while work is being conducted.

### **3.8 Security**

- .1 Be responsible for the security of construction site materials, tools, equipment, temporary facilities and storage and all construction.

### **3.9 Removal and restoration of temporary facilities and controls**

- .1 Remove temporary facilities and controls from the site on completion of the works, or as otherwise ordered in writing by the Consultant. Unless specifically stated otherwise in the Contract Documents, maintain ownership over the temporary facilities including furnishings.
- .2 As each portion of the work is completed, as determined by the Consultant, restore disturbed areas, roadways, fences, building, etc. equal to or better than the initial condition and clean up the construction area as instructed by the Consultant.
- .3 Leave clean and in good order, roads, parking areas, walks, grassed areas and other areas disturbed by the construction and Contractor's activities. Failure to make satisfactory progress in the execution of this work within forty-eight (48) hours of receipt of written notice from the Consultant may result in the Consultant having the surplus material removed or re-grading any area or performing any work necessary to leave the site in a satisfactory condition and having the costs deducted from payments due under the Contract.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Temporary utilities.
- .2 Salvaging products for reuse.

### **1.2 Related requirements**

- .1 Section 01 52 00 Construction facilities.
- .2 Section 01 53 00 Temporary construction.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Temporary utilities**

- .1 Make arrangements for the supply of water, electrical power, gas, sanitary facilities, heat, and any other temporary services required during construction.
- .2 Be responsible for all fees, permits and charges, including arrangements for all necessary applications, incurred throughout the construction period until the date of Substantial Performance.
- .3 Provide power generators as required to maintain construction activities and all temporary facilities, if temporary electrical power supply is delayed or unavailable from the local authority at no extra cost to the Owner.
- .4 Permanent utilities installed as part of the Work may be used for construction requirements provided that no warranties or guarantees are affected thereby. Make good any damage.
- .5 Operate equipment according to the requirements of the Ontario Ministry of Labour under the Occupational Health and Safety Act and Regulations for Construction Projects.
- .6 Arrange, pay for and maintain temporary electrical power supply until Substantial Performance as follows:
  - .1 Temporary facilities for power, where required outside the plant, such as pole lines and underground cables with the approval of the local utility company.

- .2 Connection to the existing power supply system in accordance with the Ontario Electrical Safety Code. Provide meters and switchgear as required by the utility company and the Consultant.

#### **1.4 Installation and removal**

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Salvage and assist in recycling products for potential reuse.
- .3 Remove from site all such work after use.

#### **1.5 Dewatering**

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

#### **1.6 Water supply**

- .1 Owner will provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.
- .3 Owner will pay for utility charges at prevailing rates.

#### **1.7 Temporary heating and ventilation**

- .1 Provide all temporary heat and ventilation used during the course of construction and include all costs of installation, fuel, operation, maintenance and removal of equipment.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .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 Ventilating:
  - .1 Prevent accumulation of dust, fumes, mist, 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.
- .5 Maintain strict supervision of operation of temporary heating and ventilating equipment, to:
  - .1 Conform with 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 the outside.
- .6 Maintain temperatures of minimum 10 °C in areas where construction is in progress.
- .7 Ensure date of Substantial Performance of the Work and warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.
- .8 Owner will pay utility charges when temporary heat source is existing building equipment.
- .9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

## **1.8 Temporary power and light**

- .1 Arrange, pay for and maintain temporary electrical power supply until Substantial Performance as follows:
  - .1 Provide temporary facilities for power, where required outside the facility, such as pole lines and underground cables with the approval of the local utility company.
  - .2 Connect to the existing power supply system in accordance with the Ontario Electrical Safety Code.
  - .3 Provide meters and switchgear as required by the utility company and the Consultant.
- .2 Provide and maintain temporary lighting throughout project.
- .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. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.
- .4 Existing electrical service may be used as a temporary service for lighting and the operation of electrical tools and motors during construction to the extent that there is sufficient capacity. Where capacity of existing service is insufficient, provide a temporary electrical service.
- .5 Arrange with the Owner for use of existing services prior to use and avoid overloading of circuits. Prior approval from the Owner is required.
- .6 The Owner will pay for the cost of the power supply for the existing service only. Where existing service is not sufficient, provide for additional service at Contractor's expense.
- .7 Where existing lighting fixtures and conduits require removal to complete the Work, provide temporary lighting service. Re-install original lighting upon completion of the Work.

## **1.9 Temporary water supply**

- .1 Existing water service may be used as a temporary water supply for construction.

- .2 Arrange with the Owner for use of existing services. Prior approval from the Owner is required.
- .3 The Owner will pay for the cost of the water supply for the existing service only. Where existing service is not sufficient, provide for additional service at Contractor's expense.
- .4 Supply all hoses and water containers.
- .5 Provide proper shut off valve and backflow preventer on all temporary connections between each existing and temporary service.
- .6 Use of hydrants or fire hoses is not permitted without written consent from the Owner.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Construction aids.

### **1.2 Related requirements**

- .1 Section 01 50 00 Temporary Facilities and Controls.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **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 Temporary works**

- .1 The contractor shall design, provide, erect, maintain remove and assume full and sole responsibility for all temporary works required for the safe and complete execution of the works.
- .2 In the execution of the temporary works and for the duration of the contract, the contractor shall make adequate provision for all likely construction loading and provide sufficient bracing and props to keep the works in plumb and alignment and free from excessive deflection.
- .3 Access of heavy construction equipment and accumulation of construction materials on the floors are not permitted unless such have been catered for in the contractor's temporary work design to the satisfaction of the consultant.
- .4 Submit shop drawings for all temporary works for review before fabrication commences. Shop drawings shall be sealed by a professional engineer registered in the Province of Ontario.

### **1.5 Scaffolding**

- .1 Provide and maintain temporary scaffolding required to perform the Work.



## **1.6 Hoisting**

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment.
- .2 Cranes and hoists, if used, shall be operated by qualified operator.

## **1.7 Construction parking**

- .1 Parking will be permitted on site provided it does not disrupt performance of Work or ongoing operations of Landlord.
- .2 Provide and maintain adequate access to project site.

## **2 Products**

### **2.1 Contractor's site office**

- .1 Provide temporary office area, lighted and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.
- .2 Temperature to be mechanically controlled at 20 °C to 24 °C year round including air conditioning in summer and furnace-heated in Fall/winter.
- .3 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .4 Provide 12 padded stackable chairs for site meetings
- .5 Approved model: Global Paramount Cypress Point Stack Chair
- .6 Contractor is permitted to use the construction space as a site office.

## **3 Execution**

### **3.1 Setup and removal of Contractor's site office**

- .1 Site to be left in a tidy, clean condition after removal of office area.

### **3.2 Temporary shelter sanitary facilities**

- .1 Provide and maintain drinking water and washing facilities as required by the Construction Safety Act.

- .2 Post notices and take such precautions as required by local health authorities.
- .3 Existing permanent facilities may be used during regular mall hours.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Site enclosure.
- .2 Weather enclosures.
- .3 Dust tight barriers.
- .4 Protection for off-site and public property.
- .5 Protection of applied finishes.
- .6 Protection of surrounding Work.

### **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 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.

### **1.4 Dust-tight barriers**

- .1 Provide dust tight barriers and screens or [insulated] 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.

### **1.5 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.

**1.6 Protection of applied finishes**

- .1 Provide protection for finished and partially finished surfaces 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.

**1.7 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.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Access to site.
- .2 Informational and warning devices.
- .3 Protection and control of public traffic.
- .4 Operational requirements.

### **1.2 Related requirements**

- .1 Section 01 50 00 Temporary facilities and controls.

### **1.3 Reference standards**

- .1 Ontario Traffic Manual (OTM), Book 7 - Temporary Conditions, current revision.
- .2 Ontario Provincial Standards, available for download at <https://www.library.mto.gov.on.ca/SydneyPLUS/TechPubs/Portal/tp/opsVIEWS.aspx?lang=en-US>
- .3 Traffic Control Guidelines of the Infrastructure Health and Safety Association.

### **1.4 Access to site**

- .1 Do not obstruct entrances, stairs or fire exits.
- .2 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to the work.
- .3 Provide for mud and snow removal and dust suppression, as required during the construction period.
- .4 Maintain vehicular access to all properties within and adjacent to the Place of the Work at all times except when Contractor's operations reasonably necessitate a temporary restriction. Such restrictions shall be kept to a minimum and shall be coordinated with the affected property owner or occupant.
- .5 All traffic arrangements shall be subject to the approval of the Consultant and the authority having jurisdiction.

- .6 Plan and schedule the routes of vehicles transporting all materials to, from or within the Place of the Work, so that vehicular movements are accomplished with minimum interference and interruptions to traffic.
- .7 The Owner reserves the right to alter or reject proposed delivery and trucking routes as considered necessary. The Contractor shall notify suppliers of materials and equipment of the above requirements.

### **1.5 Protection of public traffic**

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 When working on travelled way:
  - .1 Place equipment in position to present minimum of interference and hazard to traveling public.
  - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
  - .3 Do not leave equipment on travelled way overnight. Store equipment outside the roadway "clear zone" when not in use

### **1.6 Informational and warning devices**

- .1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from the Contractor's operations which requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in OTM Book 7.
- .3 Place signs and other devices in locations recommended in OTM Book 7.
- .4 Meet with Consultant prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list for approval of Consultant.
- .5 Continually maintain traffic control devices in use by:
  - .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

- .2 Removing or covering signs which do not apply to conditions existing from day to day.

### **1.7 Parking for construction personnel**

- .1 Parking for Contractor's, Subcontractors, suppliers and/or their employee's vehicles shall be limited to restricted area as designated by the Owner.
- .2 Parking for will be permitted on site provided it does not disrupt performance of Work and continuing operation of the facility.
- .3 The Owner and their employees will not be responsible for parking fines or stolen property incurred by the Contractor, Subcontractors, suppliers and/or their employees.

### **1.8 Fire routes**

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

### **2 Products – not used**

### **3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section Includes**

- .1 Product options.
- .2 Procedures for substitution requests submitted after award of the Contract.

### **1.2 Related requirements**

- .1 Appendix B Supplementary Conditions to CCDC 2 General Conditions

### **1.3 General Product requirements**

- .1 All Products and materials supplied shall have a low V.O.C. rating.

### **1.4 Specified product options**

- .1 Performance or prescriptive standards:
  - .1 Select any product, assembly or component material that meets or exceeds the specified standards for products specified only by referenced standards and performance criteria.
- .2 Acceptable products:
  - .1 Products specified by component material name, manufacturer, catalogue number, model number, or similar reference establishing the standard of acceptance that the Consultant will consider appropriate for the Work. Select any named Product, assembly or component material contained in the listing of Acceptable Products.
- .3 Acceptable manufacturers:
  - .1 Select any product, assembly or component material manufactured by the listed Manufacturers that meets or exceeds the specified standards and performance criteria.
  - .2 Submit required Shop Drawing and Product data submissions before starting any work of the relevant Specification Section for review by Consultant.



### **1.5 Product substitutions**

- .1 Submit proposals for substitute Products or groups of Products in accordance with Appendix B – Supplementary Conditions.
- .2 Owner is under no obligation to accept proposed substitute Products unless the Contractor can provide evidence satisfactory to the Consultant that such proposed substitute Product meets or exceeds the specified performance and other criteria.

### **1.6 Incorporation of specified Products**

- .1 Coordinate the installation of the selected Products into the Work:
  - .1 Make any changes in the Work as may be required to accommodate the selected Products.
  - .2 Notify Consultant where a selected Product is inconsistent with the layouts and configurations indicated on Drawings and Schedules.
  - .3 Bear costs and waive claims for additional compensation for costs that are implicit in the use of the selected Products.

### **2 Products – not used**

### **3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Product delivery requirements and conditions.

### **1.2 Delivery requirements and conditions**

- .1 Fully indemnify the Owner for all damages to persons or property resulting from the services and operations performed by employees of the Contractor and all Subcontractors and suppliers, and all contracted agents or carriers, including the delivery and unloading of goods or equipment at (and transfer and unloading of bulk chemicals or fuels to) Regional facilities.
- .2 Employ delivery vehicles that are suitably licensed, insured, operated and maintained in accordance with the Contract requirements, the Contractor's (and its agent's or carrier's) applicable policies and procedures, and all applicable federal, provincial and municipal legislation, statutes and by-laws.
- .3 Ensure that the Contractor's forces receive and sign off on all deliveries and shipments required for the Work. The Owner will not be responsible for the sign off on any deliveries for the Contractor.
- .4 Equip all delivery vehicles with any other material handling equipment required for the delivery person to safely unload the shipment at the receiving location(s) at the Place of the Work and move the Products to the designated receiving area(s) identified in the Contract.
- .5 Equip delivery vehicles, where required, with a hydraulic tailgate for unloading heavy equipment, packages, drums, pallets and similar large, heavy items at receiving locations which are not equipped with a truck loading dock.

**2 Products – not used**

**3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Progressive cleaning.
- .2 Cleaning prior to application for Substantial Performance.
- .3 Cleaning prior to Completion.

### **1.2 Related Requirements**

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 31.

## **2 Products**

### **2.1 Cleaning materials**

- .1 Cleaning agents and materials: Low VOC content.

## **3 Execution**

### **3.1 Progressive cleaning**

- .1 Maintain site in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other contractors.
- .2 Remove waste materials from site or dispose of waste materials as directed by Consultant. Do not burn waste materials on site.
- .3 Clear snow and ice from area of construction, bank or pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Make every reasonable effort to recycle or otherwise salvage the materials removed from the site. Submit a disposal plan to the Owner and do not commence work prior to the Owner's approval of the disposal plan. Include all disposal costs in bid price.
- .6 Separate and recycle waste materials and dispose of them in accordance with local municipal requirements and policies.

- .7 Dispose of unused paint material at official hazardous material collections site approved by Owner.
- .8 Remove waste material and debris from site, or deposit in waste container(s), at end of each working day.
- .9 Waste containers, if allowed:
  - .1 Provide on-site steel framed, hinged lid containers for collection of waste materials and debris.
  - .2 Provide and use clearly marked, separate bins for recycling. Secure all waste disposal and recycling bins to prevent public dumping.
  - .3 Place waste containers in an area directed by the Owner. Pay for all associated costs and permits. Do not locate bins on a structural slab.
  - .4 Remove and replace waste containers promptly when full and upon completion of the work.
- .10 Storage of waste material and debris outside of the waste containers is not be permitted.
- .11 Clean interior areas prior to start of finish work and maintain areas free of dust and other contaminants during finishing operations.
- .12 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .13 Provide adequate ventilation during use of volatile or noxious substances. Use of enclosure ventilation systems is not permitted for this purpose.
- .14 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .15 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

### **3.2 Cleaning prior to application for Substantial Performance**

- .1 Prior to applying for Substantial Performance of the Work, 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 Remove waste products and debris other than that caused by Owner or other contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 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.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Clean and polish surface finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Sweep and wash clean paved areas.
- .16 Clean equipment and fixtures to a sanitary condition; clean filters of mechanical equipment.

### **3.3 Cleaning prior to Completion**

- .1 Execute final cleaning prior to Completion acceptance review.

- .2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- .3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- .4 Replace filters of operating equipment.
- .5 Clean site; sweep paved areas.
- .6 Remove waste and surplus materials, rubbish, and construction facilities from the site.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Adjusting products and equipment required by all specification sections for this Project.

### **1.2 Related requirements**

- .1 Section 01 74 00 Cleaning and waste management
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Purpose**

- .1 Perform testing adjusting and balancing of operating systems in contract in the presence of consultant:
- .2 Prior to start of balancing, ensure systems are:
  - .1 Piped, ducted, wired and wireless services and systems, including components and equipment forming part thereof.
  - .2 Manually and mechanically operated, including components and equipment forming any part.
  - .3 Testing, adjusting and balancing will not be started until after all static checks have been completed for the system being balanced and signed off on the commissioning report forms.
  - .4 Contractor to ensure systems are operated at designated times, under conditions required for proper testing, adjusting, and balancing.
  - .5 Report any deficiencies or defects which may affect the balancing or noted during testing, adjusting and balancing, which cannot be promptly corrected.

## **2 Products – not used**



### **3 Execution**

#### **3.1 Preparation**

- .1 Prepare each system and item of equipment for testing, adjusting and balancing.
- .2 Verify that each system and equipment installation is complete and in functional operation.
- .3 Verify appropriate ambient conditions.

#### **3.2 Testing**

- .1 Tests will be conducted to confirm compliance with requirements of Contract Documents. Take corrective action as necessary.

#### **3.3 Adjusting**

- .1 Adjust operating Products and equipment to ensure smooth and unhindered operation.
- .2 Provide equipment required to ensure proper, efficient and safe operation of all equipment including belts and sheaves.

#### **3.4 Balancing**

- .1 Cooperate with and assist the balancing agent to ensure that the various parts of system are in a proper state of equilibrium.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Inspections and declarations.
- .2 Spare parts, maintenance materials and special tools.
- .3 Operation and maintenance manual
- .4 Recording actual site conditions.
- .5 Record (as-built) documents and samples.
- .6 Record documents.
- .7 Extended Warranties.

### **1.2 Related requirements**

- .1 Section 01 31 00 Project management and coordination
- .2 Section 01 33 00 Submittal Procedures
- .3 Section 01 45 00 Quality control
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Inspections and declarations**

- .1 **Contractor's inspection:** Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects, issue list of deficiencies and repair as required to conform to the Contract Documents.
- .2 Notify the Consultant in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made.
- .3 Request the Consultant's Inspection.
- .4 **Consultant's inspection:** Consultant and Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. Consultant will generate a list of deficiencies. Correct defective and deficient Work accordingly.
- .5 Consultant will identify in inspection report all items deemed to affect issuance of Substantial Performance.

- .6 **Substantial Performance:** Contractor shall submit a written certificate that the following has 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, balanced and are fully operational.
  - .4 Certificates required by authorities having jurisdiction have been submitted.
  - .5 Operation of systems have been demonstrated to Owner's personnel.
  - .6 All required documentation has been submitted.
  - .7 Work is complete and ready for Substantial Performance Inspection.
- .7 **Substantial Performance inspection:** When items noted in 1.3.6 above are completed, request Substantial Performance Inspection of the Work by the Consultant and the Owner. If Work is deemed incomplete by Consultant or Owner, complete all such outstanding items and request re-inspection.
- .8 **Declaration of Substantial Performance:** When the Owner considers deficiencies and defects have been corrected and it appears requirements of the Construction Lien Act with respect to Substantial Performance, as amended by the Supplementary Conditions, have been met, make application for Substantial Performance of the Work.
- .9 **Commencement of warranty period:** The date of Substantial Performance of the Work, as certified by the Owner, shall be the date for commencement of the warranty period.
- .10 **Commencement of lien period:** The date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period.
- .11 **Release of basic (statutory) holdback:** After issuance of certificate of Substantial Performance of the Work, submit an application for payment of the basic holdback retained by the Owner under the Construction Lien Act.

- .12 **Payment of finishing holdback:** After issuance of Certificate of Completion, submit an application for payment of finishing holdback retained by the Owner under the Construction Lien Act.
- .13 **Final inspection:** Consultant and Owner will conduct a Final Inspection within 3 months of the end of the warranty period. If deficient or defective Work is identified by Owner, correct deficient or defective Work and request re-inspection.
- .14 **Final payment:** When the Owner considers that all deficiencies and defects have been corrected and it appears all Contractor obligations under the Contract have been fulfilled, the Owner will issue a Final Acceptance Certificate and issue final payment.

#### 1.4 Operation and maintenance manual

- .1 Prepare an operation and maintenance manual during the course of construction for all equipment installed.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 At least 2 weeks prior to Substantial Performance of the Work, submit to the Consultant, 4 complete hard copies of the operation and maintenance manual in Canadian English.
- .4 A copy will be returned after the Substantial Performance inspection with Consultant's comments.
- .5 Revise content of documents of the operation and maintenance manual as required prior to final submittal.
- .6 Provide **a single PDF file** of the complete, final operation and maintenance manual after acceptance by the Owner of the hard copy. The PDF file shall not have any security protection applied (i.e. no passwords).
- .7 Substantial Performance will not be granted until an acceptable operation and maintenance manual has been submitted.

## **1.5 Operation and maintenance manual format**

- .1 Hard copy binders:
  - .1 Organize data in the form of an instructional manual.
  - .2 Provide vinyl, hard covered, 3 'D' ring, 8.5 x 11 in. binder 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:
    - .1 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 systems under 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.
- .2 Electronic files:
  - .1 Single file in PDF format duplicating hard copy manual.
  - .2 Organize PDF file same as hard copy binders.
  - .3 Use PDFs from original electronic files, combined into a single file. Avoid photocopying hard copy documents to PDF files.

## **1.6 Operation and maintenance manual contents**

- .1 Each volume of the operation and maintenance manual shall include each item specified in this article.
- .2 Provide table of contents including:
  - .1 Title of project.
  - .2 Date of submission.

- .3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
  - .4 Schedule of products and systems indexed to content of volume.
  - .5 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data:
- .1 Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .4 Drawings:
- .1 Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Certificates of Acceptance:
- .1 Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, and life safety systems performance certificate.

## **1.7 Recording actual site conditions**

- .1 Record information on set of black line drawings, and within the project manual, provided by Owner.
- .2 Annotate with red coloured felt tip marking pen, for recording changed information. As requested by the Consultant, use multiple colored marking pens to differentiate between systems.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is accurately recorded.
- .4 Contract Drawings and Shop Drawings:
  - .1 Legibly 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.
- .5 Specifications:
- .1 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, field test records, and inspection certifications required by individual specifications sections.

### **1.8 As-built documents and samples**

- .1 In addition to requirements in Section 01 31 00, maintain at the site one record copy of:
  - .1 Reviewed shop drawings, product data, and samples.
  - .2 Field test records.
  - .3 Inspection certificates.
  - .4 Manufacturer's certificates.
- .2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label as-built documents and file in accordance with section number listings in List of Contents of the Quotation Documents. Label each document "**As-Built Documents**" in neat, large, printed letters.

- .4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.
- .5 Keep as-built documents and samples available for inspection by Consultant.
- .6 Prior to Substantial Performance of the Work, provide final draft redline mark-up As-Built Drawings to the Consultant with as-built dimensions and spatial arrangements.
- .7 Consultant will review the As-Built Drawings and send comments back to the Contractor with a copy to the Owner.
- .8 Revise the As-Built Drawings taking the comments from the Consultant into account.
- .9 Submit final As-Built Drawings to the Consultant.
- .10 Substantial Performance will not be granted until final, acceptable As-Built Drawings have been submitted.

## **2 Products**

### **2.1 Materials and finishes**

- .1 Building Products, Applied Materials, and Finishes: Provide product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Provide instructions for cleaning agents and methods; precautions against detrimental agents and methods; and recommended schedule for cleaning and maintenance.
- .3 Additional Requirements: as specified in individual specifications sections.

### **2.2 Spare parts, maintenance materials and special tools**

- .1 Receive and catalog all items. Check inventory against operation and maintenance manual. Include approved listing in operation and maintenance manual.



- .2 If requested, furnish evidence as to type, source and quality of products provided.
- .3 If requested, provide receipts for delivered spare parts, materials and tools prior to Substantial Performance of the Work.
- .4 Defective products will be rejected regardless of previous inspections. Replace defective products at own expense.
- .5 Pay all costs of transportation, duties, tariffs, etc.

### **2.3 Spare parts**

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide identical items of same manufacturer, dye-lot or production run as items in the Work
- .3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in operation and maintenance manual.
- .4 Obtain receipt for delivered products and submit prior to final payment.

### **2.4 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 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in operation and maintenance manual.
- .4 Obtain receipt for delivered products and submit prior to final payment.

### **2.5 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 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in operation and maintenance manual.

### **3 Execution**

#### **3.1 Deliver to site**

- .1 Deliver spare parts, maintenance materials, and special tools to location as directed; place and store.

#### **3.2 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.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 The Section includes the requirements related to submission of extended warranties.

### **1.2 Related requirements**

- .1 CCDC 2 General Conditions
- .2 Appendix B Supplementary Conditions to CCDC 2 General Conditions
- .3 Section 01 31 00 Project management and coordination
- .4 Section 01 78 00 Closeout submittals
- .5 Extended Warranties for specific Products and systems are specified in the relevant Technical Specification Sections of Divisions 02 through 31 as applicable.

### **1.3 Definitions**

- .1 **Extended Warranty:** Unless otherwise specified, an extended warranty is a full labour and materials product or system warranty which is required beyond the expiry of the two (2) year Contract warranty period. Extended warranties shall commence upon the expiry of the Contract warranty period; therefore, the total warranty period is two (2) years plus the extended warranty period.

### **1.4 Administrative requirements**

- .1 Inform all manufacturers providing extended warranties of all obligations required under such extended warranties.

### **1.5 Submittals**

- .1 Provide the following information with each extended warranty:
  - .1 Name and address of manufacturer
  - .2 Warranty description and length of warranty
  - .3 Procedure for failure or malfunction
  - .4 Instances which will affect warranty

- .5 Certification of Contractor's installation
- .6 Manufacturer's certification
- .2 Extended warranties shall be submitted to the Consultant no later than thirty (30) calendar days after the date of Substantial Performance of the Work. **After Substantial Performance of the Work, the Owner will retain \$2,000 until satisfactory extended warranty documents are provided.**

## 1.6 Payment

- .1 Payment for this Section shall be made only upon submission of extended warranty documentation satisfactory to the Owner for all specified extended warranties. No partial payment will be made for submission of individual extended warranties.

## 2 Products

### 2.1 Extended warranties

- .1 Extended Warranties are required for the following Products and systems. Reference the specific section specification for details.
- .2 Extended Warranties for the specified components and Sections will remain in effect for the number of years as follows:

Product / System	Section	Length of Extended Warranty (years)	Total Length of Product / System Warranty (years)
Finish Carpentry (plastic laminate)	06 20 00	2	4
Solid Surfacing	06 61 16	8	10
Incandescent Lamps	26 05 00	3	5
Luminaries	26 51 00	3	5
Communications	27 05 00	3	5

### **3 Execution**

#### **3.1 Contractor requirements**

- .1 Inform all manufacturers providing extended warranties of all obligations required under such extended warranties.
- .2 Provide access to the work site to all manufacturers required to provide extended warranties for such manufacturers to witness installation of equipment and systems requiring an extended warranty as well as related and interconnected products and systems.

#### **3.2 Warrantor requirements under extended warranties**

- .1 Manufacturers shall provide extended warranties.
- .2 Extended warranties shall provide the Owner with the same rights as the original contract warranty.
- .3 All work performed under an extended warranty shall be subject to the same warranty as the original work of the Contract, and such warranty shall remain in effect until the expiry of the extended warranty
- .4 Upon notification of defects in product or services under an extended warranty, remedy any defect identified by the Owner during the period specified in Clause 3.2.3.
- .5 Remedy any damage to Owner-owned or controlled real or personal property, when such damage is the direct result of any defect of equipment, material, workmanship, or design furnished.
- .6 Commence repairs and replacements within seven (7) calendar days of notification of defect unless a shorter response time is specified elsewhere in the Contract Documents.
- .7 Supplier's/manufacture's standard disclaimers and limitations on product and services warranties shall not relieve the warrantor of their obligations required under the specific extended warranty.
- .8 The warrantor shall not be liable for the repair of any defects of material nor resultant damage where such defect or damage results from any defect in Owner-furnished material or design.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.
- .2 Seminars and demonstrations.

### **1.2 Related requirements**

- .1 Section 01 75 19 Testing and balancing
- .2 Section 01 91 00 Commissioning.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### **1.3 Description**

- .1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel a minimum of two (2) weeks prior to handover.
- .2 Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

### **1.4 Component demonstration**

- .1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.
- .2 Instruct Owner's personnel and provide written report that demonstration and instructions have been completed.

### **1.5 Submittals**

- .1 Submit schedule of times and dates for demonstration of each item of equipment and each system two weeks prior to designated dates, for Consultant's approval.
- .2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

## **1.6 Conditions for demonstration**

- .1 Equipment has been inspected and put into operation in accordance with:
  - .1 Section 01 75 19 – Testing and balancing
  - .2 Section 01 91 00 – Commissioning
  - .3 Section 21 00 01 – General requirements
  - .4 Section 22 00 01 – General requirements
  - .5 Section 23 00 01 – General requirements
  - .6 Section 26 60 02 – Testing and commissioning of electrical systems.
- .2 Testing, adjusting, and balancing have been performed in accordance with Section 01 75 19, and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

## **2 Products – not used**

## **3 Execution**

### **3.1 Preparation**

- .1 Verify that suitable conditions for demonstration and instructions are available.
- .2 Verify that designated personnel are present.
- .3 Prepare agendas and outlines.
- .4 Establish seminar organization.
- .5 Explain component design and operational philosophy and strategy.
- .6 Develop equipment presentations.
- .7 Present system demonstrations.
- .8 Accept and respond to seminar and demonstration questions with appropriate answers.



### **3.2 Preparation of agendas and outlines**

- .1 Prepare agendas and outlines including the following:
  - .1 Equipment and systems to be included in seminar presentations.
  - .2 Name of companies and representatives presenting at seminars.
  - .3 Outline of each seminar's content.
  - .4 Time and date allocated to each system and item of equipment.
  - .5 Provide separate agenda for each system.

### **3.3 Seminar organisation**

- .1 Coordinate content and presentations for seminars.
- .2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.
- .3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.
- .4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

### **3.4 Explanation of design strategy**

- .1 Explain design philosophy of each system. Include following information:
  - .2 An overview of how system is intended to operate.
  - .3 Description of design parameters, constraints and operational requirements.
  - .4 Description of system operation strategies.
  - .5 Information to help in identifying and troubleshooting system problems.

### **3.5 Demonstration and instructions**

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.

- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

### **3.6 Time allocated for instruction**

- .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
  - .1 Division 21 – Fire Suppression systems: 2 hours of instruction.
  - .2 Division 22 – Plumbing systems: 4 hours of instruction.
  - .3 Division 23 – HVAC systems: 16 hours of instruction.
  - .4 Division 26 – Electrical systems: 2 hours of instruction.
  - .5 Division 27 – Communications systems: 4 hours of instruction.
  - .6 Division 28 – Electronic Safety and Security systems: 12 hours of instruction.

**End of section**

## 1 General

### 1.1 Section includes

- .1 Commissioning, testing and documentation.
- .2 Audit testing and the commissioning auditor.

### 1.2 Related requirements

- .1 Section 01 33 00 Submittal procedures.
- .2 Section 01 75 19 Testing and balancing.
- .3 Section 01 78 00 Closeout submittals
- .4 Section 01 79 00 Demonstration and training.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 31.

### 1.3 Definitions

- .1 **Commissioning:** Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meet the original project requirements established by the Owner. The Commissioning process begins at project inception (during the pre-design phase) and continues through the life of the facility. The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets the owner's project requirements.
- .2 **Commissioning Team:** All Commissioning Team members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. Commissioning Team consists of:
  - .1 Owner's representative
  - .2 Consultant (including their Architect and Design Engineers as appropriate)
  - .3 Contractor and, as applicable, their Subcontractors for:
    - .1 Mechanical
    - .2 Electrical
    - .3 Testing and Balancing (TAB)

- .4 Control
- .5 Any other installing Subcontractors or suppliers of equipment
- .4 Facility operating staff
- .3 **Commissioning Auditor:** Party engaged by the Owner to audit or verify results assembled by the Commissioning Team.
- .4 **Testing Agency:** Specialty agency engaged by the Owner to perform tests on components or systems to verify conformance to Owner's requirements and Contract Documents.
- .5 **Commissioning Documents:**
  - .1 Commissioning Plan: A project-specific document which defines the scope and approach to commissioning of this facility.
  - .2 Submittal: Contract submittal, as specified in Contract Documents.
  - .3 Static check certificate: A document used to verify equipment data actually installed, prior to start-up or operation.
  - .4 Operating check certificate. A document used to verify equipment operation, including performance statistics.
  - .5 Start-up Reports: Report prepared by equipment start-up personnel, including start-up sequence, and performance statistics.
  - .6 Balancing Report: Report prepared by the balancing agency, indicating initial and final system performance, to Section 01 75 19.
  - .7 Operations and Maintenance Manual: A document containing detailed descriptions and technical information about start-up, operation and maintenance of equipment, to Section 01 78 00.

#### 1.4 Reference Standards

- .1 ASHRAE Guideline 0-2019.

#### 1.5 Methodology

- .1 The Contractor shall develop a commissioning plan, including as a minimum the management of commissioning meetings, and the management of project-specific commissioning documents.

- .2 Commissioning plan to include:
  - .1 Assembly of owner's requirements, including design criteria, performance goals, budgets, and schedules.
  - .2 Scheduling and chairing of commissioning meetings between team members.
  - .3 Development of static and operating check certificates for individual equipment.
  - .4 Assembly of commissioning reports, including testing and balancing reports, Operations and Maintenance Manuals, start-up reports, and testing reports.
  - .5 Verification of data by testing agency.
  - .6 Execute the commissioning plan.

## **1.6 Regulatory requirements**

- .1 Arrange for regulatory authorities to witness those commissioning start-up procedures which are also required by regulatory authorities.
- .2 Obtain certificates of approval and for compliance with regulations from authorities having jurisdiction; include copies of certificates with start-up reports.

## **1.7 Contract commissioning requirements**

- .1 Perform pre-functional and functional performance tests after all relevant and related equipment, systems, structures and areas are complete.
- .2 Perform testing and balancing after the pre-functional tests have been completed and documented.
- .3 Witnessing: Allow commissioning team members to witness starting, testing, adjusting, and balancing procedures.
- .4 Allow Commissioning team free access to the site.
- .5 Costs: Pay costs associated with starting, testing, adjusting, and relevant instruments and supplies required to perform those duties.
- .6 Employ experienced personnel for equipment start-up and commissioning, who are able to interpret results of readings and tests, and report the system status in a clear and concise manner.

- .7 Provide all equipment required to perform testing, balancing, and commissioning of systems. Calibrate instruments used in start-up as accurate; provide calibration certificates if requested
- .8 Utilize equipment check certificates and other commissioning documents required by the consultant.
- .9 Verify that equipment is installed in accordance with Contract Documents, and reviewed shop drawings. Sign and date static check certificates.
- .10 Do not start up equipment unless static check sheets have been completed and submitted.
- .11 Complete, in detail, and sign operating check certificates.

## **1.8 Responsibilities**

- .1 All Parties:
  - .1 Follow the commissioning plan.
  - .2 Attend commissioning meetings.
- .2 Commissioning (Mechanical):
  - .1 Verify Pre-Functional and Functional performance of HVAC systems for compliance with design intent as specified in the appropriate specification sections.
  - .2 Provide the documentation with standard pre-functional and functional performance reports on completion of the testing.
  - .3 Verify submissions for HVAC system operation and operations and maintenance manuals, as-built documents, spare parts listing, special tools listing, and other items as may be specified.
  - .4 Coordinate and direct training of personnel for operation and maintenance of HVAC systems and equipment.
  - .5 Coordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's representative.
  - .6 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to Contractor and Owner/Owner's representative.
    - .1

- .3 Commissioning (Electrical):
  - .1 Verify pre-functional and functional performance of electrical and miscellaneous systems for compliance with design intent as specified in the appropriate Specification sections.
  - .2 Provide the documentation with standard pre-functional and functional performance reports on completion of the testing.
  - .3 Verify submissions for electrical and miscellaneous systems operation and operations and maintenance manuals, as-built (record) documents, spare parts listing, special tools listing, and other items as may be specified.
  - .4 Coordinate and direct training of personnel for operation and maintenance of electrical and miscellaneous systems and equipment.
  - .5 Co-ordinate and direct each step of the commissioning process and recommend acceptance or non-acceptance to the Owner/Owner's representative.
  - .6 Prepare, in writing, documentation of any deficiencies discovered during the commissioning process. Submit to Contractor and Owner/Owner's representative.
- .4 Contractor:
  - .1 Facilitate the coordination of the commissioning work to ensure that commissioning activities are being scheduled into the master schedule on a monthly basis.
  - .2 Provide detailed start-up procedures.
  - .3 No later than sixty (60) calendar days prior to start-up of the first piece of major equipment, meet with the Consultant and Owner to finalize the detailed commissioning procedures/schedule.
  - .4 Provide all tools or the use of tools to start, check-out and test equipment and systems.
  - .5 Complete electronic construction checklists as work is completed and provide update consultant as required.
  - .6 Verify completeness of the building envelope, perimeter, and interior items which affect proper operation and control of HVAC, electrical and miscellaneous systems equipment and systems.

- .7 Appoint Commissioning Team members from Subcontractors and specialty trades.
  - .8 Assure participation and cooperation of Subcontractors and specialty trade contractors (e.g. mechanical, electrical, TAB, building management, etc.) under the Contractor's jurisdiction as required for the commissioning process.
  - .9 Be responsible for the actual system pre-functional and functional performance testing. Any changes to the supplied test procedures must be approved by the consultant.
  - .10 Review commissioning progress and deficiency reports and correct deficiencies identified.
  - .11 Provide assistance for seasonal or deferred performance testing, performed by the consultant, according to the Contract Documents.
  - .12 Correct deficiencies and make necessary adjustments to operation and maintenance manual and as-built drawings for applicable issues identified in any seasonal testing.
- .5 Mechanical Consultant:
- .1 The Mechanical Consultant shall provide the design intent documentation for commissioning.
  - .2 The Mechanical Consultant shall observe (pre-functional and functional performance testing), where they deem necessary.
  - .3 The Mechanical Consultant shall provide technical capabilities for resolution of deficiencies where required.
- .6 Electrical Consultant:
- .1 The Electrical Consultant shall provide the design intent documentation for commissioning.
  - .2 The Electrical Consultant shall observe (pre-functional and functional performance testing), where they deem necessary.
  - .3 The Electrical Consultant shall provide technical capabilities for resolution of deficiencies where required.

## 2 Products



## **2.1 Test equipment**

- .1 All testing equipment required to perform start-up and initial checkout and required performance testing shall be provided by the contractor for the equipment being tested.
- .2 All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply:
- .3 Temperature sensors and digital thermometers shall have a certified calibration to NIST traceable standards within the past year to accuracy of 0.5 °C and a resolution of + or - 0.1 °C.
- .4 Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
- .5 All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

## **3 Execution**

### **3.1 Commissioning process**

- .1 Commissioning process shall follow ASHRAE Guideline 0-2013: The Commissioning Process, and all addenda thereto.
- .2 Commissioning process shall encompass and coordinate the following areas:
  - .1 System documentation
  - .2 Equipment start-up and performance testing (pre-functional testing)
  - .3 Testing and balancing
  - .4 Control system calibration
  - .5 System start-up and performance testing (functional testing)
  - .6 Training. Refer to Section 01 79 00.
  - .7 Deficiency documentation and resolution

- .3 The commissioning process will not:
  - .1 Preclude the duties and responsibilities described in the Contract Documents nor the requirements and obligations of the Contract.
  - .2 Circumvent any required warranties.
  - .3 Relieve the Contractor from warranty requirements, responsibilities, or obligations.
- .4 Commissioning scope meeting
  - .1 After the contract award and before HVAC and Electrical systems construction begins, attend a commissioning scope meeting of all members of the Commissioning Team at a time and place designated by the Owner. Purpose of the meeting will be to familiarize all parties with the requirements of the commissioning process, and to ensure that the responsibilities of each party are clearly understood.
  - .2 Ensure that the appropriate Subcontractors are in attendance.
- .5 Operation and maintenance manuals for HVAC equipment and systems
  - .1 Furnish operation and maintenance manuals to the consultant (Mechanical) for review fourteen (14) calendar days prior to the functional performance tests.
- .6 Operation and maintenance manuals for electrical equipment and systems
  - .1 Furnish operation and maintenance manuals to the consultant (Electrical) for review fourteen (14) calendar days prior to the functional performance tests.
- .7 Start-up (pre-functional performance test)
  - .1 Be responsible for the pre-functional performance tests. These tests ensure that all equipment and systems are installed in accordance with the Contract Documents and manufacturers' requirements.
  - .2 Coordinate scheduling for pre-functional tests of various equipment and systems.
  - .3 In the pre-functional test, check all HVAC mechanical systems and sub-system elements, including control devices, 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 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 performance characteristics agree with those required by equipment or system manufacturer.
  - .4 Pre-Functional performance tests shall be completed prior to starting Functional Performance Tests.
  - .5 Pre-Functional performance tests need to be performed once only, if there are no deficiencies, as determined by the Commissioning Agent. Re-testing of corrected items shall be the responsibility of the Contractor.
  - .6 Completion of the pre-functional performance test shall be the responsibility of the Contractor who shall also sign and date each test.
- .4 In the pre-functional test, check all electrical and miscellaneous systems and sub-system elements, including devices, for the following:
- .1 Verify that each element has been properly installed, properly identified, and that all electrical connections have been made correctly.
  - .2 Verify that each element has been checked for proper switches, starters, circuit breakers or other conditions which may cause damage or reduce system performance.
  - .3 Verify that tests, meter readings, and specific electrical performance characteristics agree with those required by equipment or system manufacturer.
  - .4 Pre-Functional performance tests shall be completed prior to starting functional performance tests.
  - .5 Per-Functional performance tests need to be performed once only, if there are no deficiencies, as determined by the

- consultant. Re-testing of corrected items shall be the responsibility of the Contractor and shall be completed at his expense.
- .6 Completion of the pre-functional performance tests shall be the responsibility of the Contractor who shall also sign and date each Test.
  - .5 Testing, adjusting and balancing of mechanical systems (TAB):
    - .1 Commence TAB immediately following the Pre-functional Testing and in accordance with the Construction Schedule.
    - .2 Assist the TAB agency with equipment and/or manpower to allow their testing of dampers, actuators, and motors to be performed in a timely manner.
    - .3 Submit one draft copy of the TAB report to the (Mechanical) consultant and provide the necessary reviews prior to the Functional Testing.
  - .6 Testing and (load) balancing of electrical systems (TAB-E):
    - .1 Commence the TAB-E immediately following the Pre-functional Testing and in accordance with the Construction Schedule.
    - .2 Submit one draft copy of the TAB-E report to the consultant (Electrical) and provide the necessary reviews prior to the Functional Testing.
  - .7 Control commissioning and calibration:
    - .1 To be completed by the Contractor prior to the Functional Testing and in accordance with the specification.
  - .8 Functional performance tests:
    - .1 Be responsible for the functional performance tests. 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.
    - .2 Coordinate the functional performance tests for the HVAC mechanical systems and sub-systems; electrical and miscellaneous systems and sub-systems.

- .3 In the functional performance tests, check all HVAC mechanical systems, including control systems, electrical and miscellaneous systems for the following:
  - .1 Verify that each system and sub-system is operating and complies with the Contract Documents and the design intent document through the entire range of operating conditions.
  - .2 Notify the Mechanical and Electrical Consultants, in writing, at least fourteen (14) calendar day prior to date of functional performance tests.
  - .3 Re-testing of corrected items shall be the responsibility of the Contractor.
  - .4 The following parties shall be present during functional performance testing:
    - .1 Contractor
    - .2 Mechanical and controls Subcontractor(s) as relevant to specific test
  - .5 Owner's representative (operation personnel) and Consultant may be present for some or all functional performance testing.
  - .6 Deficiencies in system, sub-system, or element performance will be brought to the attention of the Commissioning Team. Deficiencies will be resolved on a case-by-case basis
- .9 Control verification:
  - .1 Verify operation of controls in conjunction with the functional performance testing and in accordance with the Contract Documents.
- .10 Reports:
  - .1 All data must be recorded as soon as possible during the course of the inspection and testing.
  - .2 All documentation shall have the date, time, and names of persons participating in the inspection and testing.
  - .3 All test instruments shall be documented for valid calibration.

- .4 The recording work sheets, inspection check lists, and performance testing plans must all be approved by the Mechanical and Electrical Consultants and the Mechanical and Electrical Commissioning Authorities prior to the start of functional performance testing.

### **3.2 Commissioning testing**

- .1 Allow for work, effort, and associated costs necessary to assist an Owner appointed and remunerated Commissioning team, for fulfilment of a commission testing process of the facility and Work.
- .2 Coordinate, cooperate, and harmonize efforts with the Commissioning team.
- .3 Commission testing will include a random testing and evaluation process as determined by the owner.
- .4 System and device checks to be suitably logged, tabulated, signed, and incorporated into project operation and maintenance manuals:
  - .1 Prior to start of testing, provide two (2) complete sets of up-to-date Contract Documents (drawings and specifications) including addenda to the Commissioning team.
  - .2 Provide two (2) copies of each approved notice of change and clarification.
- .5 Coordinate site visits by the Commissioning team and the affected parties during warranty periods.
- .6 Prior to commissioning testing, provide copies the following to the Commissioning team for components and assemblies to confirm Contract Document compliance:
  - .1 Static test certificates.
  - .2 Equipment operating certificates.
  - .3 Three (3) copies of valve tag list.
  - .4 Inspection certificates from authorities having jurisdiction.
  - .5 Required copies of shop drawings.
  - .6 Manufacturer's operating and maintenance brochures of all major equipment.

- .7 Ensure all systems have been started, adjusted to design criteria, and are functionally operational, ready for independent testing.
- .8 Cooperate with the Commissioning team in advance of activating operating systems.
- .9 Test results that reveal failure to conform to the Contract Documents, will result in a second series of tests performed by an Auditor.

### **3.3 Mechanical system commissioning**

- .1 General Requirements:
  - .1 Test operating equipment and systems in the presence of the Commissioning team (- at the Mechanical Consultant's option) to demonstrate compliance with Contract Documents. 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 Commissioning team, in writing, fourteen (14) calendar days in advance of tests being performed.
  - .3 Conduct test under specified design operating conditions as recommended or approved by the Commissioning team and Mechanical Consultant and outlined in the pre-functional and functional performance tests.
  - .4 Test all elements of systems to demonstrate that total systems satisfy requirements of the Contract Documents.
  - .5 Perform testing 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.
  - .6 Provide a copy of all test reports and records to the Commissioning team (Mechanical).
- .2 Test Procedure and Test Documentation:
  - .1 Consultant will provide the Contractor with Pre-Functional and Functional test procedures and test documentation reports. Contractor may propose alternate documentation and may alter the test procedures and test documentation to suit as-built conditions, however, the Contractor will be expected to co-operate to the level

- of detail and general approach of the provided test procedures and test documentation.
- .2 Verify test and air balance (TAB) readings for at least 10 percent of the supply (maximum and minimum primary air), return, and exhaust diffusers, registers and grilles. If more than 20% of these readings differ from the documented TAB readings by more than 10%, then TAB shall be repeated in its entirety. TAB agency shall pay all the extra costs.
- .3 The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems.
- .3 Deficiency resolution for HVAC mechanical system commissioning:
  - .1 If acceptable performance cannot be achieved, carry out the necessary corrective measures to bring system into compliance.
  - .2 The allocation of cost of deficiency resolution shall be determined by the Commissioning Team on a case-by-case basis.

### **3.4 Electrical and miscellaneous system commissioning**

- .1 General requirements:
  - .1 Operating equipment and systems shall be tested in presence of the Electrical Consultant (at the Electrical Consultant's option) to demonstrate compliance with specified requirements.
  - .2 Notify the Commissioning team, in writing, fourteen (14) calendar days in advance of tests being performed.
  - .3 Conduct test under specified design operating conditions as recommended or approved by the Electrical Consultant and outlined in the pre-functional and functional performance tests.
  - .4 Test all elements of systems to demonstrate that total systems satisfy requirements of the Contract Documents.
  - .5 Perform testing 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.
  - .6 Provide a copy of all test reports and records to the Consultant (Electrical).



- .2 Deficiency resolution for electrical system commissioning:
  - .1 If acceptable performance cannot be achieved, carry out the necessary corrective measures to bring system into compliance. The Electrical Consultant and/or the Contractor should issue appropriate directions in this regard.
  - .2 The allocation of cost deficiency resolution shall be determined by the Commissioning Team, on a case-by-case basis.

### **3.5 Audit testing and the Commissioning Auditor**

- .1 In the event on non-compliance or test failure described in the commission testing process above, comply with the following requirements.
- .2 Allow for work, effort, and associated costs necessary to assist an Owner appointed and remunerated Auditor, for fulfilment of a further audit testing of the facility and Work.
- .3 Coordinate, cooperate, and harmonize efforts with the Auditor.
- .4 Audit testing will include further random testing and evaluation as determined by the Owner, the Auditor.
- .5 Suitably log, tabulate, and incorporate signed system and device check certificates into operating and maintenance manuals.
- .6 Coordinate site visits by the Auditor, and the affected parties during warranty periods.
- .7 The audit process will not:
  - .1 Preclude the duties and responsibilities described in the Contract nor the requirements and obligations of the Contract.
  - .2 Circumvent any required warranties.
  - .3 Relieve the Contractor from warranty requirements, responsibilities, or obligations.
- .8 Cooperate with the Auditor prior to testing of operating systems.
- .9 Test results that demonstrate failure to conform to the Contract Documents, may result in the following, at the Owner's sole discretion:
- .10 Complete rejection of the subject component, assembly, or system.
- .11 Removal of defective items from the Work.

- .12 An adjustment credit to the Contract Price for the Owner's estimated value of the subject item plus remuneration for associated damages and inconvenience.
- .13 Provision of a suitable substitute Product in place of the defective Product.
- .14 Substituted Products will be required to be commissioned and audited and undergo the same scrutiny as described for commission testing and audit testing described above.

**End of section**

## **1 General**

### **1.1 Summary**

- .1 Review drawings, site conditions, and other specification sections to ascertain the extent and nature of work of this section.
- .2 The Work of this Section includes, but is not limited to the following:
  - .1 Demolish and removal of the following where indicated on the Drawings:
    - .1 Partitions.
    - .2 Doors, frames and associated hardware.
    - .3 Chalkboards, cork boards.
    - .4 Floor and wall finishes.
    - .5 Portions of existing concrete slab.
    - .6 Plumbing fixtures, washroom partitions and washroom accessories.
  - .2 Disconnect/cap existing service in areas of demolition.
- .3 Trace, demolish and remove decommissioned mechanical and electrical services found during demolition. Remove decommissioned services to the area of demolition to the source, leaving no buried services in walls and floors, unless otherwise approved by written notice from the Owner.
  - .1 Dispose of demolished materials except where required to be salvaged or reused.
  - .2 Refer to demolition notes indicated on all disciplines Drawings.
- .4 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project.

### **1.2 Related requirements**

- .1 Section 05 50 00: Metal Fabrications
- .2 Section 06 10 00: Rough Carpentry
- .3 Section 09 21 16: Gypsum Wallboard

### **1.3 Reference standards**

- .1 American National Standards Institute (ANSI):
  - .1 ANSI A10.8-2011, Scaffolding Safety Requirements
- .2 Canadian Standards Association (CSA):
  - .1 CSA S350- M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .3 National Fire Protection Association (NFPA):
  - .1 NFPA 241-09, Standard for Safeguarding Construction, Alteration, and Demolition Operations
- .4 Provincial Legislation:
  - .1 Legislation specific to Authority Having Jurisdiction for work governed by this Section.

### **1.4 Definitions**

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.

### **1.5 Examination**

- .1 Visit and examine the site and note all characteristics and irregularities affecting Work of this Section. Submit a pre-demolition inspection report. Ensure the Owner of premises being inspected is represented at inspection.
- .2 Where appropriate prepare a photographic or video record of existing conditions, particularly of existing work scheduled to remain.

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

## **1.6 Submittals**

- .1 Provide required information in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Prepare schedule in conjunction with overall project schedule and outline proposed methods in writing. Obtain approval before commencing demolition work, and indicate the following:
    - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity
    - .2 Interruption of utility services
    - .3 Coordination for shutoff, capping, and continuation of utility services

## **1.7 Quality assurance**

- .1 Conform to requirements of all authorities having jurisdiction.
- .2 Comply with applicable requirements of CSA S350-M "Code of Practice for Safety in Demolition of Structures".
- .3 Work of this Contract shall be executed by an approved company having a minimum of five (5) years continuous experience and able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.
- .4 Perform cutting and coring, where applicable, by a firm specializing in this type of work, able to produce evidence of successful completion of similar work over a period of at least five (5) years immediately prior to date of contract.
- .5 Apply for, secure, arrange and pay for all permits, notices and inspections necessary for proper execution and completion of work in this Section.

## **1.8 Protection**

- .1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.
- .2 Cease operations and notify Consultant if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Consultant.
- .3 Prevailing weather conditions and weather forecasts shall be considered. Demolition work shall not proceed when weather conditions constitute a hazard to the workers and site.
- .4 Temporarily suspended work that is without continuous supervision shall be closed to prevent entrance of unauthorized persons.

## **1.9 Remaining and adjacent structures**

- .1 Do not interfere with, encumber, endanger or create nuisance, from any cause due to demolition work, to public property or any adjacent attached and/or detached structures in possession of Owner or others, which are to remain, whether occupied or unoccupied during this work.
- .2 Make good damage to such structures resulting from work under this Section at no cost to Owner. Make good adjacent building surfaces damaged by work of this Section.

## **1.10 Protection of services and structures**

- .1 Take necessary precautions to guard against movement, settlement or collapse of existing adjacent utility services, public property and/or structures, whether to remain or not. If these or other unforeseen conditions develop, take immediate emergency measures, report to Consultant, confirm in writing, and await instructions before proceeding with any further related demolition work.
- .2 Prior to saw cutting or core drilling of existing concrete slabs, use ground penetrating radar (GPR) to detect utilities and structural reinforcing. Concrete X-Rays can be used when access to both sides of concrete slab is accessible for placement of required x-ray film.

### **1.11 Existing services**

- .1 Prior to start of demolition disconnect all electrical service lines in the areas to be demolished. Post warning signs on all electrical lines and equipment which must remain energized to serve other areas during period of demolition. Disconnect electrical service lines in demolition areas to the requirements of local authority having jurisdiction.
- .2 In each case, notify the affected utility company in advance and obtain approval where required before commencing with the work on main services.
- .3 Arrange with utility companies for locating of such services and for disconnection of existing services owned by utility companies and which will be disconnected by said utility companies, provided such services do not interfere with adjacent tenancy operators.
- .4 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.

### **1.12 Decommissioned services**

- .1 Remove fully decommissioned electrical and mechanical service lines, plumbing, ducting, fixtures and all fasteners and supports for decommissioned items.
  - .1 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.
- .2 Patch and repair surfaces affected by this selective demolition to match existing adjacent surfaces, as approved by the Consultant.

### **1.13 Existing warranties**

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

## **2 Products**

### **2.1 Debris, salvaged material, and equipment disposal**

- .1 All materials and or equipment salvaged from demolition work becomes property of demolition Contractor unless designated otherwise.
- .2 At no cost to Owner repair or replace material and/or equipment scheduled to remain which is damaged by demolition work. Do not sell any salvaged material or equipment directly from project site.
- .3 Remove waste debris continually and entirely from project site during demolition work. Do not load vehicles transporting such debris beyond their safe capacity or in a manner which might cause spillage on public or private property. If spillage does occur, clean up immediately to prevent traffic hazards or nuisance.

### **2.2 Protection**

- .1 Temporary Protection:
  - .1 Erect temporary hoarding protection, as indicated in Section 01 53 00, to enclose openings in exterior walls, and/or provide security to partially occupied interior spaces.
  - .2 Erect temporary dust screens, as indicated in Section 01 53 00, to prevent dust and debris to enter areas of the building which are not scheduled for demolition. Remove temporary dust screens when no longer required.

### **2.3 Repair materials**

- .1 Use repair materials identical to existing materials:
  - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - .2 Use a material whose installed performance equals or surpasses that of existing material.
  - .3 Comply with material and installation requirements specified in individual Specification Sections.



- .2 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes.
- .3 Gypsum Board Patching Compounds: Joint compound to ASTM C475, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16.
- .4 Fireproofing: Patch and repair all fireproofing damaged during demolition of adjacent surfaces with compatible fireproofing materials. Provide test reports from fireproofing manufacture warranting installation, adhesion and compatibility between existing and new fireproofing materials.

## **2.4 Existing materials**

- .1 Items to be retained for re-use in new construction include, but are not limited to the following:
  - .1 Millwork, as indicated on the Drawings.
  - .2 Confirm with Consultant any materials that appear to be in re-usable condition prior to disposal.
  - .3 Confirm with Consultant any materials scheduled for re-use that are not in re-usable condition prior to installation.

## **3 Execution**

### **3.1 General**

- .1 Exercise caution in dismantling, disconnecting of work adjacent to existing work designated to remain.
- .2 Carry out demolition in a manner to cause as little inconvenience to the adjacent properties as possible.
- .3 Carry out demolition in an orderly and careful manner.
- .4 Demolition by explosives is not permitted.
- .5 Selling or burning of materials on site is not permitted.
- .6 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated run-off or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

- .7 Lower waste materials in a controlled manner; do not drop or throw materials from heights.
- .8 At end of each day's work, leave in safe condition so that no part is in danger of toppling or falling.

### **3.2 Safety and security**

- .1 Maintain security of the building at all times during demolition work.
- .2 Provide and maintain fire prevention equipment and alarms accessible during demolition.

### **3.3 Access routes**

- .1 Restrict operations to designated access routes.
- .2 Do not obstruct roads, parking lots, sidewalks, hydrants and the like.

### **3.4 Selective demolition**

- .1 Provide necessary shoring and supports to assure safety of structure prior to cutting and coring.
- .2 Where practical, sawcut and remove material as required.
- .3 Where sawcutting is not appropriate, use suitable hand tools.
- .4 Demolish, cut-out and remove from site all other work noted on drawings or required to permit new construction.
- .5 Do not allow water to accumulate or flow beyond work area. Provide receptacles and mop-up as work proceeds.
- .6 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.
- .7 Demolish existing flooring and wall finishes, and adhesive remnants as follows:
  - .1 Floor and wall substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through new flooring and wall finishes.
- .8 Demolish completely all ceiling panels. Grid shall remain for use with new ceiling panels where indicated.

- .9 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.
  - .1 Prepare existing surfaces schedule to receive new finish by grinding, filling, over-coating, stripping, washing, etching, shot blasting or other chemical or mechanical means, as required to ensure satisfactory installation of new finish.

### **3.5 Patching and repairing**

- .1 Floors and Walls:
  - .1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
  - .2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
  - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
  - .4 Patch with durable seams that are as invisible as possible.
  - .5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
  - .6 Patch any existing areas adjoining / adjacent to new construction in good workmanship, filling and finishing gaps between finishes to allow new work to blend seamlessly with existing work.
  - .7 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
  - .8 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

### **3.6 Excessive demolition**

- .1 Where excessive demolition occurs, be responsible for cost of replacing such work.
- .2 Consultant shall determine extent of such 'over-demolition' and method of rectification.

### **3.7 Completion**

- .1 Leave project site as directed, reasonably clean and presentable, free from above grade debris, any salvaged material and/or equipment except those designated to remain.
- .2 Maintain access to exits clean and free of obstruction during removal of debris.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Cast in place concrete.

### **1.2 Related Sections**

- .1 Section 05 50 00 Metal Fabrications
- .2 Section 07 92 00 Sealants
- .3 Section 31 23 10 Excavating, trenching and backfilling

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM C260/C260M-10a (2016) Standard Specification for Air Entraining Admixtures for Concrete
  - .2 ASTM C309-19 Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete
  - .3 ASTM C330/C330M-17a Standard Specification for Lightweight Aggregates for Structural Concrete
- .2 American Concrete Institute (ACI)
  - .1 ACI 117-10 Standard Specifications for Tolerances for Concrete Construction and Materials.
  - .2 ACI 232.1R-12 Use of Raw or Processed Natural Pozzolans in Concrete
- .3 CSA Group (CSA)
  - .1 CSA-A23.1-14/ CSA-A23.2-14 Concrete Materials and Methods of Concrete Construction/ Methods of Test Methods and Standard Practice for Concrete.
  - .2 CSA A283-06 (R2011) Qualification Code for Concrete Testing Laboratories.
  - .3 CSA A3000-18 Cementitious Materials Compendium
- .4 OPSS 1212 (November 2003), Material Specification for Hot-Poured Rubberized Asphalt Joint Sealing Compound.

#### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples: Submit for inspection, material samples of specified mix designs.
- .3 Concrete Mix Designs:
  - .1 Submit concrete mix designs for review. Specify intended use for each mix design.
  - .2 Review of mix design does not relieve Contractor from responsibility for compliance with Contract Documents.
  - .3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1. Mix design shall be adjusted to prevent alkali aggregate reactivity problems.
  - .4 Provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements of CSA A23.1.
  - .5 Submit written requests for use of admixtures not specified, for site mixing of concrete, and for use of bonding agents.
  - .6 Submit in writing, proposed method of in-situ strength testing.
- .4 Inspection Reports: Inspection and Testing Company shall:
  - .1 Submit written reports of inspection and tests.
  - .2 Distribute reports as follows:
    - .1 Consultant.
    - .2 Contractor.
- .5 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 A23.1-14/A23.2 and maintain on site.
- .2 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.

### **1.6 Tolerances**

- .1 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 straight edge: 8 mm (Class A).
  - .2 2 metre straight edge: 4 mm.

### **1.7 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 (3) days

- after placing, not less than 10 °C for the next two (2) days and above freezing for the next two (2) days.
- .2 Do not permit alternate freezing and thawing for fourteen (14) 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.

## **1.8 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.



## **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/C295M Standard Guide for Petrographic Examination of Aggregates for Concrete.
- .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 no 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: Subject to compliance with requirements, provide Euclid Chemical Company; Floor Coat. or a comparable product by one of the following:

- .2 BASF Corporation - Construction Systems.
- .3 Sika Corporation
- .4 W.R. Meadows
- .5 Or reviewed equivalent
- .7 Bonding Agent: To ASTM C881/C881M, 100% reactive, 2 component, low viscosity, high modulus bonding adhesive.
- .8 Sealant: Refer to Section 07 92 00 – Sealants
- .9 Mechanical Anchors: 'Kwik' Bolts, 'Cinch' Anchors or Parabolts.

## **2.2 Concrete Mixes**

- .1 Ready Mix, with 28-day compressive strength as indicated on Drawings.
- .2 Design concrete mix in conformance with CSA A23.1, Tables 1, 2, 5 (Alternative 1) and 17, and as follows. Provide concrete meeting water/cementing materials ratio and air content of Table 14 in accordance with Class of exposure specified in following sub-paragraphs, and minimum strength specified on Drawings. Note that concrete designed in accordance with water/cementing materials ratio of Table 14 may yield strength exceeding minimum strength specified on Drawings.
  - .1 Slabs-on-Grade:
    - .1 Use Type 20 Portland cement, or replace 35 percent Portland cement with cementitious hydraulic slag.
    - .2 When mean daily temperature exceeds 25 °C at time of placement, replace 25 percent of Type 20 cement, or 50 percent of Type 10 cement, with cementitious hydraulic slag.
    - .3 Use water/cementing materials ratio 0.45 maximum.
    - .4 Use aggregates specified in paragraphs 2.1.3.
    - .5 Cementing materials content 325 kg/m.
    - .6 Modulus of rupture 3.5 MPa average, 3.0 MPa minimum.

- .7 Slump at delivery, before addition of superplasticizer, 50 mm; add superplasticizer, not water, to bring slump to level acceptable to floor finisher for placement.
- .3 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<sup>3</sup>; adjusted proportionally for maximum air content listed in CSA A23.1, Clause 15, Table 10.

### **2.3 Admixtures**

- .1 Chemical Admixture: Incorporate water-reducing admixture, type WN, in all concrete.
- .2 Air Entraining Agent: 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 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.

### **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 Commencement of work implies acceptance of existing conditions.
- .4 Confirm that surfaces on which concrete is to be placed are free of frost and water before placing.
- .5 Confirm that reinforcement, dowels, control joints, inserts and all other built in work are in place and secured.

#### **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 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 Do not place concrete in water or open frozen surfaces.
- .4 Remove contaminants which lessen concrete bond to reinforcement before concrete is placed.
- .5 Maintain accurate records of cast in place concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

- .6 Ensure that reinforcement, inserts, embedded items, formed expansion joints and the like, are not disturbed during concrete placement.
- .7 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.
- .8 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.

### **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 which architectural finishes will be adhered, the adhesives for which are incompatible with the curing compound.
  - .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 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.

- .6 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 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 00 – Cleaning and waste management.
- .2 Clear away from the building site excess and waste materials and debris resulting from Work of this Section.

**End of Section**

## **1 General**

### **1.1 Summary**

- .1 Furnish materials and accessories to complete the reconstruction of brick masonry walls.

### **1.2 Related requirements**

- .1 Section 07 92 00 Sealants

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM C73-17 Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).
  - .2 ASTM C207-18 - Standard Specification for Hydrated Lime for Masonry Purposes
  - .3 ASTM C216-19 Standard Specification for, Facing Brick (Solid Masonry Units Made of Clay or Shale)
- .2 CSA Group (CSA)
  - .1 CSA A82-14 Fired Masonry Brick Made from Clay or Shale.
  - .2 CSA A165 Series-14 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 A3000-18 Cementitious Materials Compendium
  - .6 CSA S304-14 (R2019) Design of Masonry Structures
- .3 Brick Industry Association (BIA)
  - .1 Technical Note No. 20-2006 Cleaning Brick Work.

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry products and include product



characteristics, performance criteria, physical size, finish and limitations.

- .2 Samples: submit full range of manufacturer's standard mortar colours.

## **1.5 Quality assurance**

Test Reports: submit certified test reports including sand gradation tests in accordance with CSA A179 showing compliance with specified performance characteristics and physical properties.

## **1.6 Site conditions**

- .1 Ambient Conditions: assemble and erect components only when temperature is above 4 °C.

## **1.7 Delivery, storage handling and protection**

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.
- .2 Receive and store materials as recommended by materials manufacturer.

## **2 Products**

### **2.1 Face brick**

- .1 Reuse existing salvaged brick.
- .2 When required provide new clay brick matching existing and as approved by the Owner.
  - .1 New brick when required shall be:
    - .1 Fired clay brick to CSA A82.
    - .2 Type: X.
    - .3 Grade: EG.
    - .4 Size: to match existing.
    - .5 Colour and texture: to match existing.
    - .6 Solid/hollow.

## **2.2 Mortar**

- .1 Conforming to CSA A179. Use same brand of material and source of aggregate for entire project.
- .2 Aggregate: CSA A179 coarse sharp clean sand, free from salt, alkaline or other organic substances, specifically graded for masonry use.
- .3 Cement: To CSA A3000, masonry cement. Type S. Blended mixes of Portland cement to CSA A3000 and double hydrated lime to ASTM C207.
- .4 Water shall be clean, potable and free of deleterious amounts of acid, alkalis, or organic materials.
- .5 Hydrated Lime: Type 'S' to ASTM C207.
- .6 Proprietary Mortar Mixes: Mortar mixes shall conform to mix requirements specified.
- .7 Mortar for facebrick units shall be coloured to match existing with ground coloured natural aggregates.
- .8 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.
- .9 Admixtures of any kind are not allowed except as specified for coloured mortar.

## **2.3 Grout**

- .1 Grout: to CSA A179, Table 3. Premixed, non-shrink non-metallic grout.

## **2.4 Accessories**

- .1 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.
  - .2 Lap Sealant: recommended by flashing manufacturer.
  - .3 Surface primers and conditioners as recommended by membrane manufacturer

- .2 Cavity Vents and Weepholes: purpose made PVC vents, with pest resisting design, size to suit masonry units. Colour to match mortar colour.
- .3 Ties: Prescriptive corrugated strip tie. 100 mm x 22 mm x 0.91 mm thick corrugated tie conforming to CSA A370.
- .4 Mechanical Fasteners: As recommended by manufacturer of material to be fastened, and in accordance with the reference standards, corrosion resistant.
- .5 Packing Insulation: mineral wool with minimum density of 17.6 kg/m<sup>3</sup>.

### **3 Execution**

#### **3.1 Inspection**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for brick masonry installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

#### **3.2 Preparation**

- .1 Protect adjacent finished materials from damage due to masonry work.

#### **3.3 Installation**

- .1 Construction to conform to CSA A371.
  - .1 Bond: Match existing.
  - .2 Coursing height: Match existing.
  - .3 Jointing: concave.
- .2 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.

- .3 Reinforcement: Install reinforcing in accordance with CSA A371.
- .4 Mortar Placement: conform to CSA A371.
- .5 Grout Placement: Grout masonry in accordance with CSA S304 and as indicated.
- .6 Repair/Restoration: Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.
- .7 Tolerances: To CSA A371.

### **3.4 Moisture control**

- .1 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 bonded to sheathing with adhesive, unless otherwise indicated. Lap all joints 150 mm and seal with adhesive.
- .2 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.

### **3.5 Cleaning and protection**

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Design, fabrication and erection of all structural steel.

### **1.2 Related Requirements**

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 05 50 00 Metal Fabrications
- .3 Section 09 90 00 Painting

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM A108-18 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
  - .2 ASTM A490-14a Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
- .2 CSA Group (CSA).
  - .1 CSA S16-14 Design of Steel Structures.
  - .2 CSA S136-07 North American Specification for the Design of Cold Formed Steel Structural Members, Includes Update No. 1 (2009), Update No. 2 (2010).
  - .3 CSA-W47.1-09 Certification of Companies for Fusion Welding of Steel Structures.
  - .4 CSA W48-18 Filler Metals and Allied Materials for Metal Arc Welding.
  - .5 CSA-W55.3-08 (R2013) Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .6 CSA W59-13 Welded Steel Construction (Metal Arc Welding).
  - .7 CSA W178.1-18 Certification of Welding Inspection Organizations.
  - .8 CSA W178.2-18 Certification of Welding Inspectors.
- .3 Structural Steel Painting Council

- .1 SSPC-SP 6-91 Commercial Blast Cleaning.
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
  - .1 CISC/CPMA 2-75 Quick-Drying, Primer for Use on Structural Steel.
  - .2 CISC/CPMA 1-73a Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .5 American Institute of Steel Construction (AISC)
  - .1 Code of Standard Practice for Steel Buildings and Bridges, Section 10, Architectural Exposed Structural Steel, latest edition.
- .6 The National Building Code of Canada.

#### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop and erection drawings. Submit typical details of connections and any special connections for review before preparation of shop drawings. Assume responsibility for the accuracy of Work. Review of submitted shop drawings is to ensure only that the Contract Documents are being correctly interpreted.
- .3 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.
- .4 Welded connections shall be designated by welding symbols in compliance with American Welding Society, AWS 2.068, Welding Symbols, and indicate clearly net weld lengths.
- .5 Submit design calculations if requested by the Consultant.
- .6 Submit diagrams showing methods of erection.
- .7 Field Work Drawings shall be submitted as shop drawings.
- .8 Notify Consultant in writing of any deviations in shop drawings from the requirements of the Contract Documents.
- .9 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 A325 or ASTM A490 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 Inspection and Testing Company when appointed shall carry out shop inspection to verify:
  - .1 Structural materials and paint conform to Specifications. Mill test reports, properly correlated to the materials, will be accepted in lieu of physical tests of structural materials.
  - .2 Fabrication and welding conforms to Specifications and dimensioned shop drawings.
  - .3 Shop cleaning and preparation and prime painting to conform to specified requirements.
  - .4 Surfaces inaccessible for cleaning and painting after assembly are treated before assembly.
  - .5 For surfaces painted with zinc rich paint or zinc primer, specified surface preparation is followed and specified paint thickness is applied.
- .9 Non-destructive Testing of Welded Connections: Carry out non-destructive testing of welded connections chosen at random as follows:
  - .1 Check and record steel member sizes for 20% of 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.
- .10 More frequent testing and inspection shall be completed if random tests described above are not satisfactory. These costs are to be paid by the Contractor.

## **1.9 Shipping, Handling and Storage**

- .1 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.
- .2 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.
- .3 Store structural steel off of ground on timber supports.

## **1.10 Waste Management and Disposal**

- .1 Refer to Section 01 74 00 – Cleaning and waste management.

## **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 A325.

- .4 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.

### **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 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 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 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.
- .5 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 90 00 - Painting.

- .1 Paint in accordance with manufacturer's published directions. Paint steel in the shop under cover. Keep painted members under cover until the paint has dried.
- .2 Clean and prepare surfaces, as appropriate for paint specified, in accordance with CISC/CPMA 2-75 or clean steel in compliance with SSPC SP6 where zinc rich paint is shop applied.
- .3 Where paint is applied adjacent to welded joints, remove it to bare metal for a distance of at least 50 mm beyond sides of joints.
- .4 Do not paint surfaces and edges to be field welded, contact surfaces of friction type connections assembled by high strength bolts, surfaces encased in or in contact with concrete.

### **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 A325 snug tight only bolts, and ASTM A325 or ASTM A490 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 00 – Cleaning and waste management.

**End of Section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all metal fabrications.

### **1.2 Related Sections**

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 05 12 23 Structural Steel
- .3 Section 06 10 00 Rough Carpentry
- .4 Section 06 20 00 Finish Carpentry
- .5 Section 09 90 00 Painting
- .6 Section 10 21 13 Compartments and Cubicles

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM A53/A53M-20 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
  - .2 ASTM A123/A123M-17 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A153/A153M-16a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .4 ASTM A240/A240M-20 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  - .5 ASTM A264-12(2019) Standard Specification for Stainless Chromium-Nickel Steel-Clad Plate
  - .6 ASTM A269/A269M-15a (2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel for General Service
  - .7 ASTM A276/A276M-17 Standard Specification for Stainless Steel Bars and Shapes
  - .8 ASTM A307-14e1 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

- .9 ASTM A312/A312M-19 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- .10 ASTM A380/A380M-17 Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
- .11 ASTM A511/A511M-20 Standard Specification for Seamless Stainless Steel Mechanical Tubing and Hollow Bar
- .12 ASTM A1008/A1008M-20 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High Strength Low Alloy, High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- .13 ASTM A1011/A1011M-18a Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- .14 ASTM C1107/C1107M-20 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- .15 ASTM D1187/D1187M-97(2018) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- .16 ASTM D6386-16a Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
- .17 ASTM F593-17 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- .18 ASTM F594-09(2020) Standard Specification for Stainless Steel Nuts
- .19 ASTM A385/A385M-20 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
- .20 ASTM F3125/F3125M-19e2 Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
- .2 CSA Group (CSA)
  - .1 CSA G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel.



- .2 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA-S16.1-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
- .3 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.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
- .5 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.
- .6 American Welding Society AWS D1.6, Structural Welding Code - Stainless Steel

#### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit Shop and Erection Drawings for review.
  - .2 Verify site dimensions before proceeding with shop fabrication and to suit field conditions and field openings.
  - .3 Show and describe in detail all the work of this Section including large scale detail of members and materials, of connection and jointing details, and of anchorage devices, dimensions, thicknesses, description of materials, metal finishing, as well as all

other pertinent data and information, including type, size and description of all fasteners and anchors.

- .4 Indicate connections to building structure.
- .5 Shop drawings for all metal fabrications shall be stamped and signed by a Professional Engineer registered in the Province of Ontario. Each submission of the shop drawings shall bear the seal of the Engineer.
- .3 Submit duplicate minimum 300 x 300 mm samples of stainless steel materials in specified finish.

### **1.5 Qualifications**

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

### **1.6 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, online, level and true.

### **1.7 Shipping, Handling and Storage**

- .1 Label, tag or otherwise mark work supplied for installation by other Sections to indicate its function, location and shop drawing description.
- .2 Protect work from damage and deliver to a location at the site in order to meet the scheduling requirements.

- .3 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.

## **1.8 Waste Management and Disposal**

- .1 Refer to Section 01 74 00 – Cleaning and waste management.

## **2 Products**

### **2.1 Materials**

- .1 Structural Steel Sections and Steel Plate: CSA G40.20-13/G40.21-13, Grade 350W.
- .2 Architectural and Miscellaneous Mild Steel: CSA G40.20-13/G40.21-13, Grade 300W.
- .3 High Strength Bolts and Nuts: ASTM F3125. Dimensions, sizes, thread, strength, quality and type of items shall be designed for the work intended. Exposed fasteners and anchors shall be same material, colour and finish as the metal to which they are applied.
- .4 Sheet Steel: (Commercial Quality) ASTM A1008 stretcher leveled or temper rolled.
- .5 Steel Pipe: ASTM A53 Schedule 40, Grade B.
- .6 Welding Materials: CSA W59.
- .7 Welding Electrodes: CSA W48 Series.
- .8 Sulphur: Commercial Grade for setting of steel posts.
- .9 Grout: non-shrink, non-metallic, non-stain, flowable, to ASTM C1107, 15 MPa at 24 hours.
- .10 Isolation Coating: Alkali resistant bituminous paint to ASTM D1187.
- .11 Adhesive Anchors: HILTI or Rawl Epoxy Adhesive Anchors sized to suit loading conditions, suitable for substrate. Adhesive to be low VOC type (maximum 250 g/l) to SCAQMD Rule 1168-03, Adhesives and Sealants Applications.

## 2.2 Stainless Steel

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

## 2.3 Finishes

- .1 Primers: All primers for metal fabrications are to be factory applied under the requirements of this Section. Refer to Finish Schedules in Section 09 90 00 for types of primers required for each application. Colour to be grey.
- .2 Pre Paint Finish: For galvanized surfaces to be exposed and finish painted, to ASTM D6386.
- .3 Galvanizing: hot dipped with zinc coating to CSA G164, ASTM A123 or ASTM A385.
  - .1 Bolts, nuts, washers, iron, and steel hardware components shall be galvanized in accordance with CSA G164 or ASTM A153.
  - .2 Galvanized coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips: Galvanized after all welding and grinding complete. No welding or grinding of galvanized products allowed.
- .4 Zinc Rich Primer: zinc rich, organic, ready mix to CAN/CGSB 1.181. Low VOC type.
- .5 Stainless Steel: NAAMM AMP-504 Finish No. 4.

### **3 Execution**

#### **3.1 Fabrication**

- .1 Fabricate to reviewed shop drawings and in general to details, sizes and materials indicated on drawings and specified herein.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Fabricate work complete with all components required for anchoring; bolting or welding to structural frame; standing free or resting in frames or sockets; in a safe and sure manner.
- .4 Where possible fit and shop assemble various sections of the work and deliver to site in largest practicable sections. Where shop fabricating is not possible, make trial assembly in shop.
- .5 Ensure exposed welds are continuous for length of each joint.
- .6 Grind and fill all welds after inspection and acceptance and leave ready for prime painting.
- .7 Fill all open joints, depressions, seams with metallic paste filler or by continuous brazing or welding and grind smooth to true sharp arises and profiles.
- .8 Fit joints and intersecting members accurately. Make work in true planes with adequate fastenings.
- .9 Supply all fastenings, anchors, accessories required for fabrication and erection of work of this Section. Make thread dimensions such that nuts and bolts will fit without re-threading or chasing threads.
- .10 Welding shall be done by the shielded metal-arc method in accordance with the requirements CSA W59 and AWS D1.6 for stainless steel. The welding operators shall be currently certified under CSA W47.1 for the work they are performing.
- .11 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.

- .12 Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter. Where weld material is deposited in two or more layers, each layer shall be cleaned before the next layer is deposited. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by approved methods.
- .13 Appearance, quality of welds made, methods of correcting defective work shall be in accordance with CSA W59.

### **3.2 Shop Drawings**

- .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 90 00, and ASTM D6386.
  - .3 Steel to receive a shop or field paint finish shall be cleaned in accordance with Sections 09 90 00 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 90 00.
- .4 All other concealed or unpainted ferrous metal work shall be given one prime paint coat type CGSB 1.40 and in accordance with CISC/CPMA 2-75. Work paint into all corners and all joints. Metal parts in contact shall be primed before shop assembly. Priming damaged during erection or through lack of protection shall be cleaned and touched up.
- .5 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 °C.
- .6 Metals in contact with other dissimilar metals, concrete or masonry materials shall be insulated or separated from one another to prevent corrosion, staining or electrolysis by use of bituminous paint.

### **3.3 Galvanizing**

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

- .3 Adhesion: the galvanized coating shall be sufficiently adherent to withstand normal handling.

### **3.4 Miscellaneous framing and supports**

- .1 General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- .2 Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- .3 Fabricate units from slotted channel framing where indicated.
- .4 Furnish inserts for units installed after concrete is placed.
- .5 Galvanize miscellaneous framing and supports where indicated.
- .6 Prime miscellaneous framing and supports with primer specified in Section 09 90 00 - Painting.

### **3.5 Angle lintels**

- .1 Provide all loose steel angle lintels required to support openings and recesses in masonry walls, whether indicated on the drawings or not. Refer to Architectural, Structural and Mechanical drawings for locations of openings. Lintels shall be as scheduled on the Structural drawings.
- .2 Steel angles: CSA G40.21, Grade 300W, sizes indicated for openings. Provide 150 mm minimum bearing at ends unless otherwise indicated.
- .3 Weld or bolt back-to-back angles to profiles as indicated.
- .4 Supply for installation by Sections 04 21 13.
  - .1 Lintels shall be prime painted unless otherwise indicated.

### **3.6 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.



### **3.7 Stainless steel tables and counters**

- .1 Fabricate stainless steel tables and counters as detailed complete with adjustable legs, shelves and countertops. All edges shall be hemmed.
- .2 Counter tops and shelves shall be 1.2mm type 304 stainless steel, satin finish. 19mm return edge; front edge shall be hemmed. Brackets fabricated from 1.6mm stainless steel to match.
- .3 Fabricate backsplash and sidesplash to sizes indicated of not less than 0.953 mm thick stainless steel.
- .4 Fabricate table legs from 316L Marine Grade stainless steel tube, 50 mm diameter, with minimum 3.7 mm wall thickness. Legs shall be adjustable.
- .5 Pre-drill brackets for anchoring as detailed.

### **3.8 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.

### **3.9 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.

### **3.10 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.

### **3.11 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.

### **3.12 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 90 00 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.

### **3.13 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Clean exposed prefinished and plated items and items fabricated from stainless steel as recommended by the metal manufacturer and protect from damage until Substantial Performance of the project.

**End of Section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all rough carpentry.

### **1.2 Related requirements**

- .1 Section 03 30 00 Cast-In-Place Concrete
- .2 Section 05 50 00 Metal Fabrications
- .3 Section 06 20 00 Finish Carpentry
- .4 Section 08 11 00 Metal Doors and Frames
- .5 Section 10 51 23 Phenolic Lockers

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .3 ASTM F1667 – 18a Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .2 CSA Group (CSA)
  - .1 CSA A247- M86 (R1996) Insulating Fiberboard.
  - .2 CSA B111-1974(R2003) Wire Nails, Spikes and Staples.
  - .3 CSA G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .4 CSA O80 SERIES-15 Wood Preservation
  - .5 CSA O86-14 Engineering Design in Wood
  - .6 CSA O121-17 Douglas Fir Plywood.
  - .7 CSA O141-05 (R2014) Softwood Lumber
  - .8 CSA O151-17 Canadian Softwood Plywood
  - .9 CSA O437 Series-93 (R2011) Standards on OSB and Waferboard
  - .10 CSA Z809-08 Sustainable Forest Management

- .3 Underwriters Laboratories Canada (ULC)
  - .1 ULC 102-2018 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .4 National Lumber Grading Authority (NGLA)
  - .1 Standard Grading Rules for Canadian Lumber, Latest Edition.
- .5 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001-2004 FSC Principle and Criteria for Forest Stewardship.
  - .2 FSC-STD-20-002-2004 Structure and Content of Forest Stewardship Standards V2-1
- .6 FSC Accredited Certified Bodies.

#### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Certified Wood:
  - .1 Submit listing of wood products and materials used, produced from wood obtained from forests certified by FSC Accredited Certification Body in accordance with FSC-STD-01-001.

#### **1.5 Quality assurance**

- .1 Sawn lumber shall be identified by the grade stamp of an association or independent grading agency certified by the Canadian Lumber Standards Accreditation Board.
- .2 Certified Wood: submit listing of wood products and materials used in accordance with CSA Z809 or FSC or SFI.

#### **1.6 Delivery, storage, handling and protection**

- .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 00 – Cleaning and waste management.

## **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 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.
  - .2 Poplar Plywood: to CSA 0153, standard construction.
  - .3 Mat formed structural panel board (oriented strand board): to CSA O437.0, square edge, 12.7 mm thickness.
- .5 Nails, Spikes and Staples: To ASTM F1667.
- .6 Bolts: 12.5 mm diameter, galvanized, complete with nuts and washers.
- .7 Proprietary Fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

- .8 Nailing Discs: flat caps, minimum 25 mm diameter, minimum 0,627 mm thick, sheet metal, formed to prevent dishing.
- .9 Wood Preservative to CSA O80 SERIES.
- .10 Adhesive: Contractors gun grade cartridge loaded wood adhesive, general purpose, to CSA 0112 Series and CAN/CGSB-71.26.
- .11 Vapour Retardant: 0.152 mm polyethylene film to CGSB 51.34 Type 1.
- .12 Fibreglass Insulation: to CSA A101, loose batt type, minimum density of 24 kg/m<sup>3</sup>.
- .13 Galvanizing: to CAN/CSA-G164. Use galvanized fasteners, and hardware for exterior work, preservative treated lumber, and materials in contact with concrete or masonry.

### **3 Execution**

#### **3.1 Installation**

- .1 Workmanship
  - .1 Execute work using skilled mechanics according to best practice, as specified here.
  - .2 Lay out work carefully and to accommodate work of other trades. Accurately cut and fit; erect in proper position true to dimensions; align, level, square, plumb, adequately brace, and secure permanently in place. Join work only over solid backing.
- .2 Rough Hardware: Include rough hardware such as nails, bolts, nuts, washers, screws, clips, hangers, connectors, strap iron, and operating hardware for temporary enclosures.
- .3 Provide treated wood nailers, blocking, cants, grounds, furring and similar members where shown and where required for screeding or attachment of other work and surface applied items. Attach to substrate as required to support applied loading.
- .4 Electrical Equipment Backboard: provide backboards for mounting electrical equipment as indicated. Use 19 mm thick fir face veneer fire retardant softwood plywood on 19 mm x 38 mm furring around perimeter and at maximum of 305 mm intermediate spacing.



- .1 Install plywood backboards with countersunk screws.
- .5 Blocking: Provide solid wood backing to support equipment and fixtures as required.
- .6 Provide plywood backing (2 layers  $\frac{3}{4}$ " plywood) in interior partitions as indicated and detailed on Dental consultant plans for support of X ray equipment.

### **3.2 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply all labour, materials, equipment, services and perform all operations required to complete all finish carpentry, millwork and fitment installation including but not limited to the following:
  - .1 Interior millwork
  - .2 Site fabricated and installed shelving and closet rods
  - .3 Hardware
  - .4 High pressure decorative laminate
  - .5 Stainless steel countertops
  - .6 Installation of metal and wood doors and finishing hardware, and all other items, to the full intent of the drawings and as herein specified.

### **1.2 Related requirements**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 06 61 16 Solid Surfacing
- .3 Section 07 92 00 Sealants
- .4 Section 08 11 00 Metal Doors and Frames
- .5 Section 08 14 16 Flush Wood Doors
- .6 Section 08 50 00 Aluminum Doors and Screen
- .7 Section 08 70 00 Hardware
- .8 Section 09 21 16 Gypsum Wallboard
- .9 Section 09 30 00 Tiling
- .10 Section 09 65 00 Resilient Flooring and Accessories
- .11 Section 09 90 00 Painting
- .12 Section 10 21 13 Compartments and Cubicles
- .13 Section 10 28 13 Washroom Accessories
- .14 Section 10 51 23 Phenolic Lockers

### **1.3 Quality assurance**

- .1 Contractor executing work of this section shall have a minimum of five (5) years continuous Canadian experience in successful manufacture/fabrication and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- .2 Follow applicable requirements of The Architectural Woodwork Manufacturer's Association of Canada (AWMAC) Standard for Millwork latest edition, including supplements and modifications.
- .3 Unless otherwise indicated on drawings, all millwork shall be Custom Grade, in accordance with AWMAC standards.
- .4 Supplements and modifications to the above standards as indicated on the drawings or as specified herein shall govern work of this section.
- .5 All millwork shall meet the requirements of Infection Prevention and Control Canada (IPAC) standards.

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Samples for Verification: Submit two (2) samples prior to fabrication of millwork as follows; accepted samples will form the standard of acceptance for the remainder of the work:
  - .1 High pressure decorative laminate for finishing of millwork
  - .2 Exposed Fasteners, Hardware and Accessories: One unit for each type and finish.
- .3 Shop Drawings:
  - .1 Submit detailed shop drawings of all shop fabricated finish carpentry components.

### **1.5 Administrative requirements**

- .1 Coordination: Coordinate sizes and locations of framing, blocking, furring, and reinforcements provided by work that is specified in other Sections is complete before starting work of this Section.

- .2 Pre-Construction Meeting: Arrange a preconstruction meeting in accordance with Section 01 31 19 attended by Contractors personnel, Consultant, finish carpentry Subcontractor to discuss:
  - .1 Installation requirements
  - .2 Special surface effects and finishing
  - .3 Coordination of work with adjacent finishes
  - .4 Protection of finishes
  - .5 Acceptability of substrates and quality of materials being used for the project

### **1.6 Delivery, storage, handling & protection**

- .1 Do not permit delivery of work of this section to site until area is sufficiently dry so that woodwork will not be damage by excessive changes in moisture content.
- .2 Coordinate deliveries to comply with construction schedules and arrange ahead for under cover storage location.
- .3 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect material with suitable non-staining waterproof coverings.
- .4 Store material in original, undamaged containers or wrappings.
- .5 Unsatisfactory materials shall be promptly removed from the site.
- .6 Adequately protect the structure and work of other sections during delivery, storage, handling and execution of the work of this section.
- .7 Provide tools, plant and other equipment required for the proper execution of the work of this section.

### **1.7 Site conditions**

- .1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on Shop Drawings where casework is indicated to fit walls and other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work; locate concealed framing, blocking, and reinforcements that support

woodwork by site measurements before being enclosed and indicate measurements on Shop Drawings.

- .2 Established Dimensions: Establish dimensions and proceed with fabricating casework without confirmed site measurements where site measurements cannot be made without delaying the Work; coordinate with the construction to ensure that actual dimensions correspond to established dimensions; allow for trimming and fitting.
- .3 Ambient Conditions: Maintain area or room in which casework is being installed at a uniform temperature and humidity for 24 hours prior to, during and after installation in accordance with AWS for relative humidity and moisture content; provide additional lighting to maintain a minimum of 430 lx on surfaces and areas where casework is being installed.

## **1.8 Warranty**

- .1 Warrant plastic laminate work of this Section against defects in materials and workmanship in accordance with General Conditions, as modified by the Supplementary Conditions, but for an extended period of two (2) years and agree to repair or replace faulty materials or work which appears during the extended warranty period, without cost to the Owner/Tenant. Defects shall include but not be limited to, opening of joints, cracking, shrinkage, warpage, delamination of plastic laminate.

## **2 Products**

### **2.1 Materials**

- .1 Framing Lumber:
  - .1 Lumber for structural components shall be of species and grade specified, well seasoned, and processed and stamped at same mill with appropriate grade markings. Conform to requirements of standard grading rule for Canadian lumber of Nation Lumber Grades Authority (NLGA) latest issue, approved by Canadian Lumber Standards Administrative Board, as follows:
    - .1 Rough Carpentry for built-in work: No. 2 select grade Ontario white pine.

- .2 Blocking, Ground, Furring and Strapping, Bucks and Nailing Strips: C.L.A. No. 1 grade pine, kiln dried stock.
- .3 Non-Exposed Softwood: Fabricator's option, meeting requirements of CAN/CSA O141-05(R2009), kiln dried for interior use to a moisture content of 4% to 8%, and 7% to 10% for exterior use; Surface 4 sides (S4S).
- .2 Hardwood: Oak, Birch, Ash, Maple or other species, as indicated on drawings and conforms to requirements of AWMAC Custom Grade and NHLA Select Grade.
- .3 Panel Materials:
  - .1 Plywood: Douglas Fir veneer core plywood, 19mm (3/4") thick or thickness as indicated on drawings, Select Sheathing-Tight Face, good two sides, sanded "B" faces and conforms to CSA 0121.
  - .2 Particleboard: ANSI A208.1, 700 kg/m<sup>3</sup> density.
  - .3 Medium density fibreboard (MDF): ANSI A208.2, density minimum 750 kg/m<sup>3</sup>, moisture resistant; standard of acceptance: Premier Plus MR MDF by Flakeboard.
- .4 Glue: CSA 0112, Type 1. Water-resistant urea-formaldehyde free resin glue.
- .5 Plastic Laminate Covered Components:
  - .1 Plastic laminate face sheets: High pressure, paper based, melamine surfaced, laminated plastic sheets, conforming to CAN3-A172, with thickness tolerances in accordance with Table 1 of CAN3-A172 and plastic laminate grades as follows:
    - .1 General Purpose Grade (GP): Minimum 1.27mm thick.
    - .2 Post-forming Grade (PF): Minimum 1.06mm thick.
  - .2 Plastic laminate face sheet colour, gloss and texture: As selected by the Consultant from the manufacturer's standard product line.
  - .3 Plastic laminate backing and liner sheets: High pressure, paper based, melamine surfaced, laminated plastic backing sheets, conforming to CAN3-A172, backing grade (BK), minimum 0.5mm thick, colour as selected later by Consultant and by manufacturer of plastic laminate face sheets.

- .4 Cores: Douglas Fir veneer core plywood, Select Sheathing-Tight Face, good two sides, sanded "B" faces and conforms to CSA 0121-08, or Canadian Softwood Ply veneer core plywood, Select Sheathing-Tight Face, good two sides, sanded "B" faces and conforms to CSA 0151-09, 19mm thick or thicknesses as indicated on drawings. Provide exterior, waterproof grade plywood veneer core for countertops to receive sinks and in "wet areas".
- .5 Laminating Adhesive: CSA-0112, water resistant type.
- .6 Draw Bolt Fasteners: 'K&V 516' by Knappe & Vogt Canada. No substitutions allowed.
- .6 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.
- .7 Rough Hardware:
  - .1 Provide required rough hardware to frame and fix all finished carpentry and include for expansion shields, nails, spikes, screws, bolts, anchors, clips, plates, washers, rods, wires, wall brackets, chrome finishing trim, and other ironmongery which may be required. All wood screws shall be drill thread screws except at chipboard where self-tapping screws shall be used. All rough hardware shall be galvanized unless otherwise noted.
- .8 Solid Core Doors: to CSA 0132.2-M1977, flush doors, 35 mm thick, face veneer and edge banding matching adjacent cabinetwork.
- .9 Stainless Steel Countertops
  - .1 Sheet: ASTM A240, 16 gauge, Type 304 alloy.
  - .2 Finish: Unless otherwise indicated, AISI No. 4 Brushed Finish

- .3 Square edge profile with 13 mm return, laminated to 38 mm thick moisture resistant MDF with 100 mm high backsplash.
- .10 Cabinet hardware: to ANSI/BHMA A156.9.
  - .1 Hinges: concealed hinges, 125° clip and 125° opening with self-closing spring. Full or half overlay. Nickel plated steel.
  - .2 Pulls: back mounted pull, D pull, brushed stainless steel.
  - .3 Catches: magnetic.
  - .4 Drawer slides: sift close, full extension drawer slide. Side mounted.
  - .5 Shelf Standards: Recessed aluminum pilasters, slotted, 500 lb capacity, BHMA Grade 1 compliant with steel shelf support clips.
  - .6 Cabinet Locks: pressure cast case, brass cylinder, pin tumbler MK & KA by room.
  - .7 Door and Drawer Bumpers: Urethane sound and vibration dampening bumpers.
  - .8 Desk Grommet Cable Outlet: plastic cable grommet with removable cap.
  - .9 Provide other hardware and hardware accessories as detailed or required.
  - .10 All exposed hardware to have Platinum (Mica) finish or equivalent unless noted otherwise.

## **2.2 Fabrication and workmanship**

- .1 Work shall be executed by skilled carpenters under the supervision of a competent carpentry foreman. All items shall be shop assembled, insofar as is practical. Unless indicated otherwise comply with AWMAC Custom Grade requirements.
- .2 Make thorough examination of drawings and details, check anchorage, interfacing with work of other sections and other factors influencing the installation of the work and be fully cognizant of requirements.
- .3 Finished woodwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity of colour, grain and texture.



- .4 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other sections.
- .5 Fabricate the work in a manner which will permit expansion and contraction of the materials without visible open joints.
- .6 Mitre exposed corners. No end grain shall be visible in completed installation.
- .7 Provide solid wood edging at exposed plywood edges.
- .8 Provide wood mouldings to profiles as indicated on drawings.
- .9 Jointing of shop assembled work shall be by means of mortise and tenons, dowels, stub tenons, dovetails, dadoes, lock joints as applicable for the jointing condition.
- .10 Accurately cut, mitre, fit and framework together to produce tight hairline joints, rigidly secured together in a permanent manner using glue, blind screw fixing or nails. Use concealed glue blocks for additional strength where possible.
- .11 Finished woodwork shall be in one piece wherever possible and all trim shall be in long lengths. Where jointing is necessary in the length, the joints between pieces shall be scarfed, glued and properly fastened. The material being jointed shall match reasonably well for grain and colour where natural finish is specified. Joints between lengths where paint finish is to be applied may be finger jointed in lieu of scarfing. Trim shall be accurately cut and mitred at all corners, glued and properly fastened.
- .12 Machine dressed work shall be properly machine using sharp cutters, the finished work shall be free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding.
- .13 Finished woodwork shall be carefully hand sanded after installation to remove roughness and planer marks. Sanding shall be done with the grain of the wood and finished with fine grit paper to leave a smooth scratch-free surface suitable to receive the paint or natural finishes to be applied over as specified in Section 09 90 00.

- .14 Nail heads in the finished surfaces shall be set with straight shank nail sets. Screw and bolt heads in finished surfaces shall be let into the work and capped with edge grain wood caps dressed and finished flush.
- .15 Provide cutouts for sinks, fixtures, fittings, inserts, outlet boxes, services, other mechanical and electrical items and appliances. Round corners, and chamfer edges. Where items for cutouts butt to underside or back of finished surface, finish exposed edge to match face. Where item covers cutout, and at all concealed cut edges of core material, apply uniform coating of seal to cut edges.
- .16 The finished work shall be of a high quality, with all corners having exact angles to ensure no swerve or twisting. All bends, crimps or angle parts shall be produced by professional equipment and tools for this purpose and if long runs or repeats are required, such shall be produced in the shop, or have proper equipment on site.
- .17 Edging Treatment:
  - .1 Provide Self Edge Laminate: HPDL, colour matching cabinet work, as indicated on the Drawings.
- .18 Plastic Laminate Covered Components:
  - .1 Meet requirements of CAN3-A172, Appendix A.
  - .2 Bond plastic laminate to core with adhesive using pressure. Provide balanced construction with plastic laminate face sheet on exposed sides of core and backer/liner sheet. Finish drawers with liner sheet on both sides of core for balanced construction.
  - .3 Unless otherwise detailed, provide 19mm (3/4") thick core.
  - .4 Apply plastic laminate to core material in accordance with adhesive manufacturer's instructions. Provide same core and laminate profiles to provide continuous support and bond over entire surface.
  - .5 Use continuous lengths up to 2439 mm (8 ft.). Keep joints 610 mm (2 ft.) from cutouts and in locations indicated on reviewed shop drawings.
  - .6 Locate joints, where required at 2439 mm to 3048 mm (8 ft. to 10 ft.) O.C. At L-shaped corners mitre plastic laminate, to the outside corner. Accurately fit members together to provide tight and flush butt joints, in true planes. Provide 6 mm (1/4") blind

- spline and approved type draw bolts; one draw bolt for widths up to 150 mm (6") at maximum 457 mm (18") centres for widths exceeding 150 mm (6"). Colour-match adjoining units.
- .7 Form shaped profiles and bends using postforming grade laminate to laminate manufacturer's instructions.
  - .8 Where curved or bent surfaces are required for counters, backsplashes and other areas, use postforming laminate.
  - .9 Self-edge straight-line-edging with general purpose laminate and radius corners with postforming laminate, of same colour and finish as facing sheet, to cover exposed edges of core material. Apply with same adhesive as facing sheet. Chamfer edges uniformly at approximately 20° using machine router. Do not mitre laminate edges.
  - .10 Fabricate horizontal wearing surfaces including counters, shelves, both sides of removable shelves, cabinet doors and drawer fronts, of general purpose laminate except where postforming is required.
  - .11 Use general purpose laminate for exposed vertical surfaces except where otherwise specified or indicated.
  - .12 Apply plastic laminate backing sheet to reverse side of core of plastic laminate finished work including under counter tops and concealed portions of plastic laminate faced work. Provide backing sheet of specified minimum thickness, increased as required to compensate stresses caused by facing sheet.
  - .13 Apply laminated plastic liner sheet to interior of cabinetry unless indicated otherwise.
  - .14 Where cutouts are required in countertops for items that butt to underside of top only, trim edges of opening with postforming laminate. Use radiused corners and chamfer edges around cutouts to avoid chipping laminate. Where item covers cutout, apply uniform coating of sealer to cut edges.
  - .15 Assemble work, true and square. Arrange adjacent parts of continuous laminate work to match in colour and pattern.

### **2.3 Moisture content**

- .1 Moisture content of interior woodwork shall be between 8% and 12%.

## **2.4 Finishes**

- .1 Finishes shall match approved finished samples of wood treatment submitted by this section for each species of wood required. Wood items provided under this section shall be finished as part of the work of this section.
- .2 Apply stain to items where scheduled, indicated or as directed Consultant, providing uniform required stain colour(s).
- .3 Provide finishes as indicated on drawings and scheduled, in accordance with requirements of Section 09 90 00.

## **3 Execution**

### **3.1 Examination**

- .1 Inspect available spaces and check surfaces over which the work of this section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those on the Contract Documents and/or detrimental to the proper and timely installation of the work of this section. The decision regarding correct measures shall be obtained from the Consultant prior to proceeding with the affected work.
- .2 Check humidity in building with moisture reading instruments if doubt exists that building is sufficiently dry and ready to receive millwork. Do not proceed until unsatisfactory conditions are corrected.
- .3 Commencement of work indicates acceptance of surfaces and conditions.

### **3.2 Installation - general**

- .1 Provide and fit in place all furring, strapping, battens, grounds and blocking required to provide adequate properly placed fixing for all finish carpentry work and as required for the work of other sections.
- .2 Refer to drawings and coordinate with drywall, the painting and floor covering sections to establish sequence of installation or execution of each others' work. Pay particular attention to areas where materials are supplied by others and installed under this Contract.

- .3 All nails where their use is permitted, shall be long enough so that at least half their length penetrates into the second member. Splitting of wood members shall be minimized by staggering the nails in the direction of the grain and by keeping nails well in from edges.
- .4 Unless otherwise permitted by Consultant, fasten finish carpentry components in concealed manner.
- .5 Plastic laminate work shall be free of cracks and chipped or broken edges. Replace damaged components.
- .6 Fitments shall be installed level, plumb and true and complete in all respects.
- .7 Fit small scribe moulds of same material as fitment to hide voids at junction of fitment to fitment and fitment to walls, partitions, ceilings, furrings.

### **3.3 Priming**

- .1 Immediately in instances where primed work is cut (as for fitting), a coat of primer shall be applied to the resulting raw surfaces.

### **3.4 Installation - finishing hardware**

- .1 Take delivery of all finishing hardware and install. Check each item as received.
- .2 Set, fit and adjust hardware according to manufacturer's directions at heights directed by Consultant. Hardware shall operate freely. Protect installed hardware from damage and paint spotting.
- .3 Install all hardware for hollow metal doors including hinges. Prepare wood doors for installation with required bevels, clearances and mortices for hardware. Install wood doors, door grilles and all applicable hardware.
- .4 Pre-drill kickplates and doors before attachment of plates. Apply with water-resistant adhesive and countersunk stainless-steel screws.

### **3.5 Installation - weatherstripping**

- .1 Obtain weatherstripping from other Section. Install weatherstripping at exterior hollow metal doors. Install effectively to tightly seal entire perimeter of door. Secure in place with non-ferrous screws, in accurate

alignment. Maintain integrity of weatherseal at head of doors fitted with closers. Adapt weatherstripping as required to achieve specified performance and provide any necessary accessories.

### **3.6 Installation - hollow metal door frames**

- .1 Receive hollow metal door frames from Section 08 11 00. Set frames in place, temporarily brace until built-in to adjacent construction. Remove bracing following permanent anchorage.
- .2 Co-operate with other Sections in locating frames. Shim up where required to ensure proper alignment and dimensions from finished floor to door head.

### **3.7 Installation - hollow metal doors**

- .1 Fit, hang and adjust plumb and true, maintaining uniform widths and heights. Fit all hardware and adjust for ease of operation. Leave 3 mm clearance at heads and jambs and 10 mm at sills.
- .2 Re-adjust and check doors upon completion of the building. Correct any restriction to free action of door.
- .3 If lock or latch set is installed before doors receive final finish by painter, remove such hardware prior to painter's work and re-install when finish completed.
- .4 Where door frames are not satisfactory for the proper installation of doors, correct condition prior to installation.

### **3.8 Installation - wood doors**

- .1 Be responsible for damage to doors until acceptance by Consultant after installation.
- .2 Fit and install doors complete with all hardware. Be responsible for the correct fitting of all doors. Warped or damaged doors will be rejected.
- .3 Maintain an even clearance not exceeding 4.7 mm between door and frame on all sides to allow free action of doors.
- .4 After trimming doors, have Section 09 90 00 seal top and bottom edges of doors.

- .5 Re-adjust and check doors upon completion of the building. Correct any restriction to free action of door.
- .6 If lock of latch set is installed before doors receive final finish by painter, remove such hardware prior to painter's work and re-install when finish completed.
- .7 Where door frames are not satisfactory for the proper installation of doors, correct condition prior to installation.

### **3.9 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all solid surfacing.

### **1.2 Related requirements**

- .1 Section 06 20 00 Finish Carpentry
- .2 Section 07 92 00 Sealants

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM G22 - 76(1996) Standard Practice for Determining Resistance of Plastics to Bacteria (Withdrawn 2002)
- .2 Architectural Woodwork Institute (AWI)
  - .1 AWI/AWMAC/WI's Architectural Woodwork Standards.
- .3 International Surface Fabricators Association (ISFA)
  - .1 ISFA 2-01 (2013) Classification and Standards for Solid Surfacing Material
- .4 American National Standards Institute (ANSI)
  - .1 ANSI ICPA-SS-1 (2001) Performance Standard for Solid Surface Materials
- .5 CSA Group (CSA)
  - .1 CSA O151-17 Canadian Softwood Plywood

### **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.
  - .1 Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated.
- .3 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 Delivery, storage, handling and protection**

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .2 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.
- .3 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 00 – Cleaning and waste management.

### **1.9 Warranty**

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

## **2 Products**

### **2.1 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 Bacterial Resistance: Pass; ASTM G22.
- .6 Pattern and Finish: Colour to be selected by the Consultant from manufacturer's full range of available selections.

- .7 Plywood: Exterior softwood plywood complying with CSA O151, CSP, B1 face, C-C inner plies and back. Touch Sanded. Thickness as indicated.

## **2.2 Accessory Materials**

- .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.

## **2.3 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.

**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 approved 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 Apply mildew resistant silicone sealant to perimeter of all countertops 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 00 – Cleaning and waste management.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Building insulation not specified elsewhere.

### **1.2 Related requirements**

- .1 Section 07 21 29 Sprayed 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 54 23 TPO Roofing
- .6 Section 09 21 16 Gypsum Wallboard

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM C518-17 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .2 ASTM C612-14 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
  - .3 ASTM E84-17a 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 702.1 Standard for Thermal Insulation Mineral Fibre for Buildings

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.

- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Submit insulation manufacturer's product literature including specified physical properties for each type of insulation specified.
  - .2 Submit installation instructions.
  - .3 Submit certification that product complies with specification requirements and is suitable for the use indicated.
  - .4 Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

### **1.5 Quality assurance**

- .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 Site conditions**

- .1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

### **1.7 Delivery, storage handling and protection**

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



## **2 Products**

### **2.1 Materials**

- .1 Spray Foam Insulation: one component expanding polyurethane or polyisocyanurate foam, ULC approved and compatible with rigid insulating materials, with Class 1 fire rating to ASTM E84 for window and door frame application.
- .2 Batt Insulation: Fibreglass friction fit batts to CSA A101-M, Type 1 or mineral fibre to ULC 702.1 Type 1 for wall application, width and thickness as shown on details.

### **2.2 Accessories**

- .1 Rough Hardware: Nails and staples as required for installation of insulation and membrane materials, galvanized to CSA B111 and B34.
- .2 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.
- .3 Vapour Retarder: As specified in Section 07 26 00.

## **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 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 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.

### **3.3 Batt Insulation**

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces. Ensure that insulation is kept dry and not compressed.
- .2 Install insulation in spaces as shown on drawings.
- .3 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.
- .4 Pack loose insulation into voids around mechanical and electrical pipes and ducts where they pass through walls and slabs.

### **3.4 Cleaning and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.
- .2 Remove all waste materials from site. Leave work in a condition satisfactory to the Consultant.

**End of section**

## **1 General**

### **1.1 Section Includes**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Requirements**

- .1 Section 07 21 13 Building Insulation
- .2 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .3 Section 07 92 00 Sealants
- .4 Section 09 21 16 Gypsum Board

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM D1621-16 Standard Test Method for Compressive Properties of Rigid Cellular Plastics
  - .2 ASTM D1622-20 Standard Test Method for Apparent Density of Rigid Cellular Plastics
  - .3 ASTM D1623-17 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
  - .4 ASTM D2842-19 Standard Test Method for Water Absorption of Rigid Cellular Plastics
  - .5 ASTM D6226-15 Standard Test Method for Open Cell Content of Rigid Cellular Plastics
  - .6 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
  - .7 ASTM E283-19 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - .8 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

- .2 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 102-18 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  - .2 ULC 705.1-15 Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Third Edition.
  - .3 ULC 705.2-05 Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application
  - .4 ULC 770-15 Standard Test Method for Determination of Long-term Thermal Resistance of Closed-Cell Thermal Insulating Foams
- .3 Canadian Urethane Foam Contractors Association (CUFCA)
  - .1 Manual for Installers of Spray Polyurethane Foam Thermal Insulation,
  - .2 Quality Assurance Program.
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-03 Adhesives and Sealants Applications.

#### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Installer Qualifications: Submit proof confirming the installing contractor is licensed by the manufacturer's quality and training program and certified to perform the installation of the product or system specified in accordance with ULC 705.2.
- .3 Submit field quality control procedures to be utilized by the applicator to ensure proper preparation and installation of the materials specified.
- .4 Submit two 300 mm x 300 mm samples of finished product to Consultant.
- .5 Provide the CCMC Evaluation Report and the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of ULC 705.1.
- .6 Manufacturer's installation instructions: indicate preparation, installation requirements and techniques, product storage and handling criteria, and limitations of the material.

- .7 When the spray polyurethane foam is the material in an air barrier assembly, submit documentation to confirm that the material meets the requirements of the CCMC's Technical Guide for Air Barrier Materials.

## **1.5 Test Reports**

- .1 Submit test reports, verifying qualities of insulation that meet or exceed requirements of this specification.

## **1.6 Design Requirements**

- .1 Provide materials which maintain continuity of thermal insulation and air barrier at building enclosure in conjunction with thermal and air barrier materials specified elsewhere.
- .2 Finished RSI value or thickness of spray applied insulation shall be as indicated on the drawings.

## **1.7 Qualifications**

- .1 Contractor performing work under this section must be certified by the manufacturer and licensed under the SPF Quality Assurance Program (QAP) used by CUFGA (Canadian Urethane Foam Contractors Association or Caliber QAP).
- .2 Installers performing work under this Section must have at least 5 years of experience in the application of spray polyurethane foam insulations and must be licensed under the SPF Quality Assurance Program. Installers shall be trained by CUFGA/NECA (National Energy Conservation Association) and certified by PSDI in accordance with the training requirements outlined in ULC 705.2. Applicators shall have their photo-identification certification cards in their possession and available on the project site, for inspection upon request.
- .3 Conduct on-site daily testing as required by the ULC 705.2 Installation Standard. The Licensed Installer shall complete the Daily Work Report as required by the ULC 705.2. Forward to the Consultant copies of the Daily Work Record upon request. Submit copies of the Daily Work Records or a monthly summary sheet to the CUFGA office, on a monthly basis, as required by the SPF Quality Assurance Program used by CUFGA.

## **1.8 Quality Assurance**

- .1 A pre-installation meeting shall be held prior to the commencement of spray operations to ensure isolation of the immediate spray area and non-interference with other trades.
- .2 Coordinate with other Sections in the preparation of mockups for each exterior wall system indicated.
  - .1 Locate mockups as directed by the Consultant.
  - .2 Mockups shall be minimum 1 m<sup>2</sup>.
  - .3 Modify mockups as necessary for Consultants approval. Mockups may remain in place as part of completed work after approval.
  - .4 Approved mockups shall represent standard for remainder of work.

## **1.9 Shipping, Handling and Storage**

- .1 Refer to Section 01 65 00 – Product Delivery Requirements.
- .2 Deliver materials in original containers and packaged with labels. Containers shall be marked as required by ULC 705.1. The “use before” date shall be included on the drum label.
- .3 Material shall be stored in a safe manner as recommended by the manufacturer, as required by ULC 705.2. During cold weather, store raw materials in heated storage.
- .4 Empty isocyanate containers to be decontaminated or removed from site on a daily basis.

## **1.10 Environmental Requirements**

- .1 Apply spray polyurethane foam when chemical, atmospheric and cavity/surface temperatures are within the limitations required by the ULC 705.2 and as recommended by the manufacturer.

## **1.11 Protection**

- .1 Ensure continuous ventilation of the work area, through a fresh air intake and the extraction of foul air, during the course of the application process and for a period of 24 hours following application.
- .2 Install temporary partitions in order to prevent any effect on the ambient air outside of the work area, from spray applied insulation material.

- .3 Ensure all structures are well protected, in accordance with the manufacturer's recommendations.
- .4 Protect all adjacent surfaces and equipment against any damage that may be caused by dispersion and overspray of insulation material beyond the prescribed limits.

### 1.12 Sequencing and Scheduling

- .1 Co-ordinate this work with the work of all Sections referencing this work.
- .2 All foam insulation closures and substrates shall be completed and secure before the work of this Section commences.

### 1.13 Waste Management and Disposal

- .1 Refer to Section 01 74 00 – Cleaning and Waste Management.

### 1.14 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 Products

### 2.1 Insulation/Air Barrier Material

- .1 Sprayed polyurethane foam material, when tested, shall meet the requirements of ULC S705.1.
  - .1 Certified by EcoLogo.
  - .2 Listed by Greenguard as a low emitting material.
  - .3 Blowing Agent: Product to utilize Zero ODS (Ozone Depleting Substance) blowing agent.
  - .4 Thermal resistance LTTR (ULC 770):

Thickness Millimetres	Thermal Resistance	
	R Value (ft <sup>2</sup> .hr.°F/Btu)/in	RSI (m <sup>2</sup> .°C/W)
50	12.2	2.14
63.5	15.8	2.78

Thickness Millimetres	Thermal Resistance	
	R Value (ft <sup>2</sup> .hr.°F/Btu)/in	RSI (m <sup>2</sup> .°C/W)
75	18.9	3.33
100	25.8	4.55
102	26.2	4.62
127	33.0	5.82

- .2 Spray polyurethane foam insulation to ULC 705.1 and meeting the following criteria:

Physical Properties	Test Procedure	Units	Result
Density (min.)	ASTM D1622	kg/m <sup>3</sup>	28.9
Compressive Strength (min.)	ASTM D1621	kPa	201
Tensile Strength (min.)	ASTM D1623	kPa	325
Water Absorption (96 hours) (max.)	ASTM D2842	% by volume	0.62
Water Vapour Permeance without skins. 50 mm Thickness (max)	ASTM E96	ng/Pa·s·m <sup>2</sup>	50
Open Cell Content (max)	ASTM D6226	%	6.0
Air Leakage	ASTM E283 and E330	L/s·m <sup>2</sup> @75 Pa	0.0053
Flame Spread	ULC 102		<500

- .3 The sprayed polyurethane foam shall exceed the requirements of the CCMC Technical Guide for Air Barrier Systems, as outlined by the Institute for Research in Construction - National Research Council of Canada (0.05 L/m<sup>2</sup>. Indoor Humidity greater than 55%).
- .4 Primers: in accordance with manufacturer's recommendations if required for surface conditions.

## 2.2 Equipment

- .1 The equipment used to spray the polyurethane foam material shall be in accordance with ULC 705.2 and the equipment manufacturer's recommendations for specific type of application.
- .2 Equipment settings are to be recorded on the Daily Work Record as required by ULC 705.2.



- .3 Each proportioner unit to supply only one spray gun.

### **3 Execution**

#### **3.1 Inspection**

- .1 Verify that surfaces and conditions are suitable to accept work required in this Section.
- .2 Ensure that all work by other trades that may penetrate through the thermal insulation is in place and complete.
- .3 Report, in writing, defects in surfaces or conditions which may adversely affect the performance of products installed under this section to the Consultant, prior to commencement of work.
- .4 Do not commence work until defects have been corrected.

#### **3.2 Protection**

- .1 Mask and cover adjacent areas to protect from over spray.
- .2 Apply primers for special condition as required by foam manufacturer.
- .3 Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.
- .4 Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.
- .5 Clean work area prior to commencing spray operations.
- .6 Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.
- .7 Mask and cover adjacent areas to protect from over spray.

#### **3.3 Surface Preparation**

- .1 Surfaces to receive sprayed polyurethane foam insulation shall be frost free and not coated with release agents or other deleterious substances. Commencement of work shall be deemed as acceptance of existing work and conditions.
- .2 Surfaces to receive sprayed polyurethane foam insulation shall be clean, dry, and properly fastened to ensure adhesion of the polyurethane foam to the substrate.

- .3 Ensure that surface preparation and any primers required conform to the manufacturer's instructions.
- .4 Apply air barrier membrane material to all transitions in accordance with Section 07 27 13 to bridge all gaps and control joints in the exterior walls and ensure all perimeter air seals at window and door openings are in place, prior to application of spray applied insulation.

### **3.4 Application**

- .1 Spray-application of polyurethane foam shall be performed in accordance with ULC 705.2 and the manufacturer's instructions.
- .2 Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and ULC 705.2.
- .3 Use primer where recommended by the manufacturer.
- .4 Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings. Passes shall be not less than 15mm and not greater than 50mm.
- .5 Do not install spray polyurethane foam within 75mm of heat emitting devices such as light fixtures.
- .6 Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
- .7 Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.
- .8 Install sealant at outside edges of transition membrane at vertical to horizontal membrane locations.
- .9 Finished polyurethane foam shall be free of voids and embedded foreign materials and to minimum thicknesses shown or specified on drawings.

### **3.5 Tolerance**

- .1 Maximum variation from required thickness: +6 mm/-0 mm.

### **3.6 Test and Inspections**

- .1 Conduct daily visual inspection, adhesion/cohesion testing and density measurements as outlined by ULC 705.2.

- .2 Installed assembly will be tested and inspected for conformance with specifications by an independent inspection and testing company paid from the Cash Allowances.

### **3.7 Protection**

- .1 The spray polyurethane foam shall be protected from ultraviolet as per manufacturer's requirements.
- .2 The spray polyurethane foam shall be covered with an appropriate thermal barrier meeting local building codes when installed on the interior of the building.

### **3.8 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

**End of Section**

## **1 General**

### **1.1 Section Includes**

- .1 Conform to the requirements of Division 1.

### **1.2 Related Requirements**

- .1 Section 07 92 00 - Sealants

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM B117-19 Standard Practice for Operating Salt Spray (Fog) Apparatus
  - .2 ASTM C150/C150M-20 Standard Specification for Portland Cement
  - .3 ASTM C297/C297M-16 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
  - .4 ASTM C1177/C1177M-17 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
  - .5 ASTM C1396/C1396M-17 Standard Specification for Gypsum Board
  - .6 ASTM D968-17 Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
  - .7 ASTM D2247-15(2020) Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
  - .8 ASTM D3273-16 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
  - .9 ASTM D4060-19 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
  - .10 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .11 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
  - .12 ASTM E119-20 Standard Test Methods for Fire Tests of Building Construction and Materials

- .13 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
- .14 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- .15 ASTM E331-00(2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- .16 ASTM E2098/E2098M-13 (2018) Standard Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution
- .17 ASTM E2134/E2134M-14 (2018) Standard Test Method for Evaluating the Tensile-Adhesion Performance of an Exterior Insulation and Finish System (EIFS)
- .18 ASTM E2273-18 Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
- .19 ASTM E2430/E2430M-19 Standard Specification for Expanded Polystyrene ("EPS") Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems ("EIFS")
- .20 ASTM E2485/E2485M-13 (2018) Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings
- .21 ASTM E2486/E2486M-13 (2018) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
- .22 ASTM G155-13 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 ULC 101-2014 Standard Methods of Fire Endurance Tests of Building Construction and Materials

- .2 ULC 102 2018 Surface Burning Characteristics of Building Materials and Assemblies
- .3 ULC 114-2018 Standard Method of Test for Determination of Non-combustibility in Building Materials
- .4 ULC 134-2013 Fire Test for Exterior Wall Assemblies
- .5 ULC S716.1-2012 Standard for Exterior Insulation and Finish Systems (EIFS) – Materials and Systems
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 268 Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
  - .2 NFPA 285 Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

#### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit the manufacturer's product data sheets describing products, which will be used on this project.
- .3 Shop Drawings: Prepare and submit complete drawings showing: wall layout, connections, details, expansion joints, and installation sequence.
- .4 Samples: Submit two samples of the EIFS system for each finish, texture and colour to be used on the project. The same tools and techniques proposed for the actual installation shall be used. Samples shall be of sufficient size to accurately represent each colour and texture being utilized on the project.
- .5 Test Reports: When requested, submit to the Consultant copies of selected test reports verifying the performance of the EIFS System.

#### **1.5 Definitions**

- .1 Base Coat: Material used to encapsulate one or more layers of reinforcing mesh fully embedded that is applied to the outside surface of the EPS.

- .2 Building Expansion Joint: A joint through the entire building structure designed to accommodate structural movement
- .3 Expansion Joint: A structural discontinuity in the system(s).
- .4 Finish: An acrylic-based coating, available in a variety of textures and colours that is applied over the base coat.
- .5 Insulation Board: Expanded polystyrene (EPS) insulation board, which is affixed to the substrate.
- .6 Reinforcing Mesh: Glass fiber mesh used to reinforce the base coat and to provide impact resistance.
- .7 Substrate: The material to which the system is affixed.
- .8 Substrate System: The total wall assembly including the attached substrate to which the system is affixed.

## **1.6 Quality Assurance**

- .1 Qualifications
  - .1 Materials shall be manufactured at a facility covered by a current ISO 9001:2000 certification. Certification of the facility shall be done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).
  - .2 Contractor: Shall be knowledgeable in the proper installation of specified system and shall be experienced and competent in the installation of exterior insulation and finish systems. Additionally, the contractor shall possess a current Trained Contractor Registration Certificate issued by the system manufacturer.
  - .3 Insulation Board Manufacturer: listed by system manufacturer, capable of producing the Expanded Polystyrene (EPS) in accordance with the current system manufacturer specification for Insulation Board and shall subscribe to the system manufacturer's Third Party Certification and Quality Assurance Program.
- .2 Regulatory Requirements:
  - .1 The EPS shall be separated from the interior of the building by as required by code.
  - .2 The use and maximum thickness of EPS shall be in accordance with the applicable building codes.

- .3 Certification
  - .1 The EIFS system shall be recognized for the intended use by the applicable building codes.
- .4 Mock-Up
  - .1 Provide a mock-up for approval.
  - .2 The mock-up shall be of suitable size as required to accurately represent the products being installed, as well as each colour and texture to be utilized on the project.
  - .3 The mock-up shall be prepared with the same products, tools, equipment and techniques required for the actual application. The finish used shall be from the same batch that is being used on the project.
  - .4 The approved mock-up shall be available and maintained at the job site.

## 1.7 System Description

- .1 General: The Exterior Insulation and Finish System (EIFS), shall be Class PB, consisting of a water-resistive barrier coating (air/water-resistive barrier), an adhesive, expanded polystyrene insulation board, base coat, reinforcing mesh and finish.
- .2 Methods of Installation
  - .1 Field Applied.
- .3 Design Requirements:
  - .1 Acceptable substrates for the EIFS system shall be:
    - .1 Exterior grade gypsum sheathing meeting ASTM C1396 requirements for water resistant core or Type X core.
    - .2 Exterior sheathing having a water-resistant core with fiberglass mat facers meeting ASTM C1177.
    - .3 Exterior fiber reinforced cement or calcium silicate boards.
    - .4 Unglazed brick, cement plaster, concrete or masonry.
  - .2 Deflection of substrate systems shall not exceed 1/240 times the span.
  - .3 The substrate shall be flat within 6.4 mm in a 1.2 m radius.



- .4 The slope of inclined surfaces shall not be less than 6:12, and the length shall not exceed 305 mm
- .5 Expansion Joints:
  - .1 As a minimum, expansion joints shall be placed at the following locations:
    - .1 Where expansion joints occur in the substrate system.
    - .2 Where building expansion joints occur.
    - .3 At floor lines where significant movement is expected.
    - .4 Where the system abuts dissimilar materials.
    - .5 Where the substrate type and behaviour changes.
  - .2 In continuous elevations at intervals not exceeding 23 m.
  - .3 Where significant structural movement occurs, such as changes in roofline, building shape or structural system.
- .6 Secondary Barriers
  - .1 The use of secondary barriers is a design requirement of this system and EIFS assemblies as governed by conformance to CCMC evaluation and the provisions of ULC-S716.1. This secondary barrier may also be used to provide the plane of air tightness as part of an air barrier system. All secondary barriers meet the requirements for air barrier classification have an air leakage rate of  $<0.05 \text{ L/s.m}^2 @ 75\text{Pa}$ .
- .7 Terminations
  - .1 Prior to applying the system, wall openings shall be treated with flashing tape.
  - .2 The system shall be held back from adjoining materials around openings and penetrations such as windows, doors, and mechanical equipment a minimum of 19 mm for sealant application.
  - .3 The system shall be terminated a minimum of 203 mm above finished grade.

.4 Sealants

- .1 Shall be manufactured and supplied under Section 07 92 00.
- .2 Shall be compatible with system materials.
- .3 The sealant backer rod shall be closed cell.

.8 Flashing: Shall be provided at all roof-wall intersections, windows, doors, chimneys, decks, balconies and other areas as necessary to prevent water from entering behind the system.

.4 Performance Requirements

.1 The EIFS System shall be tested as follows.

.1 Air/Water Resistive Barrier Coating

Test	Test Method	Criteria	Results
Tensile Bond	ASTM C297/E 2134 ICC ES (AC 212)*	Minimum 104 kPa (15 psi)	Substrate: Minimum 131 kPa (19 psi) Flashing: Minimum 2970 kPa (431 psi)
Freeze-thaw	ASTM E2485/ICC-ES Proc. ICC ES (AC 212)*	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
Water Resistance	ASTM D2247 ICC ES (AC 212)*	No deleterious effects after 14 days exposure	No deleterious effects after 14 days exposure
Water Vapor Transmission	ASTM E96 Proc. B ICC ES (AC 212)*	Vapor Permeable	7 perms
Air Leakage	ASTM E283	No Criteria	0.6 l/min/m <sup>2</sup> (0.002 cfm/ft <sup>2</sup> )
Structural Performance	ASTM E1233 Proc. A ICC ES (AC 212)*	Minimum 10 positive cycles at 1/240 deflection; No cracking in	Passed

Test	Test Method	Criteria	Results
		field, at joints or interface with flashing	
Racking	ASTM E72 ICC ES (AC 212)*	No cracking in field, at joints or interface with flashing at net deflection of 3.2 mm	Passed
Restrained Environmental	ICC-ES Procedure ICC ES (AC 212)*	5 cycles; No cracking in field, at joints or interface with flashing	Passed
Water Penetration	ASTM E331 ICC ES (AC 212)*	No water penetration beyond the inner-most plane of the wall after 15 minutes at 137 Pa	Passed
<b>Weathering</b>			
UV Exposure	ICC ES Proc. ICC ES (AC212)*	210 hours of exposure	Passed
Accelerated Aging	ICC ES Proc. ICC ES (AC212)*	25 cycles of drying and soaking	Passed
Hydrostatic Pressure Test	AATCC 127 ICC ES (AC212)*	21.6" water column for 5 hours	Passed
Surface Burning Characteristics	ASTM E84	Flame Spread < 25 Smoke Developed < 450	Passed
*AC 212 – Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing			

.2 Durability

<b>Test</b>	<b>Test Method</b>	<b>Criteria</b>	<b>Results</b>
CCMC Durability under Environmental Cyclic Conditions	CCMC EIFS Technical Guide Section 5.6.1 as per Appendix A2	No water penetration. No cracking, crazing, blistering or sagging of finish or base coat. Etc. Min 60 cycles	Passed (Primus®)
Abrasion Resistance	ASTM D968	No deleterious effects after 500 liters	No deleterious effects after 1000 liters
Accelerated Weathering	ASTM G155 Cycle 1	No deleterious effects after 2000 hours	No deleterious effects after 5000 hours
	ASTM G154 Cycle 1 (QUV)	No deleterious effects after 2000 hours	No deleterious effects after 5000 hours
Freeze-Thaw	ASTM E2485	No deleterious effects after 60 cycles	Passed - No deleterious effects after 90 cycles
	ASTM C67 modified	No deleterious effects after 60 cycles	Passed - No deleterious effects after 60 cycles
	ASTM E2485/ICC-ES Proc. ICC ES (AC235)***	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
Mildew Resistance	ASTM D 3273	No growth during 28-day exposure period	No growth during 60-day exposure period
Water Resistance	ASTM D2247	No deleterious effects after 14 days exposure	No deleterious effects after 42 days exposure

Test	Test Method	Criteria	Results
Taber Abrasion	ASTM D4060	N/A	Passed 1000 cycles
Salt Spray Resistance	ASTM B 117	No deleterious effects after 300 hours exposure	No deleterious effects after 1000 hours exposure
Water Penetration	ASTM E331 ICC ES (AC 235)***	No water penetration beyond the inner-most plane of the wall after 15 minutes at 137 Pa	Passed 15 minutes at 137 Pa
Water Vapor Transmission	ASTM E96 Procedure B	Vapor permeable	EPS 5 perm-inch Base Coat* 40 Perms Finish** 40 Perms
Drainage Efficiency	ASTM E2273 ICC ES (AC 235)***	Minimum Drainage Efficiency of 90%	Passed
<p>* Base Coat perm value based on Dryvit Genesis™  ** Finish perm value based on Dryvit Quarzputz®  *** AC 235 – Acceptance Criteria for EIFS Clad Drainage Wall</p>			

.3 Structural

Test	Test Method	Criteria	Results
Tensile Bond	ASTM C297/E 2134	Minimum 104 kPa – substrate or insulation failure	Minimum 213.6 kPa
Transverse Wind Load	ASTM E330	Withstand positive and negative wind loads as specified by the building code	Minimum 4.3 kPa *400 mm o.c. framing, 13 mm sheathing screw attached at 203 mm o.c.
* All components remain intact			

.4 Impact Resistance (In accordance with ASTM E2486:

<b>Reinforcing Mesh/Weight g/m<sup>2</sup></b>	<b>Minimum Tensile Strengths</b>	<b>EIMA Impact Classification</b>	<b>EIMA Impact Range Joules</b>	<b>Impact Test Results Joules</b>
Standard - 146	27 g/cm	Standard	3-6	4
Standard Plus - 203	36 g/cm	Medium	6-10	6
Intermediate- 407	54 g/cm	High	10-17	12
Panzer® 15* - 509	71 g/cm	Ultra High	>17	18
Panzer® 20* - 695	98 g/cm	Ultra High	>17	40
Detail Short Rolls - 146	27 g/cm	na		na
Corner Mesh - 244	49 g/cm	na		na

.5 Fire Performance

<b>Test</b>	<b>Test Method</b>	<b>Criteria</b>	<b>Results</b>
Fire Resistance	ASTM E119 CAN/ULC-S101	No effect on the fire resistance of a rated wall assembly Stay in place 15 minutes with no through cracks	Passed 1 hour Passed 2 hour
Ignitability	NFPA 268	No ignition at 12.5 kw/m <sup>2</sup> at 20 minutes	Passed
Noncombustibility*	ULC-S114	No flaming and retain 80% original test specimen weight	
Full Scale Multi-Story Fire Test	UBC Std. 26-4 (formerly 17-6)	Resist vertical spread of flame within the core of the panel from one story to the next	Passed All

Test	Test Method	Criteria	Results
	CAN/ULC-S1341	Resist flame propagation over the exterior surface Resist spread of vertical flame over the interior surface from one story to the next Resist significant lateral spread of flame from the compartment of fire origin to adjacent spaces As per NBCC Article 3.1.5.5	
Intermediate Multi-Story Fire Test	NFPA 285 (UBC 26-9)	Resist flame propagation over the exterior surface Resist vertical spread of flame within combustible core/component of panel from one story to the next Resist vertical spread of flame over the interior surface from one story to the next Resist lateral spread of flame from the compartment of fire origin to adjacent spaces	Passed All

.2 The EIFS System components shall be tested as follows:

.1 Fire

Test	Test Method	Criteria	Results
Surface Burning Characteristics	ASTM E84 CAN/ULC-S102	All components shall have a: Flame Spread < 25 Smoke Developed < 450	Passed

.2 Durability

Test	Test Method	Criteria	Results
Reinforcing Mesh Alkali Resistance of Reinforcing Mesh	ASTM E2098	> 21dN/cm (120 pli) retained tensile strength after exposure	Passed
<b>EPS (Physical Properties)</b>			
Density	ASTM C303, D1622	15.2-20.0 kg/m <sup>3</sup>	Pass
Thermal Resistance	ASTM C177, C518	4.0 @ 4.4 °C 3.6 @ 23.9 °C	Pass
Water Absorption	ASTM C272	2.5 % max. by volume	Pass
Oxygen Index	ASTM D2863	24% min. by volume	Pass
Compressive Strength	ASTM D1621 Proc. A	69 kPa min.	Pass
Flexural Strength	ASTM C203	172 kPa min.	Pass
Flame Spread	ASTM E84	25 max.	Pass
Smoke Developed	ASTM E84	450 max.	Pass

## 1.8 Shipping, Handling and Storage

.1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.



- .2 All materials shall be delivered to the job site in the original, unopened packages with labels intact.
- .3 Materials shall be stored at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Minimum storage temperature shall be as directed by the systems manufacturer. Maximum storage temperature shall not exceed 38 °C.
- .4 Protect all products from inclement weather and direct sunlight.

### **1.9 Project Conditions**

- .1 Environmental Requirements
  - .1 Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
  - .2 At the time of application, the minimum air and wall surface temperatures shall be as noted in manufacturer's specific product data sheets. These temperatures shall be maintained with adequate air ventilation and circulation for a minimum of 24 hours thereafter, or until the products are completely dry.

### **1.10 Sequencing and Scheduling**

- .1 Installation of the EIFS System shall be coordinated with other construction trades.
- .2 Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

### **1.11 Waste Management and Disposal**

- .1 Refer to Section 01 74 00 – Cleaning and Waste Management.

## **2 Products**

### **2.1 Manufacturer**

- .1 Basis of Design:
  - .1 Dryvit Systems Inc.

- .2 Subject to compliance with requirements, provide a comparable product by the following:
  - .1 Durabond
  - .2 BASF
  - .3 Adex
  - .4 or reviewed equivalent

## 2.2 Materials

- .1 Portland Cement: Type 10, meeting ASTM C150, white or gray in colour, fresh and free of lumps.
- .2 Water: Shall be clean and free of foreign matter.

## 2.3 Components

- .1 Air/Water-Resistive Barrier Components: Used as a secondary barrier over sheathing type substrates and may be utilized as part of an air barrier system.
  - .1 Noncementitious air and moisture barrier (vapour permeable)
    - .1 Backstop NT: a factory mixed, fully formulated water-based material for use over all sheathing types. Shall be used over masonry type substrates following leveling coat of Genesis (wet).
    - .2 Grid Tape: For Backstop NT, 102 mm AquaFlash Mesh or reviewed equivalent shall be used on flat joints.
- .2 Flashing Materials:
  - .1 Sheet Type:
    - .1 Flashing Tape and Surface Conditioner
    - .2 Flashing Tape: A high density polyethylene film backed with a rubberized asphalt adhesive available in rolls 102 mm, 152 mm and 229 mm wide by 23 m long.
    - .3 Flashing Tape Surface Conditioner: A water-based surface conditioner and adhesion promoter for the Flashing Tape.

- .2 Adhesive: A moisture cure, urethane-based adhesive used to adhere the drainage strip and drainage track.
  - .1 Dryvit AP Adhesive or reviewed equivalent.
- .3 Drainage Track: UV treated PVC "J" channel perforated with weep holes, complying with ASTM D1784 and ASTM C1063. Drainage track usage is limited to the base of the system at finished grade level. All other horizontal terminations shall utilize the drainage strip as shown in manufacturer's installation details. One of the following:
  - .1 Starter Trac STWP – without drip edge by Plastic Components, Inc.
  - .2 Starter Trac STDE – with drip edge by Plastic Components, Inc.
  - .3 Universal Starter Track by Wind-lock Corporation
  - .4 Sloped Starter Strip with Drip by Vinyl Corp.
  - .5 or reviewed equivalent
- .4 Drainage Strip: Corrugated plastic sheet material, which provides drainage.
  - .1 Adhesives: Used to adhere the EPS to the air/water-resistive barrier, shall be compatible with the water-resistive barrier and the EPS.
    - .1 Cementitious: Liquid polymer-based material, which is field mixed with Portland cement.
      - .1 Primus or Genesis or reviewed equivalent.
    - .2 Factory Blended: Dry blend cementitious, copolymer-based product, field mixed with water.
      - .1 Primus DM, Genesis DM, Genesis DMS, Rapidry DM 35-50, Rapidry DM 50-75 or reviewed equivalent.
- .5 Insulation Board: Expanded Polystyrene meeting manufacturer's system specifications.
  - .1 Thickness of insulation board shall be as indicated.
  - .2 The insulation board shall be manufactured by a board supplier approved by the manufacturer.

- .6 Base Coat: Shall be compatible with the EPS insulation board and reinforcing meshes.
  - .1 Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.
    - .1 Primus, Genesis, Genesis FM or reviewed equivalent.
    - .2 Noncombustible: For use with Outsulation Plus NC
      - .1 Primus DM or reviewed equivalent.
- .7 Reinforcing Mesh: A balanced, open weave, glass fiber fabric treated for compatibility with other system materials.
  - .1 Standard, Standard Plus, Intermediate, Panzer 15, Panzer 20, Detail and Corner Mesh
  - .2 At minimum standard mesh shall be used over the entire wall area in accordance with manufacturer's installation instructions and details. Minimum mesh/mesh overlap shall be 75mm.
- .8 Finish: Shall be the type, colour and texture as selected by the Consultant from full range of manufacturer's standards.

### **3 Execution**

#### **3.1 Examination**

- .1 Prior to installation, verify that the substrate:
  - .1 Is flat within 6.4 mm in a 1.2 m radius.
  - .2 Is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the system installation or performance.
- .2 Prior to installation, ensure that all needed flashings and other waterproofing details have been completed, if such completion is required prior to the application. Additionally, ensure that:
  - .1 Metal roof flashing has been installed in accordance with Canadian Roofing Contractors Association Standards.
  - .2 Openings are flashed in accordance with the manufacturer's installation details, or as otherwise necessary to prevent water penetration.

- .3 Chimneys, Balconies and Decks have been properly flashed.
- .4 Windows, Doors, etc. are installed and flashed per manufacturer's requirements and the manufacturer's installation details.
- .3 Prior to the installation, notify the general contractor and Consultant of all discrepancies.

### **3.2 Preparation**

- .1 Materials shall be protected by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.
- .2 Protect adjoining work and property during installation.
- .3 The substrate shall be prepared as to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

### **3.3 Installation**

- .1 The system shall be installed in accordance with the manufacturer's application instructions.
- .2 The overall minimum base coat thickness shall be sufficient to fully embed the mesh. Apply the base coat in two passes.
- .3 Sealant shall not be applied directly to textured finishes or base coat surfaces.
- .4 The notched trowel method of adhesive application shall be used over sheathing substrates.
- .5 High impact meshes shall be installed as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage.

### **3.4 Field Quality Control**

- .1 Certify in writing the quality of work performed relative to the substrate system, details, installation procedures, workmanship and as to the specific products used.

### **3.5 Protection**

- .1 The system shall be protected from inclement weather and other sources of damage until dry and permanent protection in the form of flashings, sealants, etc. are installed.

### **3.6 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.
- .2 All excess materials shall be removed from the job site.
- .3 All surrounding areas, where the system has been applied, shall be left free of debris and foreign substances resulting from the contractor's work.

**End of Section**

## **1 General**

### **1.1 Section includes**

- .1 Vapour retarders.

### **1.2 Related requirements**

- .1 Section 07 21 13 Building Insulation
- .2 Section 07 21 29 Sprayed Insulation
- .3 Section 08 50 00 Aluminum Doors and Screens
- .4 Section 09 21 16 Gypsum Wallboard

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
  - .2 ASTM F1249-13 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

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.
  - .2 Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

## **1.5 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 state and local regulations controlling use of volatile organic compounds (VOCs).

## **1.6 Site conditions**

- .1 Products specified are not intended for uses subject to abuse or permanent exposure to the elements.

## **1.7 Delivery, storage handling and protection**

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.
- .2 Receive and store materials as recommended by materials manufacturer.
- .3 Maintain containers and labels in undamaged condition.

## **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 Sealants and Adhesives: as specified in Section 07 92 00, compatible with vapour barrier and substrate.
- .5 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.



### **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 Inspection**

- .1 Arrange for inspection of vapour retarders immediately prior to covering, by local building department and Consultant.
- .2 Make all required repairs identified during inspection.

### **3.3 Cleaning and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.
- .2 Remove all waste materials from site. Leave work in a condition satisfactory to the Consultant.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Modified bituminous sheet air barriers.

### **1.2 Related requirements**

- .1 Section 07 21 13 Building Insulation
- .2 Section 07 21 29 Sprayed Insulation
- .3 Section 07 46 13 Preformed Metal Siding
- .4 Section 08 11 00 Metal Doors and Frames
- .5 Section 08 50 00 Aluminum Doors and Screens
- .6 Section 09 21 16 Gypsum Wallboard

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM D412-16 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
  - .2 ASTM D624-00 (2012) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - .3 ASTM D4541-17 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
  - .4 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
  - .5 ASTM E330/E330M-14 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - .6 ASTM E783-02 (2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
  - .7 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
  - .8 ASTM E2178-13 Standard Test Method for Air Permeance of Building Materials

- .9 ASTM E2357-18 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing.
- .3 National Air Barrier Association (NABA)
  - .1 National Air Barrier Association's (NABA) Quality Assurance Program (QAP)

#### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.
  - .2 Include manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
  - .4 Submit manufacturer's complete set of standard details for air barriers.
- .3 Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

#### **1.5 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 and roof 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 ASM D4541.
- .4 Provide continuity of air barrier materials and assemblies in conjunction with materials described in other Sections.

## **1.6 Quality assurance**

- .1 Adhere 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 Submit accreditation number of the Contractor and certification number(s) of the NABA Certified Installer(s).
- .3 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.

## **1.7 Sequencing**

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

## **1.8 Site conditions**

- .1 Apply sheet air barriers only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

## **1.9 Delivery, storage handling and protection**

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.
- .2 Receive and store materials as recommended by materials manufacturer.
- .3 Maintain containers and labels in undamaged condition.

## **2 Products**

### **2.1 Materials**

- .1 Materials: as required to achieve specified performance criteria; meeting specified reference standards and functionally compatible with adjacent materials and components.
- .2 Air barrier membrane components and accessories must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.

### **2.2 Membranes**

- .1 Self-adhered air barrier transition 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.

### **2.3 Adhesives and primers**

- .1 As recommended by manufacturer.

## **2.4 Mastics and termination sealants**

- .1 As recommended by manufacturer.

## **3 Execution**

### **3.1 General**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation

### **3.2 Inspection**

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

### **3.3 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.

### **3.4 Application**

- .1 Install air barrier materials continuously over substrate in accordance with manufacturer's instructions. Partial application is not acceptable.
- .2 Prime surfaces and apply membrane in strict accordance with manufacturer's printed directions.
- .3 Primed surfaces not covered by air barrier membrane during the same working day must be reprimed.
- .4 Apply membrane by heating the surface in contact with the substrate with a trigger-activated propane torch, type as recommended by the manufacturer.
- .5 Cut sheet membrane into manageable sizes, position membrane for alignment prior to removing protective film.
- .6 Install membrane horizontally, in a shingle fashion starting at lowest point. Position membrane and remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps. Promptly roll the membrane surface and all laps with a counter top roller to ensure proper surface bond and effect the seal.
- .7 Tie-in to window frames, door frames, roofing systems, metal wall 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 Ensure all projections including wall ties, are properly sealed with a trowel or caulk application of specified sealant.

### **3.5 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.



### **3.6 Cleaning and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.
- .2 Remove all waste materials from site. Leave work in a condition satisfactory to the Consultant.
- .3 Protect air barrier materials from damage during installation and the remainder of the construction period, according to material manufacturer's written instructions.
- .4 Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the material manufacturer.
- .5 Clean adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all preformed metal siding and accessories.

### **1.2 Related requirements**

- .1 Section 05 12 23 Structural Steel
- .2 Section 05 50 00 Metal Fabrications
- .3 Section 06 10 00 Rough Carpentry
- .4 Section 07 92 00 Sealants

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM A792/A792M-10 (2015) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .3 ASTM C612-14(2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
  - .4 ASTM D1005-95 (2020) Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers.
- .2 CSA Group (CSA)
  - .1 CSA S136-07 Cold Formed Steel Structural Members
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S702-09-AM1, Standard for Thermal Insulation, Mineral Fibre, for Buildings
- .4 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.
- .5 Canadian Institute of Steel Construction (CISC)
  - .1 CISC Standard Code of Practice (2009).
- .6 Underwriters Laboratories Canada (ULC)
  - .1 ULC 702.1 Standard for Thermal Insulation Mineral Fibre for Buildings

#### **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 Delivery, storage, handling and protection**

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

#### **1.8 Waste Management and Disposal**

- .1 Refer to Section 01 74 00 – Cleaning and waste management.

#### **1.9 Warranty**

- .1 Submit manufacturer's warranty 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.

### **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 Wall Panel:
  - .1 Vicwest AD300-R. 300 mm x 38 mm deep.

- .2 C.N.T. 0.76 mm.
- .3 Zinc Coating Designation Z275.
- .4 Or reviewed equivalent.
- .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 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.
- .5 Liner Panel:
  - .1 Vicwest L800 Liner with prepainted finish.
  - .2 C.N.T. 0.76 mm.
  - .3 ZF75 Galvaneal finish
  - .4 Or reviewed equivalent.
- .6 Semi Rigid Mineral Wool Insulation
  - .1 Mineral fibre board: to ASTM C612 and ULC 702.1.
  - .2 Type: IVB Compliant.
  - .3 Density: 70 kg/m<sup>3</sup>.
  - .4 Surfaces: unsurfaced
  - .5 Thickness: as indicated.

## 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 ± 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 Fasteners**

- .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.

## **2.4 Accessories**

- .1 Closures: Unifoam PVC closures to profile of cladding.

## **2.5 Sealants**

- .1 Sealants: Refer to Section 07 92 00 - Sealants.

## **2.6 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.

## **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 Install insulation tightly fitting between sub-framing members. Fasten with metal plate and screw fasteners or adhesive as recommended by manufacturer.
- .7 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.
- .8 Apply a continuous bead of caulking on faces of all supports and at top, bottom and ends of cladding to provide a complete seal.
- .9 On lapped joints, caulk continuously between laps to provide a complete water seal.
- .10 Bed all flashings, closures and corner pieces in sealant to provide a weather tight installation.
- .11 Caulk all openings, joints and around perimeter to provide a weathertight installation.
- .12 Complete all air seals between metal cladding and other systems or materials as detailed.

- .13 Provide expansion joints required by shop drawings complete with metal closures, flashings, trim and caulking, to provide a weather tight installation.
- .14 Provide all matching trim, fasteners and accessories to make building weathertight.
- .15 There shall be no apparent difference between face sheets of same colour when viewed from a minimum distance of 15 metres. Remove and replace off-colour sheets as directed by the Consultant.

### **3.3 Touch-Up**

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

### **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Clean all exposed panel surfaces in accordance with manufacturer's instructions.

**End of section**



## **1 General**

### **1.1 Section Includes**

- .1 TPO roofing.

### **1.2 Related Requirements**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 27 13 Modified Bituminous Sheet Air Barriers
- .3 Section 07 46 13 Preformed Metal Siding
- .4 Section 07 62 00 Sheet Metal Flashing and Trim
- .5 Section 07 92 00 Sealants

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM C726-17 Standard Specification for Mineral Wool Roof Insulation Board
  - .2 ASTM C1177/C1177M-17 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - .3 ASTM C1289-20 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
  - .4 ASTM C1396/C1396M-17 Standard Specification for Gypsum Board
  - .5 ASTM C1549-16 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
  - .6 ASTM D6878/D6878M-19 Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing
  - .7 ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials
- .2 CSA Group (CSA)
  - .1 CSA O121-08 Douglas Fir Plywood.

- .2 CSA O151-09 Canadian Softwood Plywood.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .4 Canadian Roofing Contractors Association (CRCA)
  - .1 CRCA Roofing Specification Manual 1997
- .5 Factory Mutual (FM Global).
  - .1 FM Approval Standard # 4470, Class 1 Roof Covers.
- .6 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
  - .1 CCMC-2002, Registry of Product Evaluations.
- .7 Underwriters' Laboratories of Canada (ULC).
  - .1 ULC 107-10 Methods of Fire Tests of Roof Coverings.
  - .2 ULC 704-11 Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
  - .3 ULC 770-15 Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams
- .8 South Coast Air Quality Management District, California State (SCAMQD)
  - .1 SCAQMD Rule 1168-03 Adhesives and Sealants Application.

#### **1.4 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Source Quality Control: Submit manufacturer's test reports verifying materials meet performance criteria specified, in accordance with Section 01 45 00 - Quality Control.
- .3 Submit proof of manufacturer's CCMC Listing and listing number to Consultant.
- .4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

- .5 Product Data:
  - .1 Submit product data sheets for insulation and roofing membranes.  
Include:
    - .2 Product characteristics.
    - .3 Performance criteria.
    - .4 Limitations.
- .6 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 -  
Submittal Procedures.
  - .2 Indicate control joints, tapered insulation, penetrations, field  
fabricated seams and installation details.
  - .3 Provide layout and sections for tapered insulation.

### **1.5 Project Site/Environmental Requirements**

- .1 Apply roofing membrane only when surfaces and ambient temperatures  
are within manufacturer's prescribed limits.
- .2 Do not install roofing membrane when air and substrate temperature  
remain below 5 degrees C in accordance with manufacturer's  
recommendations or when wind chill gives equivalent cooling effect.
- .3 Install roofing membrane on dry substrate, free of snow and ice. Use only  
dry materials and apply only during weather that will not introduce  
moisture into system.

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

- .1 Deliver, handle and store materials in accordance with manufacturer's  
printed instructions.
- .2 Provide and maintain dry, off-ground weatherproof storage.
- .3 Store materials on supports to prevent deformation.
- .4 Remove only in quantities required for same day use.
- .5 Store uncured flashing and jointing materials to prevent premature curing  
and freezing.

- .6 Store insulation protected from sunlight and weather and deleterious materials.
- .7 Store roofing materials in accordance with manufacturer's written instructions, to prevent damage or loss of performance.

### **1.7 Waste Management and Disposal**

- .1 Refer to Section 01 74 00 – Cleaning and Waste Management.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Unused adhesive and sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .6 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.
- .7 Divert wood materials from landfill to recycling facility approved by Consultant.
- .8 Collect, package and store membrane cut-offs and waste material for recycling and return to recycler in accordance with Waste Management Plan.
- .9 Fold up metal banding, flatten and place in designated area for recycling.

### **1.8 Warranty**

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of two (2) years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.
- .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 10-year warranty 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.
- .4 Solar Reflectance Warranty: Provide membrane manufacturer's warranty that roof membrane will retain sufficient solar reflectivity to meet Energy Star requirements for a minimum of 10 years following date of Substantial Performance.

## **2 Products**

### **2.1 Compatibility**

- .1 Compatibility between components of system and adjacent materials is essential. Provide a written declaration to Consultant stating that all materials and components, as assembled in system, meet this requirement.

### **2.2 Roof Systems Description**

- .1 Refer to drawings for description and detailing of roof systems and components.

### **2.3 Underlayment Board**

- .1 To ASTM C1177, moisture resistant. 1220 x 2440 mm sheets, 15.9 mm thickness, 1220 x 1220 mm size. Minimum compressive strength of 310 kPa.
  - .1 Georgia Pacific Dens Deck Prime Roof and Substrate Board
  - .2 CGC Securock Gypsum Fiber Roof Board
  - .3 Or reviewed equivalent
- .2 Adhesive as recommended by the manufacturer.
  - .1 Low VOC type to conform to SCAQMD Rule 1168-03.

## 2.4 Vapour Retarder

- .1 “Peel and stick” rubberized asphalt membrane with compatible film coating, 40-mil composite consisting of 35 mils of self-adhering rubberized asphalt laminated to a 5-mil polyolefin film.
- .2 Vapour retarder is to be free of nicks and cuts and shall demonstrate an average moisture transmission rate of 0.04 perms when tested to ASTM E96, Procedure B
- .3 Adhesives and primers as recommended by manufacturer to suit substrate, low VOC type to conform to SCAQMD Rule 1168-03.

## 2.5 Membrane

- .1 Roof Membrane: To ASTM D6878, Energy Star listed, Non-Halogenated TPO (Thermoplastic Polyolefin), 1.5mm thick reinforced membrane manufactured with a 9 x 9, 1000 denier polyester reinforcement conforming to the following physical properties:

Property	Test Method	Typical Test Values
Colour (Face)		White
Weight	ASTM D751	1.02 kg/m <sup>2</sup>
Thickness, Nominal	ASTM D751	1.5 mm
Thickness Over Scrim, mm (in)	ASTM D4637 Optical Method	.381 mm min.
Breaking Strength, min	ASTM D751	1 k/N min.
Elongation (unreinforced)	ASTM D421	500%
Tearing Strength, Min.	ASTM D751	245 N
Properties after heat aging	ASTM D751	
a. Breaking Strength	ASTM D3045	90%
b. Tear Strength		90%
c. Elongation		90 %
Brittleness Point	ASTM D2137	- 40 °C
Ozone Resistance	ASTM D1149	Pass
Water Absorption, Max.	ASTM D471	+/- 2%
Linear Dimensional Change, Max.	ASTM D1204	+/- 2%

Property	Test Method	Typical Test Values
Weather Resistance	ASTM G53	Pass (No Cracks)
Solar Reflectance	ASTM C1549	White: 75 min
Water Vapour Transmission	ASTM E96	13 (perm mils)
Puncture Resistance	FTM 101C Method 2031	200 lbs Min.
Fungus Resistance	ASTM G21 (21 days)	No sustained growth - Pass
Solar Reflectance, % 65% required for Energy Star	Albedo x 100 Spectrum Reflectometer	White: 75 min., 87 typical
Emittance, IR	ASTM E408	0.92 typical

- .2 Elastic flashings - Field fabricated with TPO membrane, 1.6 mm thick.
- .3 Adhesive as recommended by membrane manufacturer, low VOC type to conform to SCAQMD Rule 1168.

## 2.6 Isocyanurate (Urethane) Insulation, Faced

- .1 Polyisocyanurate Base Insulation to ULC 704, and ASTM C1289, Type II, Class 1, Grade 3 (25 psi), manufactured with HC blowing agent foam core laminated to medium weight non-asphaltic fiber-reinforced felt facers on top and bottom surfaces.
  - .1 Meeting the requirements of ULC 107.
  - .2 Evaluated and listed by current CCMC approvals guide and approved and listed by Factory Mutual Global for Class 1-60 windstorm classification and meeting FM 4450 approval requirements for Class 1A Fire as a component in roof deck construction.
  - .3 Provide minimum 2 layers of insulation. Thickness as indicated.
  - .4 Minimum compressive strength of 138 kPa.
  - .5 Size: 1220 x 2440 mm board sizes. Square edges
- .2 Tapered Insulation: Polyisocyanurate foam with black glass/felt facers on one side and meeting the requirements of ULC 704 and ASTM C1289, compatible with roofing system, slope as shown on the drawings but not

less than 2% starting thickness of 0 mm, factory tapered. 1220 x 1220 mm board size.

- .3 Insulation adhesive: as recommended by manufacturer, low VOC type to SCAQMD Rule 1168-03.

## **2.7 Sealants**

- .1 Sealants: Refer to Section 07 92 00 - Sealants.
- .2 Compatible with all roofing materials.
- .3 Low VOC type to conform to SCAQMD Rule 1168-03.

## **2.8 Fasteners and Plates**

- .1 As recommended by manufacturer.
- .2 Underlayment board to steel deck: No.12 flat head, self-tapping, Type A or AB, cadmium plated screws. Fasteners and plates must meet FMG 4470 for wind uplift and corrosion resistance. Fasteners must penetrate a minimum of 12 mm into steel deck.
- .3 Insulation fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and provided by roofing system manufacturer.

## **2.9 Metal Edging and Membrane Termination**

- .1 As recommended by manufacturer.
- .2 Fascia or coping system component designed per ANSI/SPRI ES-1 standard.

## **2.10 Walkway Pads**

- .1 Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface- textured protective surfacing for roof traffic shall be membrane manufacturer's standard TPO walkway rolls.

## **2.11 Adhesives, Tapes and Primers**

- .1 Adhesive, tapes and primers, in accordance with manufacturer's recommendations.



- .2 Low VOC type to conform to SCAQMD Rule 1168.

### **3 Execution**

#### **3.1 Workmanship**

- .1 Do roofing work in accordance with applicable standard in CRCA Roofing Specifications Manual and manufacturer's instructions except where specified otherwise.

#### **3.2 Substrate Examination**

- .1 Examine work of other trades and notify in writing to the Consultant that the work is acceptable or of any defects or discrepancies. Verify that work of other trades which penetrates roof deck or requires men and equipment to transverse roof deck has been completed or adequate protection is provided.
- .2 Concrete deck shall be cured minimum 28 days prior to application of adhesive vapour retarders in accordance with manufacturer's instructions.
- .3 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.
- .4 Prior to beginning Work ensure: Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris.
- .5 Ensure curbs have been built and installed.
- .6 Ensure drains have been installed at proper elevations relative to finished surfaces.
- .7 Ensure plywood and lumber nailer plates have been installed to walls and parapets as indicated.

#### **3.3 Protection**

- .1 Cover walls, walks and adjacent work where materials hoisted or used.

- .2 Use warning signs and barriers. Maintain in good order until completion of Work.
- .3 Dispose of rainwater away from face of building until drains or hoppers are installed and connected.
- .4 Protect from traffic and damage. Comply with precautions deemed necessary by Consultant.
- .5 Place plywood runways over work to enable movement of material and other traffic.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.
- .7 Seal and ballast exposed edges.
- .8 If metal connectors are used, treat connectors and decking with rust proofing.

### **3.4 Substrate Board**

- .1 Mechanically fasten glass mat gypsum board to steel deck with screws spaced 400 mm on centre each way.
- .2 Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs.

### **3.5 Vapour Retarder**

- .1 Prime substrate and adhere roof vapour retarder over underlay board with approved adhesive at manufacturer's recommended rate.
- .2 Overlap vapour retarder minimum 100 mm for side laps and 150 mm for end laps.
- .3 Extend vapour retarder under cant strips and blocking. Extend to perimeter and deck protrusions.
- .4 Seal roof vapour retarder to wall air/vapour barrier system with flexible flashing membranes to ensure continuity of building air/vapour barrier envelope.
- .5 Ensure vapour retarder membrane is completely sealed to all roof protrusions and around the perimeter of the roof.

### **3.6 Insulation**

- .1 Loose lay insulation panels over vapour retarder ensuring panels are butt-edged together with a maximum separation of 2mm.
- .2 Install appropriate size insulation fasteners according to the required spacing and density of Roofing System Supplier and Factory Mutual Systems.
- .3 All cut insulation panels or cut parts shall have a minimum of two (2) fasteners.
- .4 Adhere top layered insulation to base layer using adhesive. Place boards in parallel rows with ends staggered, and in firm contact with one another.
- .5 Apply adhesive in continuous ribbons at 300 mm on centre.
- .6 Cut end pieces to suit. Insulation shall be installed in two layers with joints offset by minimum 1/3 of the board width.
- .7 Tapered insulation application.
  - .1 Mop insulation to top layer of insulation with adhesive at the rate recommended by the manufacturer.
- .8 Install tapered insulation in accordance with shop drawings. Stagger joints between layers 150 mm minimum.

### **3.7 Exposed Membrane Application**

- .1 Membrane, adhered, exposed application.
  - .1 Position membrane over insulation starting at highest point.
  - .2 Allow membrane to relax for ½ hour.
  - .3 Apply adhesive to membrane and substrate in accordance with manufacturer's written instructions.
- .2 Lap joints.
  - .1 Clean both mating surfaces, apply primer and splicing contact cement in accordance with manufacturer's written instructions.
  - .2 Apply double-sided adhesive tape in accordance with manufacturer's written instructions.
  - .3 Solvent clean edge and apply lap sealant.

- .3 Perimeter securement with adhesive and mechanical fasteners in accordance with manufacturer's written instructions.
- .4 Edge securement: Attach fastening strips to mechanically secure membrane. Ensure screws penetrate into deck or wood nailers.
- .5 Flashings: Install 1.6 mm thick TPO membrane flashings in accordance with manufacturer's written instructions.
- .6 Penetrations: Install vent stack covers and other penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

### **3.8 Walkways**

- .1 Install walkway pads in accordance with manufacturer's instructions.
- .2 Install walkway pads at all traffic concentration points and all locations as identified on the drawings.

### **3.9 Field Quality Control**

- .1 Inspection and testing of membrane application will be carried out by independent testing agency retained by the Contractor and approved by the Consultant. Refer to Section 01 45 00 – Quality Control.

### **3.10 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.
- .2 Check drains to ensure cleanliness and proper function, and remove debris, equipment and excess material from site.

**End of Section**

## **1 General**

### **1.1 Section includes**

- .1 Sheet metal flashing and trim.

### **1.2 Related requirements**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 24 00 Exterior Insulation and Finish Systems
- .3 Section 07 46 13 Preformed Metal Siding
- .4 Section 07 54 23 TPO Roofing
- .5 Section 07 92 00 Sealants

### **1.3 Reference standards**

- .1 ASTM International (ASTM):
  - .1 ASTM A653/A653M-18 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 Canadian General Standards 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
- .3 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.
- .4 Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual.

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.

- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.
  - .2 Samples: Submit for approval and colour selection sample of each type of prefinished metal proposed to be used.
  - .3 Submit duplicate 300 x 300 mm samples of each type of sheet metal material, colour and finish when requested by the Consultant.
  - .4 Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

### **1.5 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.

### **1.6 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.

## **1.7 Delivery, storage handling and protection**

- .1 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.
- .2 Materials showing evidence of improper handling and storage shall be rejected and removed from the site at no additional expense to the Owner.

## **2 Products**

### **2.1 Materials**

- .1 Ensure compatibility of all materials in contact with roof membrane.
- .2 Sheet Metal: 0.61 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.
- .3 Prefinished material shall be colour coated with manufacturer's standard finish system, utilizing silicone modified polyester resin, minimum dry film thickness of  $1.0 \pm 0.1$  mils when tested to ASTM D1005.
  - .1 Colour for all sheet metal flashing and trim shall be as selected by the Consultant from full range of manufacturer's standard colours.
  - .2 Up to three colours may be selected.
- .4 Continuous hook on strips and metal bellows: 0.65 mm galvanized sheet steel, zinc coating designation ZF275.
- .5 Isolation Coating: Alkali resistant exterior bituminous paint to CAN/CGSB 1.108-M.
- .6 Plastic Cement: To CAN/CGSB 37.5.
- .7 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.
- .8 Underlay: No. 15 perforated asphalt felt to CSA A123.3-M or dry sheathing, breather type, to CAN/CGSB-51.32
- .9 Cleats: Of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

### **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 and installation**

- .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 perfectly 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.

### **3.3 Caulking of flashings**

- .1 Sealants shall be as specified in Section 07 92 00 - 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 and protection**

- .1 Proceed in accordance with Section Refer to Section 01 74 00 – Cleaning and Waste Management.
- .2 Remove all waste materials from site. Leave work in a condition satisfactory to the Consultant.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and install materials in accordance with published 'Through-Penetration Firestop Systems' in UL's Fire Resistance Directory or the publication of another approved independent laboratory.

### **1.2 Related requirements**

- .1 Section 07 92 00 Sealants
- .2 Section 09 21 16 Gypsum Wallboard

### **1.3 Reference standards**

- .1 Underwriters Laboratories of Canada (ULC):
  - .1 CAN/ULC S115-05 Standard Method of Fire Tests and Firestop Systems
- .2 American Society for Testing and Materials (ASTM):
  - .1 ASTM E814-13a (2017) Standard Test Method for Fire Tests of Penetration Firestop Systems

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Shop Drawings:
  - .1 Provide details indicating all reinforcing, anchorages, fastening and proposed method of installation for the various conditions within the project.
- .3 Samples:
  - .1 Submit samples of each type of firestop and smoke seal material and accessory.

### **1.5 Quality assurance**

- .1 Applicator shall be licensed by the manufacturer of fireproofing materials.
- .2 Conform to flame and temperature ratings established by ULC CAN4-S115 and ASTM E814.

- .3 Submit manufacturer's certification that materials meet or exceed specified requirements.
- .4 Maintain flame and temperature ratings equal to surrounding materials.

## **1.6 Delivery, storage, handling and protection**

- .1 Deliver materials in original, unopened packages bearing name of manufacturer and product identification.
- .2 Store materials off ground, under cover, and away from damp surfaces.

## **1.7 Site conditions**

- .1 Do not apply materials when temperature of substrate material is below 4 °C and surrounding air temperature is below 4 °C, for 24 hours prior to application.

## **2 Products**

### **2.1 Materials**

- .1 Bears UL, ULC or Warnock Hersey label and confirmation of compliance with ASTM E814 or CAN4-S115.
- .2 Provide fire stopping and smoke sealing systems in accordance with CAN4-S115-M and shall also conform to special requirements in part 3.5 of the Building Code.
- .3 Fire-resistant rating of fire stopping material assemblies must meet or exceed the fire-resistance rating of the floor or wall section being penetrated.
- .4 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control shall be elastomeric seal type. Do not use a cementitious, or rigid seal at such locations.
- .5 Primers shall be to manufacturer's recommendation for specific material, substrate, and end use.
- .6 Damming and backup materials, supports and anchoring devices shall be to manufacturer's recommendations, and in strict accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

- .7 Sealants for vertical joints, shall be non-sagging type.

### **3 Execution**

#### **3.1 Protection**

- .1 Mask adjacent work of other Sections as necessary to avoid spillage onto adjoining surfaces. Remove stains on adjacent surfaces as required.

#### **3.2 Preparation**

- .1 Examine sizes and conditions to establish correct thickness and installation of backup materials. Ensure surfaces are dry and frost free.
- .2 Clean bonding surfaces of deleterious substances including dust, paint, rust, oil, grease and other foreign matter which may otherwise impair effective bonding.
- .3 Do not apply firestops and smoke seals to surfaces previously painted or treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Prepare surfaces in accordance with manufacturer's instructions.
- .5 Priming and Sealing: Prime surfaces in accordance with manufacturer's instructions.

#### **3.3 Application**

- .1 Mix materials in accordance with manufacturers' written instructions.
- .2 Apply in strict accordance with ULC certification and manufacturer's recommendations to provide a temperature and flame rated seal equal as a minimum to the rating of the wall or floor surrounding.
- .3 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
- .4 Seal all joints to ensure an air and water resistant seal, capable to withstand compression due to thermal, wind or seismic joint movement.

- .5 Consult with Mechanical Engineer and project manager prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
- .6 Apply to mechanical and electrical service through-penetrations, to formed, sleeved, or cored openings in smoke and fire rated masonry, or gypsum wallboard stud walls and structural floors and ceilings.
  - .1 Coordinate with plumbing, HVAC and electrical contractors to ensure proper firestopping application, providing smoke seal around penetrations through fire rated assemblies. Ensure that end joints between lengths of firestopping material have been properly sealed.
- .7 Apply to head of smoke and fire rated gypsum wallboard stud wall abutting underside of structure (concrete or steel deck).
- .8 Apply to control joints in rated stud walls.
- .9 Apply to penetrations for passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire rated vertical barriers (walls and partitions), horizontal beams (floor/ceiling assemblies) and vertical service shaft walls and partitions.
- .10 Apply to safining slots gaps between edge of floor slabs and curtain walls.
- .11 Apply to openings between structurally separate sections of walls and floors.
- .12 Apply to gaps between tops of walls and ceiling or roof assemblies.
- .13 Apply to expansion joints in fire rated walls and floors.
- .14 Apply to openings and penetrations in fire rated partitions or walls containing fire doors.
- .15 Apply to openings around structural members which penetrate fire rated floors or walls.
- .16 Apply firestop and smoke seal materials in accordance with manufacturer's directions, with sufficient pressure to properly fill and seal openings.
- .17 Tool or trowel exposed surfaces.
- .18 Remove excess compounds promptly as work of this Section progresses and upon completion of work of this Section.

### **3.4 Curing**

- .1 Cure materials in accordance with manufacturer's instructions.
- .2 Do not cover up materials until proper curing has taken place.

### **3.5 Identification**

- .1 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - .1 The words: "Warning: Through-Penetration Firestop System - Do Not Disturb"
  - .2 Contractor's name, address and telephone number.
  - .3 Designation of applicable testing and inspection agency.
  - .4 Date of installation.
  - .5 Manufacturer's name for firestop materials.

### **3.6 Clean up and repairs**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Clean adjacent surfaces immediately and leave work neat and clean.
- .3 Remove excess materials using recommended procedures, as work progresses.
- .4 Remove dams after initial set of firestops and smoke seals as required.
- .5 Correct staining and discolouring of adjacent surfaces as directed by Consultant.
- .6 Remove all debris and excess materials entirely from the site and leave the work in a neat and tidy condition.
- .7 Perform one simulated smoke test for each penetration type once per day. Simulate smoke at a rate of four seconds/100 cubic feet (2.8 cubic metres) and maintain the fog density until inspection is complete.

- .8 After inspection is complete, repair all defective firestopping and smoke seals and test again. Continue this procedure until all firestopping and smoke seals passes test.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labour, materials, equipment and incidentals necessary and required for the completion of the sealant.
- .2 Read other Sections of the Specification for extent of sealant specified in those Sections. Do all other sealing indicated, specified or required.

### **1.2 Related requirements**

- .1 Section 05 50 00 Metal Fabrications
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 84 00 Firestopping and Smoke seals
- .4 Section 08 11 00 Metal Doors and Frames
- .5 Section 09 21 16 Gypsum Wallboard
- .6 Section 09 90 00 Painting

### **1.3 Reference standards**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM C509-06(2015) Standard Specifications for Elastomeric Cellular Performed Gasket and Sealing Material
  - .2 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants
  - .3 ASTM D2240-15e1 Standard Test Method for Rubber Property - Durometer Hardness
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-19.13-M87 Sealing Compound, One-Component, Elastomeric, Chemical Curing

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.



- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.
  - .2 Samples: Submit for approval and colour selection sample of each type of compound, recommended primers and joint filler or fillers proposed to be used.
  - .3 Mock-Up:
    - .1 If requested by the Consultant, construct mock-ups where directed to show location, size, shape, colour and depth of joints complete with back-up material, primer and sealant. Mock-up may be part of finished work.
    - .2 Allow 24-hours for inspection of work before proceeding with work.
  - .4 Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

### **1.5 Quality assurance**

- .1 Adhere to Manufacturer's recommendations for mixing or preparation of materials listed in this Section.
- .2 Pot life or installation times shall not be exceeded.
- .3 Integral materials which compose a joint detail shall be compatible.
- .4 Component parts, where possible, shall have the same manufacturer.
- .5 A representative of sealant material manufacturer shall visit the site during application to ensure that all Work is carried out according to the manufacturer's printed instructions.

### **1.6 Site conditions**

- .1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

## **1.7 Delivery, storage handling and protection**

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.
- .2 Receive and store materials as recommended by materials manufacturer.
- .3 Maintain containers and labels in undamaged condition.

## **2 Products**

### **2.1 Materials**

- .1 Joint Cleaner:
  - .1 Non-corrosive solvents as recommended by sealant manufacturer for applicable substrate material(s).
- .2 Primer:
  - .1 Non-staining type as recommended by sealant manufacturer, for use on substrate conditions outlined, and compatible with specified sealant being applied.
- .3 Joint Back-Up – Backer Rod:
  - .1 Round, open cell, reticulated foam, 50% compression, compatible with sealant and primer, non-adhering to sealant.
- .4 Bond Breaker:
  - .1 Pressure sensitive plastic tape, not bondable to sealant as recommended by sealant manufacturer.
- .5 Sealant Type "A" – Joints around Interior Door Frames, Windows and Under Exterior Thresholds:
  - .1 One-part, low or medium modulus, neutral curing 100% silicone joint sealant, conforming to ASTM C920 Type S, Grade NS, Class 35.
    - .1 DC CWS by Dow Corning.
    - .2 SWS by GE
    - .3 SikaSil WS-305CN by Sika
    - .4 Or reviewed equivalent

- .2 One component, low modulus, moisture curing, polyurethane joint sealant, conforming to ASTM C920 Type S, Grade NS, Class 25.
  - .1 Dymonic FC by Tremco Ltd., division of RPM Company.
  - .2 Sikaflex 1A by Sika Canada Inc.
  - .3 Sonolastic NP1 by BASF.
  - .4 Pourthane NS by W.R MEADOWS
  - .5 Or reviewed equivalent
  
- .6 Sealant Type "B" – Expansion / Control Joints:
  - .1 One-part, ultra low modulus, non-staining neutral curing 100% silicone joint sealant, conforming to ASTM C920 Type S, Grade NS, Class 50.
    - .1 DC 790 by Dow Corning.
    - .2 Spectrem 1 by Tremco
    - .3 SCS2700 SilPruf LM by GE
    - .4 SikaSil WS-290 by Sika
    - .5 Or reviewed equivalent
  
- .7 Sealant Type "C" – Floor Control Joints:
  - .1 Multi-component, chemical curing, self-levelling, polyurethane joint sealant, conforming to ASTM C920 Type M, Grade P, Class 25.
    - .1 THC-900 by Tremco (Canada) Ltd., division of RPM Company.
    - .2 Sonolastic SL2 by Sonneborn Building Products, division of BASF Building Systems.
    - .3 Sikaflex 2c SL by Sika Canada Inc.
    - .4 Or reviewed equivalent
  
- .8 Sealant Type "E" – Mould and Mildew Resistant:
  - .1 Mould and mildew resistant, Shore A Hardness 15-25, conforming to ASTM C920 Type S, Grade NS, Class 25, use NT, G, and A:
    - .1 SCS1700 by GE
    - .2 DC 786 by Dow Corning
    - .3 Tremsil 200 by Tremco

- .4 Omni Plus by Sonneborn
  - .5 SikaSil –GP by Sika
  - .6 Or reviewed equivalent
- .9 Sealant Type "F" – Glazing Joints:
- .1 Silicone Sealant: Butt glazing, one part, moisture curing, shore A hardness 15-25, conforming to CAN/CGSB-19.13-M, Classification C-1-40-B-N and C-1-25-B-N and ASTM C920-11, Type S, Grade NS, Class 25, use NT, G, A, O; Colour: clear (translucent):
    - .1 DC 795 by Dow Corning
    - .2 SCS2000 by GE.
    - .3 Multiseal by Chemtron.
    - .4 Spectrum 2 by Tremco
    - .5 SikaSil WS-295 by Sika
    - .6 Or reviewed equivalent
- .10 Sealant Type "H" – Saw Cut Sealant:
- .1 Multi-component, self-levelling, conforming to ASTM D2240:
    - .1 Tremco Control Joint Sealant
    - .2 BASF Masterfill 300
    - .3 Sika Loadflex
    - .4 Rezi-Weld Flex by W.R MEADOWS
    - .5 Or reviewed equivalent
- .11 Sealant Type "I" – HVAC Sealant:
- .1 One-part, RTV, acetoxy-cure silicone sealant for heating, ventilation, air conditioning and refrigeration applications:
    - .1 Dow Corning HVAC Silicone Sealant
    - .2 Or reviewed equivalent
- .12 Sealant Type "J" – Electrical Sealant:
- .1 One-part, white, non-flowing moisture cure adhesive for electrical applications:
    - .1 Dow Corning 738 Electrical Sealant
    - .2 Or reviewed equivalent

- .13 Preformed Compression Seal:
  - .1 Compartmental open cell neoprene extrusion type conforming to ASTM C509 complete with liquid lubricant adhesive recommended by manufacturer.

### **3 Execution**

#### **3.1 Inspection**

- .1 Verify at site that joints and surfaces conditions provided will not adversely affect execution, performance or quality of completed work.
- .2 Ensure masonry and concrete have cured 28 days minimum.
- .3 Ascertain that sealers and coatings applied to substrates are compatible with sealant used and that full bond of the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and adhesion, if necessary.
- .4 Verify that specified recommended environmental conditions are present before commencing work.
- .5 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.
- .6 Do not start work of this Section until conditions are satisfactory.

#### **3.2 Preparation**

- .1 Clean joint surfaces using joint cleaner as necessary, to remove dust, paint, loose mortar, and other foreign matter and dry joint surfaces.
- .2 Remove dust, silt, scale and coatings from ferrous metals by wire brush, grinding or sandblasting.
- .3 Remove oil, grease and other coatings from non-ferrous metals with approved cleaning solvent.
- .4 Ensure surfaces are free of frost, rust, lacquers, laitance, release agents, moisture or other matter which might adversely affect adhesion of sealant.

- .5 Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's written recommendations for specified sealant.
- .6 Support joint filler on horizontal traffic surfaces against vertical movement which might result from traffic loads or foot traffic.
- .7 Prepare surfaces as recommended by sealant manufacturer.
- .8 Fully remove existing sealant scheduled to be removed and replaced with new sealant, in areas indicated on the Drawings.
  - .1 Follow manufacturers procedures for removal of existing sealant and test areas for adhesion of new sealant. Provide the Consultant with field report identifying results of adhesion testing.
- .9 Install joint backing material or apply bond breaker tape to achieve correct joint depth and prevent three-sided adhesion.
- .10 To protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or sealing.
- .11 Prime sides of joints using two cloth method in accordance with manufacturer's directions immediately prior to sealing.
- .12 Before any sealing is commenced, a test of the material shall be made for indications of staining, poor adhesion or other undesirable effects.
- .13 Seal joints in surfaces to be painted before painting. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure prime paint is compatible with primer and sealant. If incompatible inform Consultant, consult the manufacturer, and change primer and sealant to approved compatible types.
- .14 Check form release agent used on concrete for compatibility with primer and sealant. If incompatible inform Consultant and change primer and sealant to approved compatible types or clean concrete to Consultant's approval.

### **3.3 Application**

- .1 Apply sealant in accordance with manufacturer's directions, using a gun with proper nozzle size, ensuring to fill voids and joints completely, to

leave a weathertight, airtight installation. Superficial pointing with skin bead is not acceptable.

- .2 Neatly tool surface to a slight concave profile. Surface of sealant shall be smooth, free from ridges, wrinkles, sags, air pockets and embedded impurities.
- .3 Clean adjacent surfaces immediately and leave Work neat and clean. Remove excess sealant and droppings, using recommended cleaners as Work progresses. Remove masking tape after tooling of joints.

### **3.4 Cleaning and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Remove all waste materials from site. Sealant shall be cleaned of all foreign material as recommended by the sealant manufacturer. Leave work in a condition satisfactory to the Consultant.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Fabrication, supply and installation of metal doors and frames.

### **1.2 Related requirements**

- .1 Section 07 92 00 Sealants
- .2 Section 08 70 00 Door Hardware
- .3 Section 09 21 16 Gypsum Wallboard
- .4 Section 09 90 00 Painting

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 ASTM C177-19 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
  - .3 ASTM C518-17 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .4 ASTM E330/E330M-14 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.
  - .2 CGSB 41-GP-19M-84 Rigid Vinyl Extrusions for Windows and Doors.
- .3 CSA Group (CSA)
  - .1 CSA-G40.20-13/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-18 Welded Steel Construction (Metal Arc Welding).



- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000
  - .2 CSDMA Recommended Specifications for Commercial Steel Doors and Frames, 2006.
  - .3 CSDMA Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.
- .5 Underwriters Laboratories Canada (ULC)
- .6 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 Provide submittals in accordance with Section 01 33 00.
- .2 Provide shop drawings
  - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed louvred, arrangement of hardware, and finishes.
  - .2 Indicate each type frame material, core thickness, reinforcements, location of anchors and exposed fastenings, reinforcing and finishes.
  - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

#### **1.5 System description**

- .1 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.

## **1.6 Site conditions**

- .1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

## **1.7 Delivery, storage handling and protection**

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.
- .2 Receive and store materials as recommended by materials manufacturer.
- .3 Maintain containers and labels in undamaged condition.

## **2 Products**

### **2.1 Materials**

- .1 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.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653, ZF75.

### **2.2 Door core material**

- .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.

### **2.3 Primer**

- .1 Touch-up prime CAN/CGSB-1.181, organic zinc rich, rust inhibitive.
  - .1 Maximum VOC limit 50 g/L to GC-03.

### **2.4 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 Steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

## **2.5 Accessories**

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Metallic paste filler: to manufacturer's standard.
- .3 Sealant: As specified in Section 07 92 00.
- .4 Fiberglass: to CAN/ULC-S702-09-AM1, loose batt type, minimum density of 24 kg/m<sup>3</sup>.

## **2.6 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 Interior frame product shall be 1.60 mm. Interior frames, transoms, sidelights and window assemblies shall be welded type construction.
  - .4 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.
  - .5 Prepare frames to receive electrical conduit for door operators where indicated and required.
  - .6 Protect mortised cutouts with steel guard boxes.
  - .7 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 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.

- .8 Minimum reinforcing, anchor and other component gauges shall be in accordance with Table 1 of the CSDMA, "Recommended Specifications for Commercial Steel Door and Frame Products".
  - .9 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.
  - .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .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, transom bars, 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

## **2.7 Finishes**

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

## **3 Execution**

### **3.1 Manufacturer's instructions**

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

### **3.2 Installation**

- .1 Install doors and frames to CSDMA Installation Guide, NAAMM-HMMA 840, Installation Guide for Commercial Steel Doors and Frames.
- .2 Prior to installation, remove temporary shipping spreaders.
- .3 Prior to installation, the area of floor on which the frame is to be installed, and within the path of the door swing, shall be checked and corrected for flatness.
- .4 Check door and frame product for correct size, swing, rating and opening number.
- .5 The supplier shall be advised of any discrepancies prior to installation.
- .6 Set frames plumb, square, level and at correct elevation.
- .7 Secure anchorages and connections to adjacent construction.

- .8 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width. Provide vertical support at centre of head for openings exceeding 1200 mm in width.
- .9 During the setting of frame product, check and correct as necessary for opening width, opening height, square, alignment, twist and plumb, in accordance with the CSDMA, "Recommended Dimensional Standards for Commercial Steel Doors and Frames".
- .10 Remove wood spreaders after frames have been built-in.
- .11 Make allowance for deflection to ensure structural loads are not transmitted to frame product.
- .12 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 70 00 - Door Hardware.
- .13 Adjust operable parts for correct clearances and function.
- .14 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows:
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Finished floor and thresholds: 13 mm.
  - .4 Adjust operable parts for correct function.
- .15 Caulk perimeter of frames.

### **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 and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

- .2 Remove all waste materials from site. Leave work in a condition satisfactory to the Consultant.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all wood doors

### **1.2 Related sections**

- .1 Section 06 20 00 Finish Carpentry
- .2 Section 08 11 00 Metal Doors and Frames
- .3 Section 08 70 00 Hardware
- .4 Section 09 90 00 Painting

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM D1761-12 Standard Test Methods for Mechanical Fasteners in Wood
  - .2 ASTM D5456-18 Standard Specification for Evaluation of Structural Composite Lumber Products
  - .3 ASTM E90-09(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  - .4 ASM E413-16 Classification for Rating Sound Insulation
  - .5 ASTM E1332-16 Standard Classification for Rating Outdoor-Indoor Sound Attenuation
  - .6 ASTM E2235-04(2012) Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods
- .2 American National Standards Institute (ANSI):
  - .1 ANSI A208.1 - Standard for Particleboard.
- .3 CSA Group (CSA)
  - .1 CSA O115-M1982 (R2001) Hardwood and Decorative Plywood.
  - .2 CSA O132.2 Series-90 (R2003) Wood Flush Doors



- .4 Canadian General Services Board (CGSB)
  - .1 CAN/CGSB-71.19 Adhesive, Contact, Sprayable
  - .2 CAN/CGSB-71.20 Adhesive, Contact, Brushable
- .5 Architectural Woodwork Manufacturers Association of Canada (AWMAC):  
Quality Standards for Architectural Woodwork
- .6 Window and Door Manufacturer's Association (WDMA)
  - .1 ANSI/WDMA I.S. 1A-13 Interior Architectural Wood Flush Doors
- .7 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.
- .8 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.
  - .1 Submit manufacturer's printed product literature, specifications and data sheets for door materials and adhesives.
  - .2 Submit shop drawings and door schedules.
    - .1 Indicate door types, sizes, thicknesses, and details of construction.
  - .3 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.
  - .4 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.

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

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .2 Wood door delivery, storage and handling shall be in accordance with Part 6, Item 3, of the AWMAC Quality Standards.
- .3 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.
- .4 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 00 – Cleaning and waste management.

## **2 Products**

### **2.1 Manufacturers**

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

## **2.2 Materials**

- .1 All door materials to conform to CSA 0132.2-M.
- .2 Doors shall be constructed of solid laminated wood core with 3.0 mm thick Grade A book matched flat cut Maple face, 50 mm stiles and 76 mm top and bottom rails. Stiles to be solid hardwood.
- .3 Core shall consist of low density wood blocks, random lengths with staggered joints. All cores shall be drum sanded both sides.
- .4 Door thickness: as indicated.
- .5 Adhesive: To CSA 0132.2, Type II, water resistant, for interior use.

## **3 Execution**

### **3.1 Fabrication**

- .1 Fabricate doors in accordance with CSA 0132.2.
- .2 Bevel vertical edges of single acting doors 3.0 mm on lock side and 1.6 mm on hinge side.
- .3 Prepare doors for hardware.
- .4 Fabricate doors with reinforced openings for glazed lites. Provide manufacturer's standard trim and stops.
- .5 Sand and prepare doors to receive paint finish as indicated on the Room Finish and Door Schedules.

### **3.2 Installation**

- .1 Unwrap and protect doors in accordance with CSA-O132.2 Series, Appendix A.
- .2 Install doors and hardware in accordance with manufacturer's printed instructions and CSA-0132.2 Series, Appendix A.
- .3 Adjust hardware for correct function.
- .4 Doors to receive clear urethane finish as specified in Section 09 90 00.

### **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 00 – Cleaning and waste management.

**End of Section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all aluminum entrance doors, hardware, windows and screens

### **1.2 Related requirements**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 92 00 Sealants
- .3 Section 08 80 00 Glazing

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
  - .2 ASTM E1748-95(2017) Standard Test Method for Evaluating the Engagement Between Windows and Insect Screens as an Integral System
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40-97 Anticorrosive Structural Steel Alkyd Primer.
- .3 CSA Group (CSA)
  - .1 CSA A440-17 North American Fenestration Standard/Specification for Windows, Doors, and Skylights
- .4 American Architectural Manufacturers Association (AAMA)
  - .1 AAMA/WDMA/CSA 101/I.S.2/A440-08 - NAFS - North American Fenestration Standard / Specification for Windows, Doors, and Skylights
- .5 Aluminum Association (AA), Designation System for Aluminum Finishes (2000)
- .6 Ontario Ministry of Municipal Affairs and Housing (MMAH)
  - .1 Ontario Building Code

#### 1.4 Submittals

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit shop drawings.
  - .1 Submit drawings
  - .2 Indicating materials and details in full size scale for head, jamb and sill, profiles of components, interior 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 Windows classifications.
  - .2 Anodized finish, weathering characteristics.
  - .3 Air infiltration
  - .4 Water tightness.
  - .5 Wind load resistance.
  - .6 Condensation resistance.
  - .7 Forced entry resistance.
  - .8 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
  - .1 Provide operation and maintenance data for doors, windows and hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## **1.5 Delivery, storage handling and protection**

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

## **1.6 Warranty**

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of two (2) years from the date of Substantial Performance and agree to make good promptly any defects which occur or become apparent within the warranty period.
- .2 Provide a manufacturer's warranty stating that the anodized finish will be non-fading, nonconvertible, and permanently a part of the metal surface for a period of two (2) years after acceptance of the building. The warranty shall state that any item showing failure during the warranty period will be replaced or refinished to the original condition, at no cost to the Owner.

## **2 Products**

### **2.1 Materials**

- .1 General: to CSA A440/A440.1 supplemented as follows:
  - .1 All storefront framing shall be by same manufacturer.
  - .2 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 aluminum storefront 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 B 221: 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.

- .1 Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- .4 Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- .5 Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- .6 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.
- .7 Glass: As scheduled and as specified in Section 08 80 00.
- .8 Spandrel Panel Insulation: To ULC 702 Type 1 or ASTM C612 Type IVB, semi rigid stone wool insulation board, unfaced, square edged. Density 56 kg/m<sup>3</sup>. Thickness as indicated.
  - .1 Curtainrock. by Roxul
  - .2 MinWool Curtainwall by Johns Manville
  - .3 Or reviewed equivalent
- .9 Fasteners and adhesive
  - .1 Adhesive types as recommended by insulation manufacturer for application.
  - .2 Insulating clips to be adhesive bonded pin and disc type.
- .10 Isolation coating: alkali resistant bituminous paint. Coating material shall be low VOC type conforming to SCAQMD Rule 1113-96.

## **2.2 Window and Screen types**

- .1 Entrance Framing:
  - .1 Thermally Broken Storefront Framing: thermally broken, inside glazed.



- .2 Classification rating: to CSA-A440/A440.1.
  - .1 Air Tightness: A3.
  - .2 Water tightness: B3.
  - .3 Wind load resistance: C3.
  - .4 Surface condensation control: compliant with standard CSA-A440.2/A440.3.
  - .5 Forced Entry: Pass test for resistance to forced entry.
- .2 Exterior Window Types:
  - .1 Thermally Broken Aluminum Window Framing.
    - .1 Basis of Design: Kawneer 518 Isoweb
    - .2 Clear Anodized Finish.
    - .3 127 mm Deep Profile.
    - .4 25 mm Sealed, glazed units as specified in Section 08 80 00.
    - .5 Install with high performance thermally broken windowsill receptor.
    - .6 Glazed Spandrel Panels 8.0 mm thick tempered spandrel glass as specified in Section 08 80 00, stone wool insulation with 0.84 mm galvanized sheet steel metal back-up as indicated on the Drawings.

### **2.3 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 Exterior glass: 25 mm sealed units, insulating glass.

## **2.4 Door hardware**

- .1 Provide the following hardware or reviewed equivalent for aluminum doors, as appropriate to location and configuration:
  - .1 Interior Doors:
    - .1 To size indicated on schedules and drawings.
    - .2 Continuous heavy-duty hinge with stainless steel ball bearings and clear epoxy finish.
      - .1 Reinforce doors for continuous hinges.
    - .3 Panic Device
    - .4 Automatic Door Operator: as specified in Section 08 71 13

## **2.5 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.

- .5 Fabricate sills including oversized sills to suit new and existing wall construction and as detailed. This Section shall provide sills at all new windows and existing windows to remain.

## **2.6 Aluminum Finishes**

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
- .2 Clear anodic finish to match existing: not less than 18 micrometre thick, Architectural Class I designation.

## **2.7 Isolation coating**

- .1 Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials to provide isolation coating. Isolate aluminum from following:
  - .1 Dissimilar metals, except stainless steel, zinc, or white bronze of small area.
  - .2 Concrete, mortar, masonry and other alkaline materials.

## **2.8 Glazing**

- .1 Glaze doors and screens in accordance with CSA-A440/A440.1 and Section 08 80 00 – Glazing.
  - .1 Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer's standards. Exterior glazing shall be silicone back bedding sealant.
- .2 Glazed Spandrel Panels 8.0 mm thick tempered spandrel glass as specified in Section 08 80 00, stone wool insulation with 0.84 mm galvanized sheet steel metal back-up as indicated on the drawings.

## **3 Execution**

### **3.1 Examination**

- .1 Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

Verify rough opening dimensions, levelness of sill plate and operational clearances.

- .2 Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 Screen installation**

- .1 Install in accordance with CSA 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 Maintain dimensional tolerances after installation. Maintain alignment with adjacent work.
- .8 Seal framing joints with butyl polyisobutylene or silicone sealant.
- .9 Install glazing splines and gaskets uniformly, with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.
- .10 Continuously and uniformly compress glazing splines and gaskets during installation.
- .11 Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

### **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.

### **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 Adjustment**

- .1 Adjust operating doors, sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.

### **3.6 Cleaning and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

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

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and install door hardware listed in the Door Hardware Schedule, prepared by an Architectural Hardware Consultant
- .2 This section establishes the quality standards, finishes, manufacturers and functions.

### **1.2 Related requirements**

- .1 Section 08 11 00: Metal Doors and Frames
- .2 Section 08 50 00: Aluminum Doors and Screens

### **1.3 Administrative requirements**

- .1 Submission of Substitutions: Materials other than the named products for the Project may be acceptable to the Consultant. Submit manufacturer's names and complete catalogue number of alternative hardware types proposed for supply and submit this list for review before preparing shop drawings.
- .2 Substitutions for materials of this section will be considered after the close of bids.
- .3 Pre-installation Conference: Arrange a preconstruction meeting in accordance with Section 01 31 19 to discuss the following:
  - .1 Keying Conference: Conduct keying conference at Project site and incorporate decisions into final keying schedule after reviewing door hardware keying system.
  - .2 Electrified Hardware Conference: Conduct pre-installation conference at Project site and review methods and procedures related to electrified door hardware.
- .4 Coordination: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Coordinate with shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware.

#### **1.4 Submittals**

- .1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with the General Conditions and Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit product data indicating installation details, material descriptions, dimensions of individual components and profiles, and finishes.
  - .2 Shop Drawings: Submit shop drawings indicating details of electrified door hardware including, but not limited to, the following:
    - .1 Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and site installed wiring.
    - .3 Hardware Schedule: Submit door hardware schedule. Hardware shall match style and finish of existing hardware.
- .3 Do not order hardware from manufacturers until samples have been approved. Hardware and finishes supplied shall be identical with approved samples.

#### **1.5 Project closeout submission**

- .1 Operation and Maintenance Data: Provide operations and maintenance information in accordance with Section 01 78 00.
- .2 Spare Parts and Tools: Submit unique parts and tools for maintaining hardware system in accordance with Section 01 78 00.

#### **1.6 Quality assurance**

- .1 Hardware Supplier: Obtain hardware from one source having a minimum of three (3) years industry experience, with resources to provide all products indicated in the Hardware Schedule, consistent in quality, appearance and physical properties.



## **1.7 Delivery, handling and protection**

- .1 Pack hardware in suitable wrappings and containers to protect from injury during shipping and storage. Enclose accessories, fastening devices and other loose items with each item. Mark packages for easy identification as indicated on approved delivery schedule. Hand over hardware to designated installer.

## **2 Products**

### **2.1 General**

- .1 Supply to the job site all items of finishing hardware as indicated in the Hardware Scheduled appended to this Section. All items to be supplied with complete and adequate fixing and anchoring devices necessary for satisfactory installation into or upon the various surfaces to which it is to be affixed.
- .2 Cooperate with all trades using hardware supplied under this Section.
- .3 Render a complete service to the metal fabrication contractor wherein full cooperation is assured them of the supply of hardware information, and templates as requested.
- .4 Supply for installation by others where specified, as scheduled or indicated on the drawings.
- .5 In case of dispute the Consultant's decision will be binding in all cases.
- .6 Provide six, (6) copies of the hardware specification for field construction and office use.
- .7 All hardware shall be of the best quality and design, construction and finish, free from all defects.
- .8 All blank strikes shall be ASA with no lip.
- .9 Lock strikes shall be ASA with lip.
- .10 All deadlock strikes shall be ASA with no lip.
- .11 Where door pulls are scheduled on one side of door and a push plate on the other side, the contractor shall be responsible for fixing, so that the pull shall be secured through the door from the reverse side and the push

plate installed to cover the thru bolts which will be countersunk flush with door.

- .12 All door closers shall be non sized and where possible non handed. They shall be sized and adjusted by the installer to suit the site conditions.
- .13 Panic sets are to be of style specified and completely plated.
- .14 Before installing any hardware, carefully check all architectural drawings of Work requiring hardware, verify door swings, door and frame material and operating conditions. Ensure hardware will fit Work.
- .15 Provide ULC approved hardware to ULC labelled doors.
- .16 Check shop drawings and frame and door lists affecting hardware type and installation. Certify to correctness or advise Consultant in writing of required revisions.
- .17 Templates:
  - .1 Check hardware schedule, drawings and specifications. Furnish promptly to applicable trades any patterns, templates, template information and manufacturer's literature required for proper preparation for and application of hardware, in ample time to facilitate progress of Work.
  - .2 Exposed screws for installing hardware shall have Phillips or Robertson heads.
  - .3 All door closers shall have back-checking features and shall be of proper size to operate door efficiently.
  - .4 Use no wall stops on drywall.
  - .5 Rim Panic Device strikes shall be mortise type application. Equip panic devices with hex bolts.
- .18 Hinges
  - .1 Provide mortise type hinges, steel based for interior doors and stainless steel or brass for exterior doors or interior doors exposed to moisture.
  - .2 Provide hinges with stainless steel pins; non removable for exterior and public interior exposure, non rising for non security exposure.

- .3 Provide full length continuous geared hinges, continuous pin and barrel hinges or full mortise type heavy weight butt hinges on all high frequency use or extreme weighted doors.
  - .4 Where doors are required to swing 180 degrees, provide ball bearing type swing clear hinges sufficient to clear trim.
- .19 Locks, Cylinders, Latches and Bolts
- .1 Locks are to be ANSI Grade 1 mortise type unless specified otherwise.
  - .2 Equip all locks with anti-friction latches with auxiliary latch guard. All fire rated doors must have a minimum latch throw as indicated on the fire door label.
  - .3 Where lever trim is required, provide levers containing concealed mounting and constructed of solid cast or forged material.
  - .4 Locks must be lever type.
  - .5 Provide locks in accordance with current barrier free accessibility requirements as set out by the OBC or by the jurisdiction having authority, when located in the barrier free path of travel.
  - .6 Strikes shall be ANSI standard size with curved lip strikes for latch bolts and no lip strikes for deadlocks. Provide complete with wrought iron boxes finished to match strike.
  - .7 Provide Cylinders and thumb turns with the correct cam or tailpiece to operate hardware correctly.
  - .8 Automatic flush bolts are to be equipped on all fire rated pairs of doors with regular use. Provide a coordinator in conjunction with automatic flush bolts.
  - .9 Provide a filler bar when using coordinators for a clean architectural appearance.
- .20 Exit Device
- .1 All exit devices installed on labelled fire doors shall carry a ULC or Warnock Hersey Label.
  - .2 Coordinate exit devices with astragals, coordinators, carry open bars and thresholds for correct and safe operation.

- .3 All exit devices shall have exposed metal to match architectural finishes used on other hardware.
  - .4 Exit devices are push pad style only.
  - .5 Provide non-fire rated exit devices with hex key dogging feature (Cylinder dogging may be required in lieu of hex key dogging).
  - .6 Provide Power supplies of same manufacturer when using electrified exit devices.
  - .7 Match style and finish of trims on exit devices for locksets used.
- .21 Closers
- .1 All closers shall be hydraulically controlled and full rack and pinion in operation.
  - .2 All closers shall be fully adjustable including the following features: back check, speed control, and latch speed control.
  - .3 Provide mounting plates where required on special frame applications.
  - .4 Install all necessary attaching brackets, mounting channels, and cover plates where necessary for correct application of door closers.
  - .5 Supply to the Owner any special keys and wrenches as usually packed with door closers.
  - .6 Closers complete with a cover unless specified otherwise by the Consultant. Provide cover of matching architectural finish to the other hardware used in the project.
  - .7 Coordinate closers with overhead stops & holders.
- .22 Door Stops and Holders
- .1 Wall stops are only to be used on wall conditions such as block or masonry. If necessary to mount on drywall, provide proper backing to ensure no damage to the wall.
  - .2 Supply floor stops of sufficient height to suit floor conditions and the undercut of the door.
  - .3 Provide gray rubber exposed resilient parts.

- .4 Surface mount overhead door stops may be used unless they conflict with the door closer. All overhead stops are to be set to 90 degree opening unless stated otherwise.
- .23 Door Seals and Thresholds
  - .1 Perimeter seals must be provided that fully seal all gaps between the floor, door and frame. Perimeter seal must protect against weather, smoke and sound.
  - .2 Frame gasketing must be constructed of neoprene. The aluminum housing must have a rib to prevent against distortion during installation.
  - .3 Provide aluminum frames with felt inserts by door supplier.
  - .4 Install Thresholds in a manner that ensures the door bottom comes in full contact.
  - .5 All thresholds shall be aluminum and installed with lead shields and stainless steel screws.
  - .6 Cut ends of thresholds to follow exactly the door frame profile.

## **2.2 Hardware finishes**

- .1 P - Primed
- .2 32D - Brushed Stainless Steel
- .3 AL - EN - Aluminum Paint
- .4 26D - Brushed Chrome
- .5 15 - Brushed Nickel
- .6 28 - Anodized Aluminum
- .7 CAD - Cadmium Plated
- .8 26 - Polished Chrome
- .9 3 - Polished Brass
- .10 EAB - Brass Paint
- .11 BRN – Brown
- .12 630 – Stainless Steel

### **3 Execution**

#### **3.1 Installation**

- .1 Subcontractor installing the hardware shall carefully follow manufacturers' instructions for installation of all finish hardware.
- .2 For mounting heights of various hardware items refer to the following;
  - .1 Locksets: 1024 mm (40-5/16") from centre of knob to finished floor.
  - .2 Deadlocks: 1220 mm (48") from centre of cylinder to finished floor.
  - .3 Mortise Night Latches: 1024 mm (40-5/16") from centre of cylinder to finished floor.
  - .4 Panic Bolts: 1024 mm (40-5/16") from centre of crossbar to finished floor.
  - .5 Push Plates: 1143 mm 45" from centre of plate to finished floor.
  - .6 Guard Bars: 1024 mm (40-5/16") from centre of bar to finished floor.
  - .7 Door Pulls: 1067 mm (42") from centre of pull to finished floor.
  - .8 Blank Strike: 1024 mm (40-5/16") from centre of strike to finished floor.
  - .9 Blank Fronts: 1024 mm (40-5/16") from centre of strike to finished floor.

#### **3.2 Performance**

- .1 Adjust and Clean:
  - .1 Provide services of competent mechanic without additional cost to Owner. Mechanic shall inspect installation of all hardware furnished under this Section and supervise all adjustments (by trades responsible for fixing) necessary to leave hardware in perfect working order.

**End of section**

CONSULTANT : **KEVIN WILBUR**  
CONTRACT # :

**DEC 21/20**  
**FEB 2/21**  
**MAR 11/21**  
**Mar 25/21**



# **RIVETT ARCHITECTURAL HARDWARE LTD.**

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## FINISHING HARDWARE SCHEDULE

FOR

**RELOCATION OF DENTAL CLINIC**  
**200 JOHN ST**  
**OSHAWA, ONTARIO**

ARCHITECT/ENGINEER/CONSULTANT

**BBA**

**CUSTOMER :**

**SUBMITTED BY :**

	<b>RIVETT ARCHITECTURAL HARDWARE LTD.</b> 111 INDUSTRIAL DR., WHITBY, ONTARIO CANADA L1N 5Z9 TEL-905-668-4455 FAX-905-668-4433
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**kevin@rivett.com**  
**OVER FORTY-FOUR YEARS OF EXCELLENCE**

# HARDWARE INFORMATION AND SPECIFICATIONS

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April 1, 2021

**FINISH:** ALL FINISHES SHALL BE AS INDICATED IN THE FINISHING HARDWARE SCHEDULE BY INTERNATIONAL CODES.

**KEYING:** KEYING TO BE CONFIRMED

**INSTALLATION:** ALL HARDWARE SHALL BE INSTALLED AND ADJUSTED COMPLETE AS PER THE MANUFACTURERS PRINTED INSTRUCTIONS AND TEMPLATES, BY SKILLED CARPENTERS IN THE APPLICATION OF FINISHING HARDWARE.

**PRODUCTS:** MANUFACTURER'S PRODUCTS SHALL ALL BE AS SPECIFIED. ANY EQUALS MAYBE APPROVED IN WRITING IF THEY ARE EQUAL IN DESIGN, FUNCTION, QUALITY, AND FINISH AS LISTED HEREIN.

HINGES BY HAGER  
LOCKS BY SCHLAGE  
CLOSERS BY LCN  
PDO'S BY BESAM CANADA

TRIM HARDWARE BY HAGER  
SEALS BY K.N. CROWDER  
EXIT DEVICES BY VON DUPRIN  
TOUCHLESS CONTROLS BY CAMDEN

**HANDLING:** WHERE DOORS AND FRAMES ARE TO BE FIELD PAINTED OR FINISHED, ALL HARDWARE SHALL BE REMOVED BY THE GENERAL CONTRACTOR, PRIOR TO SAME. AFTER FINISHING HAS BEEN COMPLETED, THE GENERAL CONTRACTOR SHALL RE-INSTALL ALL THE HARDWARE TO MANUFACTURERS RECOMMENDATIONS.

**PACKING:** LABEL ALL FINISHING HARDWARE WITH DOOR NUMBERS AND ITEM NUMBERS. THE GENERAL CONTRACTOR SHALL RECEIVE IN A LOCKED DRY STORAGE AREA AND ADVISE WITHIN 24 HOURS OF ANY SHORTAGES.

**SUBMITTAL:** BEFORE MATERIAL IS ORDERED, SUBMIT (1) ONE COPY OF THE COMPLETED HARDWARE SCHEDULE FOR FINAL APPROVAL. SUPPLY ALL NECESSARY TEMPLATES REQUIRED FOR FABRICATION.

**WARRANTY:** THE WARRANTY PERIOD SHALL BE ONE (1) YEAR GENERALLY AND TEN (10) YEARS FOR DOOR CLOSERS, THIS SHALL BE SENT TO THE GENERAL CONTRACTOR ON COMPLETION.

**OMISSIONS:** ANY ITEMS OF FINISHING HARDWARE REQUIRED FOR THIS PROJECT AND NOT INCLUDED IN THIS SPECIFICATION AND/OR SCHEDULE WILL BE ADDED TO THE CONTRACT AFTER AN APPROVED CHANGE NOTICE HAS BEEN ISSUED BY THE ARCHITECT.

**QUALITY:** PERSONNEL WHO WILL BE RESPONSIBLE FOR SCHEDULING, ORDERING AND CO-ORDINATION HARDWARE FOR THIS PROJECT SHALL BE AN EXPERIENCED HARDWARE CONSULTANT AND WITH AN EXPERIENCED HARDWARE DISTRIBUTOR BOTH OF WHICH SHALL HAVE A MINIMUM OF FIVE YEARS EXPERIENCE. THE ARCHITECT MAY REQUEST A QUALIFICATION FORM SUBMITTED.

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## SYMBOLS



<b>B.H.M.A.</b>	<b>CANADIAN</b>	<b>U.S.A.</b>	<b>DESCRIPTION</b>
600	CP	USP	PRIMED FOR PAINT
602	C2C	US2C	CADMIUM PLATED
603	C2G	US2G	ZINC PLATED
605	C3	US3	BRIGHT BRASS CLEAR COATED
606	C4	US4	SATIN BRASS CLEAR COATED
609	C5	US5	SATIN BRASS BLACKENED CLEAR COAT
612	C10	US10	SATIN BRONZE CLEAR COATED
613	C10B	US10B	OXIDIZED SATIN BRONZE OIL RUBBED
619	C15	US15	SATIN NICKEL PLATED CLEAR COATED
625	C26	US26	BRIGHT CHROMIUM PLATED
626	C26D	US26D	SATIN CHROMIUM PLATED
627	C27	US27	SATIN ALUMINUM CLEAR COATED
628	C28	US28	SATIN ALUMINUM CLEAR ANODIZED
629	C32	US32	BRIGHT STAINLESS STEEL
630	C32D	US32D	SATIN STAINLESS STEEL
689	SBL	USP28	ALUMINUM PAINT
690	DBL	USP20	DARK BRONZE PAINT

**HANDING**

LH	LEFT HAND	LHA	LEFT HAND ACTIVE
RH	RIGHT HAND	RHA	RIGHT HAND ACTIVE
LHR	LEFT HAND REVERSE	LHRA	LEFT HAND REVERSE ACTIVE
RHR	RIGHT HAND REVERSE	RHRA	RIGHT HAND REVERSE ACTIVE

**WORDS**

ALUM	ALUMINUM	NRP	NON REMOVABLE PIN
ASA	ASA STRIKE	PR	PAIR
BS	BACKSET	SEC	SECTION
CC	CANCELED	SGLE	SINGLE
CYL	CYLINDER	STD	STANDARD
DA	DOUBLE ACTING	TB	THRU BOLTS
DS	DEAD STOP	ULA	UNDERWRITERS LABELED 3 HOUR RATED
EA	EACH	ULB	UNDERWRITERS LABELED 1 1/2 HOUR RATED
ELEV	ELEVATION	ULC	UNDERWRITERS LABELED 3/4 HOUR RATED
HDWE	HARDWARE	ULD	UNDERWRITERS LABELED 1/3 HOUR RATED
HO	HOLD OPEN	UL	UNDERWRITERS FIRE LABELED
MM	MILLIMETERS	161	STANDARD CYLINDER LOCK CUTOUT

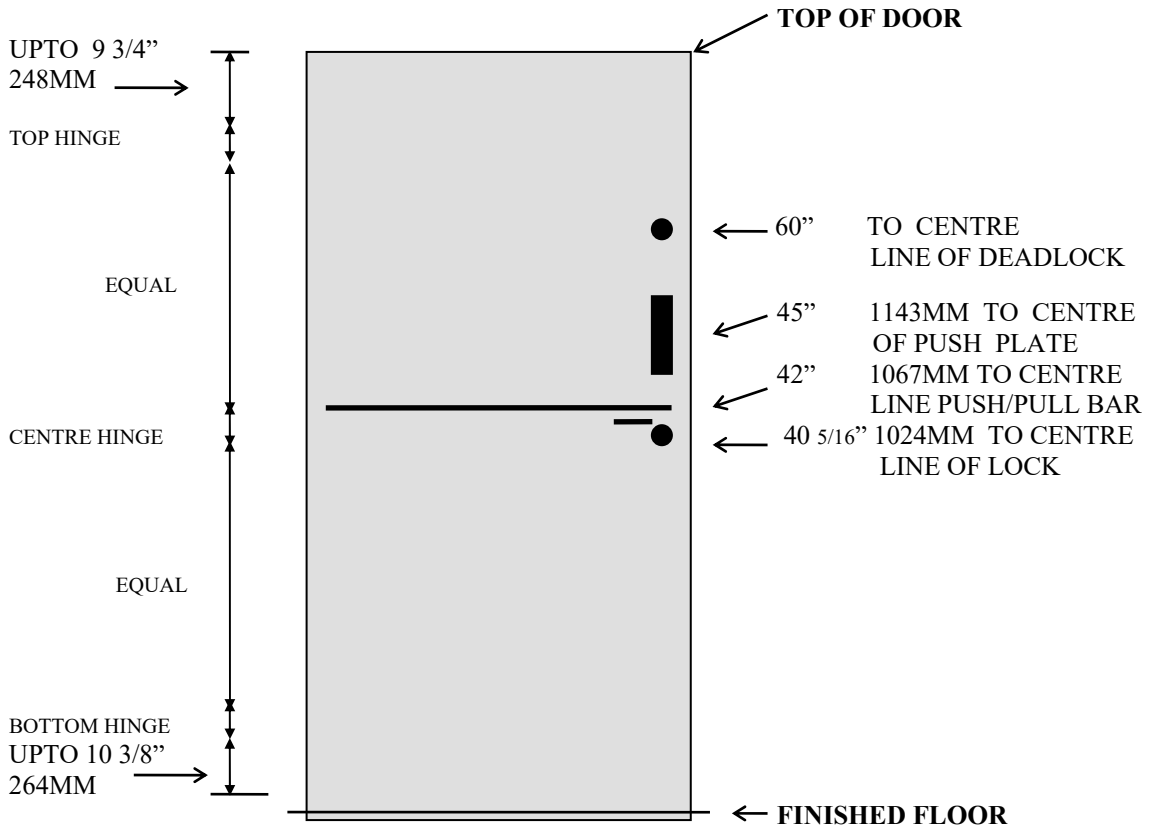
**DOORS & FRAMES**

FS	FRAME SINGLE "KD"	FD	FRAME DOUBLE "KD"
FSW	FRAME SINGLE WELDED	FDW	FRAME DOUBLE WELDED
FSWTH	FRAME SINGLE WELDED THERMO	FDWTB	FRAME DOUBLE WELDED THERMO
FSTB	FRAME SINGLE THERMO "KD"	FDWDE	FRAME WELDED DOUBLE EGRESS
FSDW	FRAME SINGLE DRYWALL	FDWCS	FRAME WELDED CONTRA SWING
FSDWW	FRAME SGLE DRYWALL WELDED	FDDW	FRAME DOUBLE DRYWALL "KD"
D	DOOR "D" SERIES HONEYCOMB CORE	-14	14 GAUGE STEEL DOOR OR FRAME
H	DOOR "H" SERIES STEEL STIFFENED	-16	16 GAUGE STEEL DOOR OR FRAME
E	DOOR "E" SERIES EMBOSSED	-18	18 GAUGE STEEL DOOR OR FRAME
Z	DOOR "Z" SERIES STEEL STIFFENED	-20	20 GAUGE STEEL DOOR OR FRAME
M	FLUSH FACE DOOR	PSF	PRESSED STEEL FRAME
G	HALF LITED DOOR	WF	WOOD FRAME
NL	NARROW LITED DOOR	HMD	HOLLOW METAL DOOR
L	LOUVERED DOOR	HCWD	HOLLOW CORE WOOD DOOR
2G	TWO LITED DOOR	SCWD	SOLID CORE WOOD DOOR
V	VIEW LITED DOOR	PL	PLASTIC LAMINATED DOOR
KD	KNOCK DOWN	FR	FRAME
TRR	TEMPERATURE RISE RATED	CIF	CHANNEL IRON FRAME
STC	SOUND TRANSMISSION	DR	DOOR

**KEYING**

GGMK	GREAT GRAND MASTER KEY	KD	KEYED DIFFERENT
GMK	GRAND MASTER KEY	KA	KEYED ALIKE
MK	MASTER KEY	CMK	CONSTRUCTION MASTER KEY
EMK	EMERGENCY MASTER KEY	SK	SEPARATE KEY NO MASTERS
BK	BLOCK-O KEYED	CC	CONSTRUCTION CORE
RM	REMOVABLE CORE	CK	CUT KEYS

**HARDWARE LOCATION DIAGRAM**



ALL HARDWARE MOUNTING LOCATIONS SHALL BE AS PER LOCATIONS DIAGRAM AND HELD CONSISTENT THROUGHOUT THE PROJECT, UNLESS INDICATED ELSEWHERE IN THE ARCHITECTS DRAWINGS, FINISHING HARDWARE SCHEDULE OR AS DIRECTED BY

**Rivett Architectural Hardware Ltd.**

**Door Listing**

**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

**Schedule 90861**  
**Date Mar 25-21**

<b>Door Number</b>	<b>Set Number</b>
102	8
105	9
106	10
107	10
108	11
109	11
110	11
111B	12
112	7
113	13
114	13
115	7
117A	14
117B	14
118	15
119	16
120	16
121	16
122	16
123	17
123B	18
124	16
125	16
126	16
127	16
128	19
129	20
130	21
131	22
132	23
133	23
C01	4
C02	5
C03	6
C06	24
V01A	1
V01B	2
V02A	1



**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule **90861**  
Date **Mar 25-21**

**Set # 1**

1 PAIR OF DRS # V01A EXTERIOR FROM VESTIBULE V01 RHRA/LHR  
1 PAIR OF DRS # V02A EXTERIOR FROM VESTIBULE V02 RHRA/LHR

2 -PAIR OF 3'0"x 7'0" x 1-3/4" x EXIST/ALD x EXIST/ALF  
hinges, t/hold, w/stripping & pulls remain as is

**Qty**

:	:	2 EA DOOR OPERATOR	SW200i X SINGLE HSG X 628
		10V to head of frame by EC	
:	:	4 EA TOUCHLESS WAVE BUTTON	#CM324/42SW X SS WAVE BUTTON
		single gang junction boxes and low voltage wiring to push buttons by EC	
:	:	4 EA PANIC DEVICE	3527AEO X 626
:	:	2 EA POWER SUPPLY FOR EL DEVICE	PS-914 X 900-2RS
:	:	2 EA ELECTRIC LATCH RETRACTION	35-EL ADD ON
		install on RHR doors	
:	:	2 EA CARD READER	BY SECURITY
		doors with card readers/power door operators - note - does owner want card reader to open power door operator? If so, a touchless wave button is not required on card reader side of door.	
:	:	2 EA RIM CYL.	20-021 X 626
:	:	2 EA LABOUR CHARGE	LABOUR - INSTALL OPERATOR
:	:	2 EA DOOR LOOP	9507-18
		install on RHR door. Flex loop so low voltage wiring can be transferred down door to tie into wire from exit device	
:	:	2 EA INTERFACE UNIT	#EJ-11 (CX- 12)

**Rivett Architectural Hardware Ltd.**

**Hardware Schedule**

**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule **90861**

Date **Mar 25-21**

**Set # 2**

1 PAIR OF DRS # V01B VESTIBULE V01 FROM WAITING AREA 101

RHRA/LHR

1 -PAIR OF 3'0"x 7'0" x 1-3/4" x EXIST/ALD x EXIST/ALF  
hinges and pulls to remain as is

**Qty**

:	:	1 EA	DOOR OPERATOR	SW200i X SINGLE HSG X 628
			110v to head of frame by EC	
:	:	2 EA	TOUCHLESS WAVE BUTTON	#CM324/42SW X SS WAVE BUTTON
			single gang junction boxes and low voltage wiring to push buttons by EC.	
:	:	2 EA	PANIC DEVICE	3527AEO X 626
			dog exit devices down during daytime operators.	
:	:	1 EA	POWER SUPPLY FOR EL DEVICE	PS-914 X 900-2RS
:	:	1 EA	ELECTRIC LATCH RETRACTION	35-EL ADD ON
			install on RHR door	
:	:	1 EA	CARD READER	BY SECURITY
:	:	1 EA	RIM CYL.	20-021 X 626
:	:	1 EA	LABOUR CHARGE	LABOUR - INSTALL OPERATOR
:	:	1 EA	DOOR LOOP	9507-18
			install on RHR door. Flex loop so low voltage wiring can be transferred down door to tie into wire from exit device	
:	:	1 EA	INTERFACE UNIT	#EJ-11 (CX- 12)

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule 90861  
Date Mar 25-21

**Set # 3**

1 SINGLE DR # V02B VESTIBULE V02 FROM CORRIDOR C06 RHR

1 -965 x 2150 x 45 x AL2/ALD x ALUM FRAME

**Qty**

:	:	3 EA	HINGE	BB1168-114 X 101- 626
:	:	1 EA	PANIC DEVICE	35AL X 360L X LC X RHR X 626
:	:	1 EA	DOOR OPERATOR	SW200i X SINGLE HSG X 628
			110v to head of frame by EC. Dog exit device down during daytime operation.	
:	:	2 EA	TOUCHLESS WAVE BUTTON	#CM324/42SW X SS WAVE BUTTON
			single gang junction boxes and low voltage wiring to push buttons by EC	
:	:	1 EA	CONCEALED STOP	104S X 630
			template installation to stop door at 96 degrees	
:	:	1 EA	ELECTRIC STRIKE	9600 X 630
:	:	1 EA	CARD READER	BY SECURITY
:	:	1 EA	MORTISE CYL.	20-001 X 1.25 X 626
			install in trim of exit device	
:	:	1 EA	LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST
:	:	1 EA	INTERFACE UNIT	#EJ-11 (CX- 12)

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule **90861**  
Date **Mar 25-21**

**Set # 4**

1 SINGLE DR # C01 CORRIDOR C01 FROM CORRIDOR C04 LHR  
1 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	3 EA HINGE	BB1168-114 X 101- 626
:	:	1 EA PANIC DEVICE	98L X 996-LNL-RIGID X LHR-628
:	:	1 EA RIM CYL.	20-021 X 626
:	:	1 EA DOOR OPERATOR	SW200i X SINGLE HSG X 628
		110v to head of frame by EC	
:	:	2 EA TOUCHLESS WAVE BUTTON	#CM324/42SW X SS WAVE BUTTON
		low voltage wiring and single gang junction boxes to push buttons by EC	
:	:	1 EA ELECTRIC STRIKE	9600 X 630
		low voltage to strike by EC	
:	:	1 EA CARD READER	BY SECURITY
:	:	2 EA KICKPLATE	190S X 152 X 914 X 630
		install on both sides of door	
:	:	1 EA FLOOR STOP	243F X 626
:	:	1 EA LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST
:	:	1 EA INTERFACE UNIT	#EJ-11 (CX- 12)



**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule   **90861**  
Date         **Mar 25-21**

**Set #     5**

RHR/RHR

1 PAIR OF DRS # C02 CORRIDOR C01 FROM CORRIDOR C02  
1 -PAIR OF 965/305 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	5 EA	HINGE	BB1168-114 X 101- 626
:	:	1 EA	PANIC DEVICE install on RHR door	9875L X 996L-M X RHR X 628
:	:	2 EA	FLUSH BOLT install in edge of LHR door	282D X 626
:	:	1 EA	FAIL SECURE ELECTRIC STRIKE install in edge of LHR door	1006 X CBL X 630
:	:	1 EA	DOOR OPERATOR install on RHR door. 110v to head of frame by EC	SW200i X SINGLE HSG X 628
:	:	2 EA	TOUCHLESS WAVE BUTTON low voltage wiring and single gang junction boxes to push buttons by EC	#CM324/42SW X SS WAVE BUTTON
:	:	1 EA	MORTISE CYL. install in lever trim of exit device	20-001 X 1.125 X 626
:	:	1 EA	CARD READER	BY SECURITY
:	:	2 EA	KICKPLATE	190S X 152 X 914 X 630
:	:	2 EA	KICKPLATE	190S X 152 X 254 X 630
:	:	1 EA	FLOOR STOP	243F X 626
:	:	1 EA	ELECTRIC HINGE install in middle hinge of LHR door. Provide wire race way through mid point of door to electric strike.	ETW-4BB1279-114 X 101-626
:	:	1 EA	INTERFACE UNIT	#EJ-11 (CX- 12)
:	:	1 EA	LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST

**Rivett Architectural Hardware Ltd.**

**Hardware Schedule**

**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule 90861  
Date Mar 25-21

**Set # 6**

1 SINGLE DR # C03 CORRIDOR C06 FROM CORRIDOR C03 LHR

1 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	3 EA HINGE	BB1168-114 X 101- 626
:	:	1 EA PANIC DEVICE	98L X 996-LNL-RIGID X LHR-628
:	:	1 EA RIM CYL.	20-021 X 626
:	:	1 EA DOOR OPERATOR	SW200i X SINGLE HSG X 628
		110v to head of frame by EC	
:	:	1 EA ELECTRIC STRIKE	9600 X 630
		low voltage wiring to strike by EC	
:	:	1 EA CARD READER	BY SECURITY
:	:	2 EA KICKPLATE	190S X 152 X 914 X 630
		install on both sides of door	
:	:	1 EA FLOOR STOP	243F X 626
:	:	2 EA TOUCHLESS WAVE BUTTON	#CM324/42SW X SS WAVE BUTTON
		low voltage wiring and single gang junction boxes to push buttons by EC	
:	:	1 EA INTERFACE UNIT	#EJ-11 (CX- 12)
:	:	1 EA LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST

**Set # 7**

1 SINGLE DR # 115 CUBICLES/WORKSTATIONS 111 TO FILE RM 115 RH

1 SINGLE DR # 112 CUBICLES/WORKSTATIONS 111 TO OFFICE/STRG 112 LH

2 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	6 EA HINGE	BB1168-114 X 101- 626
:	:	2 EA STOREROOM LOCKSET	AL80PD X SAT X ASA X 626
:	:	2 EA FAIL SECURE ELECTRIC STRIKE	1006 X CBL X 630
		low voltage wiring to strike by EC	
:	:	2 EA CARD READER	BY SECURITY
:	:	2 EA CLOSER	1461 X 689
:	:	2 EA KICKPLATE	190S X 152 X 914 X 630
:	:	2 EA FLOOR STOP	243F X 626

**Rivett Architectural Hardware Ltd.**

**Hardware Schedule**

**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

**Schedule 90861**  
**Date Mar 25-21**

**Set # 8**

1 SINGLE DR # 102 CORRIDOR C02 TO COPY AREA 103

RH

1 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	3 EA	HINGE	BB1279-114 X 101- 626
:	:	1 EA	STOREROOM LOCKSET	AL80PD X SAT X ASA X 626
:	:	1 EA	CLOSER	1461 X 689
:	:	1 EA	KICKPLATE	190S X 152 X 914 X 630
:	:	1 EA	FLOOR STOP	243F X 626
:	:	1 EA	FAIL SECURE ELECTRIC STRIKE	1006 X CBL X 630
:	:		low voltage wiring to strike by EC	
:	:	1 EA	CARD READER	BY SECURITY

**Set # 9**

1 SINGLE DR # 105 CORRIDOR C01 TO UNIVERSAL W/RM 105

LH

1 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	3 EA	HINGE	BB1168-114 X 101- 626
:	:	1 EA	STOREROOM LOCKSET	AL80PD X SAT X ASA X 626
:	:	1 EA	ELECTRIC STRIKE FAIL SAFE	1006 X FS X CLB X 630
:	:	1 EA	DOOR OPERATOR	SW200i X SINGLE HSG X 628
:	:		110v to head of frame by EC	
:	:	1 EA	DOOR OPERATOR ADD ON	SW200i ADD FOR INSWING ARM
:	:	1 EA	OCC/EMERGENCY KIT LESS BTNS	#OCC-1-EMR-R KIT
:	:		all low voltage wiring to single gang boxes by EC	
:	:	2 EA	TOUCHLESS WAVE BUTTONS	#CM324/42SW X SS WAVE BUTTON
:	:		single gang junction boxes and low voltage wiring to push buttons by EC	
:	:	1 EA	FLOOR STOP	243F X 626
:	:	1 EA	LABOUR CHARGE ( STD BUTTON)	LABOUR - INSTAL OP-OCC1-ES-EMR

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule **90861**  
Date **Mar 25-21**

**Set # 10**

- 1 SINGLE DR # 106 CORRIDOR C01 TO CONSULT ROOM 2 106 RH
- 1 SINGLE DR # 107 CORRIDOR C01 TO CONSULT ROOM 1 107 LH
- 2 -965 x 2150 x 45 x WD DR x PSF

**Qty**

- : : 6 EA HINGE BB1279-114 X 101- 626
- : : 2 EA LATCHSET AL10S X SAT X ASA X 626
- : : 2 EA KICKPLATE 190S X 152 X 914 X 630
- : : 2 EA FLOOR STOP 243F X 626

**Set # 11**

- 1 SINGLE DR # 108 CUBICLES/WORKSTATIONS 111 TO OFFICE 1 108 RH
- 1 SINGLE DR # 109 CUBICLES/WORKSTATIONS 111 TO OFFICE 2 109 RH
- 1 SINGLE DR # 110 CORRIDOR C05 TO OFFICE 3 110 LH
- 3 -965 x 2150 x 45 x WD DR x PSF

**Qty**

- : : 9 EA HINGE BB1279-114 X 101- 626
- : : 3 EA OFFICE LOCKSET AL53PD X SAT X ASA X 626
- : : 3 EA KICKPLATE 190S X 152 X 914 X 630
- : : 3 EA FLOOR STOP 243F X 626

**Set # 12**

- 1 PAIR OF DRS # 111B CUBICLES/WORKSTATIONS 111 TO CLOSET SLIDING
- 1 -PAIR OF 965 x 2150 x 45 x WD DR x SLIDING DOOR TRACK

**Qty**

- : : 1 EA SET BI-PASSING DOOR TRACK C-500 X 84" X 2DR X 628
- : : 2 EA FLUSH PULL C-71 X 626

**Rivett Architectural Hardware Ltd.**

**Hardware Schedule**

**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

**Schedule 90861**  
**Date Mar 25-21**

**Set # 13**

1 SINGLE DR # 113 CORRIDOR C05 TO PHONE RM 1 113 LH  
1 SINGLE DR # 114 CORRIDOR C05 TO PHONE RM 2 114 RH

2 -965 x 2150 x 45 x WD DR x PSF

**Qty**

: : 6 EA HINGE BB1279-114 X 101- 626  
: : 2 EA PRIVACY SET AL40S X SAT X ASA X 626  
: : 2 EA KICKPLATE 190S X 152 X 914 X 630  
: : 2 EA FLOOR STOP 243F X 626

**Set # 14**

1 SINGLE DR # 117A CORRIDOR C02 TO STERILIZATION RM 117 SLIDING  
1 SINGLE DR # 117B CORRIDOR C03 TO STERILIZATION RM 117 SLIDING

2 -1070 x 2150 x 45 x WD DR x SLIDING DOOR TRACK

**Qty**

: : 2 EA POCKET FRAME-- QUICK RELEASE TYPE CC-1W EHW4 - 4'0" WIDE  
: : 4 EA FLUSH PULL C-71 X 626  
: : 2 EA MAGNETIC CATCH 327A92

**Set # 15**

1 SINGLE DR # 118 CORRIDOR C02 TO OPERATORY 1 118 LH

1 -1220 x 2150 x 45 x WD DR x PSF

**Qty**

: : 3 EA HINGE BB1168-114 X 101- 626  
: : 1 EA LATCHSET AL10S X SAT X ASA X 626  
: : 1 EA STRETCHER PLATE 190S X 914 X 1167 X 630  
: : 1 EA FLOOR STOP 243F X 626

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule **90861**  
Date **Mar 25-21**

**Set # 16**

1 SINGLE DR # 119	CORRIDOR C03 TO OPERATORY 2 119	LH
1 SINGLE DR # 120	CORRIDOR C03 TO OPERATORY 3 120	LH
1 SINGLE DR # 121	CORRIDOR C03 TO OPERATORY 4 121	LH
1 SINGLE DR # 122	CORRIDOR C03 TO OPERATORY 5 122	LH
1 SINGLE DR # 124	CORRIDOR C03 TO OPERATORY 6 124	LH
1 SINGLE DR # 125	CORRIDOR C03 TO OPERATORY 7 125	LH
1 SINGLE DR # 126	CORRIDOR C06 TO MEETING ROOM 126	RH
1 SINGLE DR # 127	CORRIDOR C06 TO KITCHEN 127	LH

8 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	24 EA HINGE	BB1168-114 X 101- 626
:	:	8 EA LATCHSET	AL10S X SAT X ASA X 626
:	:	8 EA FLOOR STOP	243F X 626

**Set # 17**

1 SINGLE DR # 123	CORRIDOR C03 TO COMPRESSOR RM 123	RH
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1 -965 x 2150 x 45 x HMD x PSF x 45min

**Qty**

:	:	3 EA HINGE	BB1168-114 X 101- 626
:	:	1 EA STOREROOM LOCKSET	AL80PD X SAT X ASA X 626
:	:	1 EA FAIL SECURE ELECTRIC STRIKE	1006 X CBL X 630
:	:	1 EA CLOSER	1461 X 689
:	:	1 EA CARD READER	BY SECURITY
:	:	1 EA KICKPLATE	190S X 152 X 914 X 630
:	:	1 EA FLOOR STOP	243F X 626

**Set # 18**

1 SINGLE DR # 123B	COMPRESSOR ROOM 123 FROM O & N CLOSET 123B	RHR
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1 -965 x 2150 x 45 x HMD x PSF x 45min

**Qty**

:	:	3 EA HINGE	BB1279-114 X 101- 626
:	:	1 EA LATCHSET	AL10S X SAT X ASA X 626
:	:	1 EA CLOSER	1461 X 689

**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule **90861**  
Date **Mar 25-21**

**Set # 19**

1 SINGLE DR # 128 CORRIDOR C07 TO LOCKERS 128 LH  
1 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	3 EA HINGE	BB1168-114 X 101- 626
:	:	1 EA PUSH PLATE	30S X 101 X 406 X 630
:	:	1 EA DOOR PULL	31G X 8" X 630
:	:	1 EA CLOSER	1461 X 689
:	:	2 EA KICKPLATE	190S X 152 X 914 X 630
		install on both sides of door	
:	:	1 EA FLOOR STOP	243F X 626

**Set # 20**

1 SINGLE DR # 129 CORRIDOR C07 TO DENTURIST WORKSHOP 129 LH  
1 -965 x 2150 x 45 x HMD x PSF x 45min

**Qty**

:	:	3 EA HINGE	BB1168-114 X 101- 626
:	:	1 EA LATCHSET	AL10S X SAT X ASA X 626
:	:	1 EA CLOSER	1461 X 689
:	:	1 EA KICKPLATE	190S X 152 X 914 X 630

**Set # 21**

1 SINGLE DR # 130 CORRIDOR C07 TO IT/ELEC 130 RH  
1 -965 x 2150 x 45 x HMD x PSF x 45min

**Qty**

:	:	3 EA HINGE	BB1279-114 X 101- 626
:	:	1 EA STOREROOM LOCKSET	AL80PD X SAT X ASA X 626
:	:	1 EA CLOSER	1461 X 689
:	:	1 EA FAIL SECURE ELECTRIC STRIKE	1006 X CBL X 630
:	:	1 EA CARD READER	BY SECURITY
:	:	1 EA KICKPLATE	190S X 152 X 914 X 630
:	:	1 EA FLOOR STOP	243F X 626





**Rivett Architectural Hardware Ltd.**  
**Hardware Schedule**  
**RELOCATION OF DENTAL CLINIC - 200 JOHN ST - OSHAWA, ONTARIO**

Schedule **90861**  
Date **Mar 25-21**

**Set # 24**

1 SINGLE DR # C06 CORRIDOR C06 TO CORRIDOR C05 RH  
1 -965 x 2150 x 45 x WD DR x PSF

**Qty**

:	:	3 EA HINGE	BB1168-114 X 101- 626
:	:	1 EA STOREROOM LOCKSET	AL80PD X SAT X ASA X 626
:	:	1 EA ELECTRIC STRIKE	1006 X CBL X 630
		low voltage wiring to strike by EC	
:	:	1 EA DOOR OPERATOR	SW200i X SINGLE HSG X 628
		110v to head of frame by EC	
:	:	1 EA DOOR OPERATOR ADD ON	SW200i ADD FOR INSWING ARM
:	:	2 EA TOUCHLESS WAVE BUTTONS	#CM324/42SW X SS WAVE BUTTON
		single gang junction boxes and low voltage wiring to push buttons by EC	
:	:	1 EA CARD READER	BY SECURITY
:	:	2 EA KICKPLATE	190S X 152 X 914 X 630
		install on both sides of door	
:	:	1 EA FLOOR STOP	243F X 626
:	:	1 EA LABOUR CHARGE	LABOUR - INSTALL OPER. & E/ST

**Set # 25**

1 SINGLE DR # 104 ADMIN 104 FROM STORAGE RHR  
1 -965 x 2150 x 45 x WD DR x PSF  
door, frame and hardware deleted from contract

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of automatic swing door operator, surface mounted, and complete with accessories required for complete finish, installation and operation.

### **1.2 Related requirements**

- .1 Section 08 11 00: Metal Doors and Frames
- .2 Section 08 14 16: Flush Wood Doors
- .3 Section 08 50 00: Aluminum Doors and Screens
- .4 Section 08 70 00: Hardware

### **1.3 Reference standards**

- .1 American Association of Automatic Door Manufacturers (AAADM)
- .2 American National Standards Institute (ANSI)
  - .1 ANSI A156.19 – Power Assist and Low Energy Power Operated Doors
  - .2 ANSI 117.1 – Accessible and Usable Buildings and Facilities
- .3 Builders' Hardware Manufacturers Association (BHMA)
- .4 Underwriters Laboratory Canada (ULC)
- .5 Canadian Standards Association (CSA)
- .6 National Fire Protection Association (NFPA)
- .7 International Code Council (ICC)

### **1.4 System description**

- .1 Performance Requirements:
  - .1 Design system to operate, hold open and close doors under design wind and suction loads calculated in accordance with applicable code.
  - .2 Provide for thermal expansion and contraction of door and frame units, transmitted to operating equipment.

- .3 Provide for dimensional distortion of components during operation.
- .4 Operating Temperature Range: -33 deg. C to 72 deg. C ambient.
- .5 Eliminate system performance interference by ambient light and radio frequencies.
- .6 Provide for manual open and close operation of door leaves in the event of power failure.

### **1.5 Quality assurance**

- .1 Manufacturer's Qualifications: Manufacturer to have at least (5) five years experience in the fabrication of automatic and manual entrance systems.
- .2 Subcontractor executing work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- .3 The installation shall be in conformity with laws, by-laws and regulations which govern the design and installation of automatic entrance doors.
- .4 Installer's Qualifications: Products specified shall be represented by a factory authorized and trained distributor. Distributor shall be AAADM Certified and maintain a parts inventory and trained service personnel capable of providing service.
- .5 Pre-installation Conference:
  - .1 Schedule a pre-installation conference no later than one week prior to commencing work of this Section.
  - .2 Contact Contractor two weeks prior to proposed meeting to confirm schedule.
- .6 All automatic equipment to comply with UL325 and CAN/CSA-C22.2 No 247-92.
- .7 All automatic equipment to comply with ANSI A156.19.

### **1.6 Submittals**

- .1 Submit submittals in accordance with Section 01 33 00.

- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit product data indicating installation details, material descriptions, dimensions of individual components and profiles, and finishes.
  - .2 Shop Drawings: Submit shop drawings indicating details of electrified door hardware including, but not limited to, the following:
    - .1 Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and site installed wiring.
    - .2 Submit complete elevations, details and methods of anchorage to location; installation of hardware; size, shape, connections; and details of joining with other construction.
  - .3 Templates and Diagrams: As needed shall be furnished to fabricators and installers of related work for coordination of swinging door system with concrete work, electrical work, and other related work.
  - .4 Samples: Submit to Consultant for approval, before fabrication of the work, samples of materials, components, and finishes to be used in the work.
  - .5 Maintenance Data and Operating Instructions: On completion of work of this Section, supply three (3) copies of maintenance instructions for insertion into Operating and Maintenance Manual.

## **1.7 Project closeout submission**

- .1 Operation and Maintenance Data: Provide operations and maintenance information in accordance with Section 01 78 00.
- .2 Spare Parts and Tools: Submit unique parts and tools for maintaining hardware system in accordance with Section 01 78 00.

## **1.8 Delivery, handling and protection**

- .1 Pack hardware in suitable wrappings and containers to protect from injury during shipping and storage. Enclose accessories, fastening devices and other loose items with each item. Mark packages for easy identification as indicated on approved delivery schedule. Hand over hardware to designated installer.

## **1.9 Site conditions**

- .1 Site Survey: Verify site conditions including, but not limited to the following; opening sizes, floor conditions, plumb and level mounting surfaces.
  - .1 Substrates shall be of proper dimension and material.
- .2 Coordinate installation with glass, glazing hardware and electrical to avoid construction delays.

## **1.10 Warranty**

- .1 Warrant work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of two (2) years and agree to promptly make good defects which become evident during warranty period without cost to the Owner.
- .2 Warrant that any unit failing shall be removed and replaced without cost to the Owner.

## **2 Products**

### **2.1 Manufacturers**

- .1 Supply all automatic door operators and accessories from one manufacturer to ensure compatibility of system components.
- .2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 Besam Ltd.
  - .2 Horton Automatics

- .3 Gyro Tech Inc
- .4 Record-USA
- .5 Or reviewed equivalent

## **2.2 Automatic swing door system**

- .1 Coordinate the work of all trades, including glass and glazing, masonry, and electrical requirements covered in manufacturer's details and appropriate sections of the specifications.
- .2 Coordinate with electrical contractor for provision of service to each operator from junction box for multiple operators.
- .3 Coordinate with electrical contractor and provide electrical conduit and wiring from specified controls to operators as outlined on manufacturer's drawings.
- .4 Finish Hardware Supplier: Provide and install the following automatic door operators and connecting hardware, and power on/off switch and safety sensor.
  - .1 Overhead Concealed Side Access (Type A): Provide and install overhead concealed swing door operator, for single or double doors, consisting of operator and electronic control, aluminum header.
    - .1 Basis of Design Material: Besam SW200i-OS by ASSA ABLOY, or reviewed equivalent.
  - .2 Surface Mount Single Push (Type B): High performance, heavy use application, surface mounted operator, complete with aluminum header case and arm link.
    - .1 Basis of Design Material: Besam SW200i by ASSA ABLOY, or reviewed equivalent.
  - .3 Automatic entrance equipment: comply with ANSI A156.10 or A156.19.
  - .4 Aluminum header extrusions: minimum nominal 4 mm wall thickness with finish anodized AA-M12-C22-A31 clear.
  - .5 Equipment must operate between -35 °C and +55 °C in all climate conditions.

- .6 Operator: Electro-mechanical system installed in a header to resist dust, dirt and corrosion; entire operator shall be removable from the header as a unit.
- .7 Bearings: Fully lubricated and sealed to minimize wear and friction.
- .5 Electrical Control:
  - .1 Solid-state microprocessor unit, allowing the opening speed, closing speed, back check and latch check speed each to be adjusted separately and independently from each other to meet specific site conditions.
  - .2 Adjustable opening and closing speeds shall be set in accordance with ANSI A156.19.
  - .3 Control shall include time delay. All adjustments shall be specific and reproducible.
  - .6 The door forces and speeds generated during power opening, and manual opening in both directions of swing, and spring closing in both directions of swing shall conform to the requirements of ANSI A156.10 or A156.19.
  - .7 Verify that no defects or errors are present in completed phases of the work that would result in poor application or installation or cause latent defects of the automatic door equipment.
  - .8 Installation and warranty adjustments shall be performed by authorized distributors' factory trained technician.

## **2.3 Activating devices**

- .1 Wall Switches: Barrier free wave sensor as indicated on the Drawings.

## **3 Execution**

### **3.1 Installation**

- .1 Automatic door equipment shall be installed by AAADM Certified, factory-trained installers in compliance with ANSI A156.19, manufacturer's recommendations and approved shop drawings.

### **3.2 Cleaning and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 After installation, clean framing members as recommended by the manufacturer.
- .3 Protect aluminum surfaces in contact with masonry, concrete or steel by use of neoprene gaskets, where indicated, or a coat of bituminous paint to prevent galvanic or corrosive action.
- .4 Advise general contractor to protect unit from damage during subsequent construction activities.

### **3.3 Performance**

- .1 Provide services of certified technician without additional cost to Owner, to inspect and adjust installation of all hardware furnished under this Section to assure compliance with ANSI A156.10.

**End of section**



## **1 General**

### **1.1 Section includes**

- .1 Furnish glazing materials and accessories with the exception of r fire resistant glazing specified in Section 08 88 13 to complete the fabrication and installation of:
  - .1 Metal doors and frames
  - .2 Wood doors
  - .3 Aluminum windows and doors

### **1.2 Related requirements**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 92 00 Sealants
- .3 Section 08 11 00 Metal Doors and Frames
- .4 Section 08 14 16 Flush Wood Doors
- .5 Section 08 50 00 Aluminum Doors and Screens
- .6 Section 08 88 13 Fire Resistant Glazing

### **1.3 Reference standards**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM C542-05(2017) Standard Specification for Lock-Strip Gaskets
  - .2 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-12.1-M90 Tempered or Laminated Safety Glass
  - .2 CAN/CGSB-12.3-M91 Flat, Clear Float Glass
  - .3 CAN/CGSB-12.8-97 Insulating Glass Units
  - .4 CAN/CGSB-12.9-M91 Spandrel Glass
  - .5 CGSB-12.20-M89 Structural Design of Glass for Buildings

- .3 National Fire Protection Association (NFPA):
  - .1 NFPA 80-2013 Standard for Fire Doors and Other Opening Protectives
- .4 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 Provide submittals in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit manufacturer's product data for each type of product specified. Data shall indicate compliance with specification and installation recommendations of manufacturer of products being used.
  - .2 Samples: Submit samples of materials if required by Consultant before commencing work of this section. Samples shall be clearly labeled with manufacturer's name and type.
  - .3 Shop Drawings: Submit shop drawings, to the Consultant for review prior to fabrication.
  - .4 Samples for Verification: Submit samples for verification including sample sets showing the full range of variations expected where products involve normal colour variations.
  - .5 Maintenance Data: Upon completion of installation, supply instructions covering re-glazing, adjustments and other relevant maintenance data.
  - .6 Insulating Glass products are to be permanently marked wither 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)

## **1.5 Quality assurance**

- .1 Conform to the requirements of the Flat Glass Marketing Association Glazing Manual, latest Edition.
- .2 Insulating glass units in combination with aluminum window, 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.

## **1.6 Delivery, storage and handling**

- .1 Delivery and Acceptance Requirements: Deliver packaged materials in their original containers with manufacturer's labels and seals intact.
- .2 Storage and Handling Requirements: Store vertically, blocked off the floor in a weatherproof enclosure in original containers with manufacturers labels and seals intact until read for installation, and as follows:
  - .1 Install glass as soon as possible after delivery to site.
  - .2 Handle glass carefully to its place of installation.
  - .3 Prevent damage to glass, adjacent materials and surfaces.

## **1.7 Site conditions**

- .1 Ambient Conditions: Maintain temperature, humidity and solar exposure conditions of Glass Glazing materials during shipping, storage and site installation as required by manufacturer to maintain warranty and performance of installed products.

## **2 Products**

### **2.1 Materials**

- .1 Float Glass: In accordance with CAN/CGSB-12.3, glazing quality and as follows:
  - .1 Clear Glass: No tint
- .2 Tempered Glass:

- .1 Minimum 6.4 mm thick or as noted I on drawings, clear, conforming to CAN/CGSB-12.1, Type 2, Class 'B'. Tempering shall be performed using horizontal tong free method.
- .3 Gaskets:
  - .1 Neoprene/EPDM thermoplastic rubber type gaskets of sufficient thickness to be compressed 25% when installed, having 2,000 psi tensile strength, with 50 durometer shore A hardness plus/minus 5, maximum 30% resistance to permanent set, resistance to ozone without cracking, minimum elongation at break of 300% and conforming to ASTM C542.
  - .2 Colour - "Black".
- .4 Sealant:
  - .1 One component, silicone base, solvent curing sealant conforming to ASTM C920. Colour as selected Later by Consultant.
- .5 Glazing Compound:
  - .1 Non-hardening modified oil type glazing compound.
- .6 Setting Blocks:
  - .1 Neoprene/EPDM rubber type, 4" long, with 40 to 50 durometer shore A hardness plus/minus 5; resistant to sunlight, weathering, oxidation and permanent deformation under load and wide enough to extend from fixed stop to opposite face of glass of thickness suitable to glazing condition to provide adequate glazing "bite".
- .7 Spacer Shims:
  - .1 Neoprene/EPDM rubber type, with 40 to 50 durometer shore A hardness plus/minus 5; resistant to sunlight, weathering, oxidation and permanent deformation under load and of adequate thickness to provide correct glass to face clearance at least 1/8".
- .8 Glazing Tape:
  - .1 Macro-polyisobutylene preformed glazing tape, 'Polyshim' or 'Vision Strip' by Tremco Ltd., division of RPM Company, or approved equal.

## **2.2 Insulated Glass Units**

- .1 Performance requirements for insulating glass units specified herein are the minimum permitted requirements. Provide engineered shop drawings and calculations showing that glazed assemblies including framing and glazing products in combination, meet or exceed the minimum requirements of MMAH Supplementary Standard SB-10.
- .2 Insulating Glass Units: To CAN/CGSB-12.8-M, double glazed sealed units, 25mm overall thickness.
  - .1 Glass: to CAN/CGSB-12.1(tempered) Glass thickness: 6.4 mm each light.
  - .2 Inter-cavity space thickness: 12.7 mm with low conductivity spacers.
  - .3 Glass coating: surface number 2, low "E" colour.
  - .4 Inert gas fill: argon.

## **2.3 Spandrel Glass**

- .1 Spandrel Glass: to CAN/CGSB-12.9, 8 mm thick.
- .2 Type 2 Heat strengthened.
- .3 Class A-Float.
- .4 Style 1 Opacifying coating on the No. 2 (inboard) surface.
- .5 Form M-Monolithic.
- .6 Colour to be selected by the Consultant from full range of manufacturer's standards.

## **2.4 Glass Channels**

- .1 U channel frames with top load gasket for 13 mm and 19 mm thick glass for glass screens. Channel size 45 mm x 43 mm. Brushed stainless-steel finish.

## **2.5 Fire Rated Glass**

- .1 Refer to Section 08 88 13

## **2.6 Fabrication and manufacture**

- .1 Label each light of glass with the registered name of the product and the weight and quality of the glass.
- .2 Check dimensions on site before cutting materials.
- .3 Minimum bite or lap of glass on stops and rabbets as recommended by glass manufacturer. Finish surfaces shall be free of tong marks.
- .4 Cut glass true to dimensions, square, plumb and level. Verify all dimensions prior to fabrication.
- .5 Distortion, pock marking or defects detrimental to appearance and/or performance, as determined by the Consultant, will be rejected.

## **3 Execution**

### **3.1 Examination**

- .1 Examine areas of work affecting the work of this section. Report in writing all defects, errors and discrepancies immediately to the Consultant.
- .2 Commencement of work implies acceptance of surfaces and conditions.

### **3.2 Preparation**

- .1 Openings shall be free from moisture, frost, rust, dirt and foreign matter.
- .2 Clean surface to receive sealant with a clean cloth dampened with xylol or a 50-50 mixture of acetone and xylol. Wipe dry with a clean, dry cloth.

### **3.3 Installation**

- .1 Conform to the recommendation of the glazing manual, Flat Glass Marketing Association, latest edition and as specified herein.
- .2 Unless otherwise indicated on drawings otherwise, provide tempered glass at all doors, transoms, sidelights and vision lites.
- .3 Glaze doors scheduled to be glazed.
- .4 Set sheet glass with draw lines horizontal.
- .5 Glaze interior openings using compound or glazing tapes or gaskets.

- .6 Install removable stops. Insert spacer shims between glass and stops at 24" O.C. and not less than 1/4" below "sight lines". Fill remaining voids with sealant or glazing compound to "sight lines" and trim sealant/glazing compound to produce clean, sharp, straight lines without voids or depressions.
- .7 Replace loose stops in their original positions, tighten all screws.
- .8 Refer to drawings and door and frame schedule for locations of each type of glass.

### **3.4 Glass Channels**

- .1 Install U channel frames and glass screens in accordance with manufacturer's installation instructions.

### **3.5 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Repair all defects caused by the work of this section. Remove as work progresses, all excess or foreign materials or droppings which would set or become difficult to remove from surfaces at time of final cleaning.
- .3 Immediately prior to acceptance of work of this section by Consultant, remove temporary protection, clean and polish exposed surfaces of all work of this section. Use proper cleaning materials and methods to prevent damage to surfaces, finishes, sealer or work of other trades. Make good such damage to Consultant's satisfaction.
- .4 Do not use steel wool, wire brushes or steel scrapers on any finished surfaces.
- .5 Replace or make good to Consultant's satisfaction, upon completion of work of this section, all defective, scratched or damaged work, at no extra cost to the Owner.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of glass privacy films

### **1.2 Related requirements**

- .1 Section 08 50 00 Aluminum Doors and Screens
- .2 Section 08 80 00 Glazing

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM E308-18 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 G155-13 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic 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 Verification Samples: For each finish product specified, two samples representing actual product, colour, and patterns.
- .5 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.
  - .1 Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
- .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 Delivery, handling and protection**

- .1 Store products in manufacturer's unopened packaging until ready for installation.

- .2 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 00 – Cleaning and waste management.

## **2 Products**

### **2.1 Manufacturer**

- .1 Acceptable Manufacturer: 3M Window Film or reviewed equivalent

### **2.2 Glazing Film**

- .1 Single Patterned Film (#1)
  - .1 Fasara - Milano SH2MA ML Decorative / Privacy Glazing Film (or approved equal):
    - .1 Ultraviolet Rejected (ASTM E903): Not less than 99 percent.
    - .2 Visible Light Transmission (ASTM E903, ASTM E308): Not more than 59 percent.
    - .3 Visible Light Rejected (ASTM E903): Not less than 17 percent.
    - .4 Solar Heat Reduction: Not less than 21 percent.
    - .5 Shading Coefficient at 90 Degrees (Normal Incidence) (ASTM E903): Not less than 0.75.
- .2 Opaque Film (#2)
  - .1 Fasara – Opaque Black (or approved equal)
    - .1 Visible Light Transmission (ASTM E903, ASTM E308): Not more than 0.4 percent.

- .2 Solar Heat Reduction: Not less than 5 percent.

### **3 Execution**

#### **3.1 Examination**

- .1 Do not begin installation until substrates have been properly prepared.
- .2 If substrate preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

#### **3.2 Preparation**

- .1 Clean surfaces thoroughly prior to installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.3 Installation**

- .1 Install in accordance with manufacturer's instructions.
- .2 Cut film edges neatly and square at a uniform distance of 3 mm to 1.5 mm of window sealant. Use new blade tips after 3 to 4 cuts.
- .3 Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
- .4 Apply film to glass and lightly spray film with slip solution.
- .5 Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
- .6 Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
- .7 Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

#### **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .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**

## **1 General**

### **1.1 Section includes**

- .1 Furnish materials and accessories to complete the fabrication and installation of fire-resistant glazing.

### **1.2 Related requirements**

- .1 Section 07 92 00 Sealants
- .2 Section 08 11 00 Metal Doors and Frames
- .3 Section 08 80 00 Glazing

### **1.3 Reference standards**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA 80 - 2019 Standard for Fire Doors and Other Opening Protectives
  - .2 NFPA 252 - 2017 Standard Methods of Fire Tests of Door Assemblies.
  - .3 NFPA 257 - 2017 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.
  - .4 Underwriters Laboratories of Canada (ULC)
  - .5 ULC 104 -2015 Standard Method for Fire Tests of Door Assemblies.
  - .6 ULC 106 - 2015 Standard Method for Fire Tests of Window and Glass Block Assemblies
- .3 Consumer Products Safety Commission (CPSC)
  - .1 CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials.

- .4 Glass Association of North America (GANA)
  - .1 GANA - Glazing Manual
  - .2 FGMA - Sealant Manual

#### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .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.
- .6 Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

#### **1.5 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 Site 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 Delivery, storage handling and protection**

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.
- .2 Receive and store materials as recommended by materials manufacturer.

## **1.8 Warranty**

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of five (5) 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 Products**

### **2.1 Fire rated glazing**

- .1 Material:
  - .1 Fire protective safety laminated glass ceramic with hose stream, fire rating as indicated.
  - .2 Conforming to ULC 104 & ULC 106
- .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.
  - .4 Or reviewed equivalent

- .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 accessory as follows:
  - .1 Glazing tape: Closed cell polyvinyl chloride (PVC) foam, Pemko Manufacturing Company, FG3000S90 or Unifax Corporation Fiberfrax Alumino-Silicate fiber glazing tape or reviewed equivalent.
  - .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.



### **3 Execution**

#### **3.1 Manufacturer's instructions**

- .1 Comply with manufacturer's product data including product technical bulletins and installation instructions

#### **3.2 Inspection**

- .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 and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .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**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of components required for a complete wall and ceiling assemblies with proprietary components as follows:
  - .1 Non-Loadbearing Steel Framing:
    - .1 Metal Studs
    - .2 Floor and Ceiling Partition Track
    - .3 Furring Members
  - .2 Gypsum board panels:
    - .1 Gypsum Board
    - .2 Fire-Rated Gypsum Board 'Type X'
  - .3 Gypsum Wallboard Accessories:
    - .1 Screws, tape, joint compound and all other accessories required for gypsum board ceiling and wall partitions.
  - .4 Lead liner sheeting

### **1.2 Related requirements**

- .1 Section 05 50 00 Metal Fabrications
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 84 00 Firestopping and Smoke seals
- .4 Section 07 92 00 Sealants
- .5 Section 08 11 00 Metal Doors and Frames
- .6 Section 08 50 00 Aluminum Doors and Screens
- .7 Section 09 90 00 Painting
- .8 Section 10 80 00 Miscellaneous Specialties

### **1.3 Reference standards**

- .1 Canadian Standards Association (CSA)
  - .1 CSA S136-07 North American Specification for the Design of Cold-Formed Steel Structural Members.

- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-7.1-98 Lightweight Steel Wall Framing Components
- .3 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A641/A641M-19 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .2 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3 ASTM A792/A792M-10 (2015) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .4 ASTM A875/A875M-13 Specification for Steel Sheet, Zinc-5% Aluminum Alloy-coated by the Hot Dip Process.
  - .5 ASTM A1003/A1003M-15 Specification for Steel Sheet, Carbon, Metallic and Non-Metallic Coated for Cold Formed Framing Members.
  - .6 ASTM B29-19 Standard Specification for Refined Lead
  - .7 ASTM B749 - 20 Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products
  - .8 ASTM C11-18b Standard Terminology Relating to Gypsum and Related Building Materials.
  - .9 ASTM C473-19 Standard Test Methods for Physical Testing of Gypsum Panel Products.
  - .10 ASTM C475/C475M-17 Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .11 ASTM C645-18 Standard Specification for Nonstructural Steel Framing Members.
  - .12 ASTM C665-17 Standard Specification for Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .13 ASTM C754-20 Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
  - .14 ASTM C840-20 Standard Specification for Application and Finishing of Gypsum Board.

- .15 ASTM C841-03(2018) Standard Specification for Installation of Interior Lathing and Furring.
- .16 ASTM C954-18 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033" to 0.112" in Thickness.
- .17 ASTM C1002-18 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .18 ASTM C1047-14a (2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .19 ASTM C1396/C1396M-17 Standard Specification for Gypsum Board.
- .20 ASTM C1629/C1629M-19 Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- .21 ASTM D3273-16 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- .22 ASTM D3274-09 (2017) Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation.
- .4 Gypsum Association (GA):
  - .1 GA-214-10 Recommended Levels of Gypsum Board Finish.
  - .2 GA-216-10 Application and Finishing of Gypsum Board.
  - .3 GA-231-06 Assessing Water Damage to Gypsum Board.
  - .4 GA-238-03 Guidelines for the Prevention of Mold Growth on Gypsum Board.
- .5 Health Canada
  - .1 Safety Code 30- Radiation Protection in Dentistry - Recommended Safety Procedures for the Use of Dental X-Ray Equipment.

#### **1.4 Quality assurance**

- .1 Contractor executing work of this Section shall have a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

#### **1.5 Submittals**

- .1 Submit submittals in accordance with Section 01 33 00.
- .2 Shop Drawings: Submit shop drawings showing the design, construction and relevant details of furring, enclosures and partitions which require a fire rating.
- .3 Product Data: Submit manufacturer's current technical literature for each component.
- .4 Samples: Supply for Consultant's review, if requested, samples of the following:
  - .1 Board: Submit sample of each panel product specified, 150mm square.
  - .2 Trim: Submit sample of each type of trim specified, 305mm long.
- .5 Quality Assurance Submittals:
  - .1 Design Data, Test Reports: Provide manufacturer's test reports indicating product compliance with indicated requirements.
  - .2 Manufacturer's Instructions: Provide manufacturer's written installation instructions.

#### **1.6 Delivery, storage, handling and protection**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, enclosed, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact, in accordance with GA-238 and manufacturer's recommendations.
- .4 Protect bagged products from excessive moisture or wetting. Store metal component sections in crates to prevent damage to material. Do not use bent or deformed material.

## **1.7 Project conditions**

- .1 Establish and maintain environmental conditions for application and finishing gypsum wallboard to comply with ASTM C 840 and in accordance with manufacturer's written instructions.
- .2 In cold weather (outdoor temperatures less than 13 deg. C), controlled heat in the range of 13 °C to 21 °C must be provided. This heat must be maintained both day and night, 24 hours before, during, and after entire gypsum board joint finishing and until the permanent heating system is in operation or the building is occupied. Minimum temperature of 10 °C shall be maintained during gypsum board application.
- .3 Ventilate building spaces to remove excess moisture and humidity during the drying process. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

## **2 Products**

### **2.1 Materials - wallboard**

- .1 Gypsum Board Panels: Meeting requirements of ASTM C1396M; 12.7 mm thickness 1220 mm Wide x maximum practical length, ends square cut, edges tapered with round edge:
- .2 Fire-Rated Gypsum Board 'Type X':
  - .1 Conforming to ASTM C1396, 1220 mm wide sheets of maximum practical lengths to minimize end joints, tapered edges, 16mm (5/8") thick, as indicated on drawing.
    - .1 Sheetrock Brand Gypsum Panels, Firecode Core by CGC Inc.
    - .2 ProRoc Type X by CertainTeed.

- .3 ToughRock Fireguard Gypsum Board by Georgia-Pacific Canada.
- .4 Or reviewed equivalent.
- .3 Water and moisture resistant board: to ASTM C1396, 12.7 mm. 1220 mm wide with tapered edges.

## **2.2 Materials - steel framing**

- .1 Non-Loadbearing Steel Framing:
  - .1 General:
    - .1 Steel sheet components shall comply with ASTM C645 requirements for metal, unless otherwise indicated.
    - .2 Steel for non-loadbearing members shall have metallic coats that conform to ASTM A653M or ASTM A792M with minimum metallic coating weighs (mass) of Z120 and AZM150 respectively.
    - .3 Framing members shall comply with the CAN/CSA S136 - North American Specification for the Design of Cold Formed Steel Structural Members, for conditions indicated.
    - .4 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use bituminous paint, butyl tape or other approved divorcing material.
  - .2 Metal Studs:
    - .1 Minimum 0.0179" (25 gauge), screwable with crimped web and returned flange. Provide knockout openings in web at 150 mm O.C. to accommodate (if required) horizontal mechanical and electrical service lines, and bracing. Widths as indicated on drawings. Provide structural studs where indicated.
    - .2 Framing behind all fire resistant gypsum board shall be minimum 0.0329" (20 gauge).
    - .3 Framing behind all abuse resistant gypsum board shall be minimum 0.0329" (20 gauge).



- .4 Where metal stud framing forms walls are to be thermally insulated as indicated on drawings, provide metal studs with integrated fastening system for glass fibre/mineral fibre insulation.
- .5 Provide special shapes indicated on drawings as part of steel stud/drywall assemblies.
- .3 Floor and Ceiling Partition Track:
  - .1 Made from galvanized sheet steel, minimum 0.0179" (25 gauge), with minimum 30 mm legs, top track having longer legs were required to compensate for deflection of structure above. Width to suit metal studs.
  - .4 Furring Members:
    - .1 Hat-shaped, rigid furring channels shall comply with the ASTM C645 and shall have a minimum base steel thickness of (25 gauge) and a minimum depth of 22 mm the minimum width of furring attachment flanges shall be 13 mm.
    - .2 Resilient furring channels designed to reduce sound transmission shall have a minimum base steel thickness of 0.0179" (25 gauge) and have a minimum depth of 13 mm.
    - .3 Furring members shall be used for furring out any surface for application of gypsum wallboard finish and for secondary furring member in suspended ceilings/soffits.
    - .4 All furring members shall be hot-dipped galvanized.

### **2.3 Accessories**

- .1 Concrete Anchors:
  - .1 Self-drilling tie wire anchors, "Red-Head No. T-32" by Phillips Drill Company, Division of ITT Industries of Canada Ltd., or reviewed equivalent.
- .2 Concrete Inserts:
  - .1 Hot-dip galvanized "turtle back" type concrete inserts to suit conditions as approved by Consultant, by Acrow-Richmond National Concrete Accessories, Division of Premetalco Inc., or reviewed equivalent.

- .3 Acoustic Insulation: To CAN/ULC S702 mineral fiber thermal insulation for buildings, Type 1 Compliant. Acoustical Fire Batt (AFB) by Rockwool or equivalent product by Owens Corning. Thickness to match stud thickness.
- .4 Gypsum Wallboard Accessories:
  - .1 In general, gypsum wallboard accessories shall conform to ASTM C1047.
  - .2 Corner Beads:
    - .1 Made from galvanized steel sheet conforming to ASTM A653, minimum 0.0179" (25 gauge). Minimum width of flanges 28 mm for 13 mm thick wallboard and 32 mm for 16mm thick wallboard.
  - .3 Casing Beads:
    - .1 Made from galvanized steel sheet conforming to ASTM A653, minimum 30 gauge, U-shaped designed for finishing with joint compound.
  - .4 Control Joints:
    - .1 Made from galvanized sheet steel conforming to ASTM A653, minimum 0.0179" (25 gauge), or roll-formed zinc-alloy to resist corrosion, with expansion joint material perforated flanges.
      - .1 'Zinc Control Joint No. 093' by CGC Inc.
      - .2 or reviewed equal.
  - .5 Reveals:
    - .1 Galvanized sheet steel conforming to ASTM A653, minimum 0.0179" (25 gauge), in profiles as indicated on drawings.
  - .6 Curved Edge Corner Bead: With notched or flexible flanges; use at curved openings and curved walls.
- .5 Wallboard Screws:
  - .1 Corrosion resistant, self-drilling, self-tapping gypsum wallboard screws conforming to ASTM C1002 (Type S) and ASTM C954 (Type S-12), 25mm long No. 6 for single layer application, 41mm long No. 7 for double layer application.

- .2 At fire rated construction, type and size of wallboard screw shall be same as used in fire-rating test.
- .6 Joint Compound for Interior Gypsum Board:
  - .1 Conforming to ASTM C475 and as recommended by gypsum wallboard, fire-rated gypsum wallboard and exterior wallboard manufacturers to suit conditions.
- .7 Adhesive:
  - .1 Conforming to CGSB 71-GP-25M, and as recommended by manufacturer and compatible with contacted surfaces.
- .8 Lead Sheeting: To ASTM B29 and B749, unpierced, minimum 0.8 mm thick medical grade (nominal 2 lbs. per square foot) lead sheet. Where indicated, install lead sheeting in two layers 0.8 mm thickness or one single layer 1.6 mm thickness.
  - .1 Lead Lining at electrical boxes, medical gas penetrations, and similar conditions shall be shielded with the same thickness as the lead sheeting.

### **3 Execution**

#### **3.1 Examination**

- .1 Examine gypsum wallboard panels for damage and existence of mould. Install only undamaged panels.
- .2 Examine gypsum wallboard in accordance with GA-231 for water damage.
- .3 Examine areas and substrates, with installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
- .4 Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 Preparation**

- .1 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

### 3.3 Installation - general

- .1 Conform to ASTM C840, except as otherwise specified herein. Cooperate with mechanical, electrical and other trades to accommodate fixtures, fittings and other items in wallboard areas.
- .2 Review extent of temporary heat provided. Carry out the work of this Section only when temperature is maintained and controlled in the range of 13 °C to 21 °C for at least 24 hours before installing gypsum wallboard and is maintained or can be maintained until joint compound and adhesives are dried or cured.
- .3 Metal studs in partitions and bulkheads are to be continuous to underside of steel deck, except where noted otherwise on drawings. Continue framing around ducts penetrating partitions above ceiling.
- .4 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- .5 Install bracing at terminations in assemblies.
- .6 Do not bridge building control and expansion joints with non-loadbearing steel framing members. Frame both sides of joints independently.
- .7 Bring gypsum board into contact, but do not force into place.
- .8 Lead sheeting:
  - .1 Conform to the requirements of the Ontario Ministry of Labour, Training and Skills Development, the Occupational Health and Safety Act.
  - .2 Install lead sheeting over metal studs in accordance with requirements noted on X-ray plans, in accordance with the Health Canada Safety Code -30 and to the entire satisfaction of the Ontario Ministry of Health X-Ray Inspection Service. Install lead sheeting to minimum 2.0 metres above floor level. Obtain all necessary approvals of installed materials prior to covering with gypsum board.
    - .1 Ontario X-ray Inspection Service: Ontario Ministry of Health, 7 Overlea Boulevard, 6th Floor, Toronto, Ontario M4H 1A8

### 3.4 Stud partitions

- .1 Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- .2 Provide continuous dampproof course to underside of floor track.
- .3 Install studs so flanges within framing system point in same direction.
- .4 Provide accurately aligned partition tracks at top and bottom of partitions. Secure at 610 mm O.C. and 50 mm from each end.
- .5 Erect studs vertically in partition tracks at 406 mm or 610 mm O.C. maximum as required, and not more than 50 mm from abutting walls, openings and each side of corners.
- .6 Install cut to length intermediate vertical studs, in same manner and spacing as wall studs, over door frames and above and below other openings.
- .7 Door Openings:
  - .1 Extend studs on each side of openings from floor to ceiling or structure above, whichever is indicated.
  - .2 Install cut to length piece of runner horizontally over door frames.
  - .3 Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
  - .4 Install two (2) studs at each jamb, unless otherwise indicated.
  - .5 Install cripple studs at head adjacent to each jamb stud, with a minimum 13 mm clearance from jamb stud to allow for installation of control joint in finished assembly.
- .8 Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- .9 Fire-Resistance Rated Partitions: Install framing to comply with fire-resistance rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

- .10 Where studs extend over 3658 mm in height provide internal horizontal bridging spaced approximately 1220 mm O.C. vertically and provide double studs at each side of door frames.
- .11 Size, brace and reinforce studs as necessary to provide sturdy, rigid partitions to heights and lengths required.
- .12 Design bridging to prevent member rotation and member translation perpendicular to the minor axis. Provide for secondary stress affects due to torsion between lines of bridging. Wallboard shall not be used to help restrain member rotation and translation perpendicular to the minor axis. Maximum bridging spacing to be 1220 mm O.C.
- .13 Securely anchor framing to building structure making allowance for deflection of structure above with relief joint to avoid transmission of structural loads to partitions.
- .14 Where horizontal runs of service lines are to be installed, arrange with applicable trades to have lines installed prior to wallboard application.
- .15 Z-Furring Members:
  - .1 Erect insulation, as specified in Section 07 21 13 - Building Insulation, vertically and hold in place with Z-furring members.
  - .2 Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or power-driven fasteners spaced 610 mm O.C.
  - .3 At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12" from corner and cut insulation to fit.
- .16 Coordinate installation of plywood backing for support of dental equipment in metal stud partitions with Section 06 10 00 – Rough Carpentry

### **3.5 Gypsum wallboard - single layer application**

- .1 Metal Studs:
  - .1 Apply gypsum wallboard with screws. Erect wallboard with long dimension at right angles to supports. For fire rated partitions, erect board vertically or horizontally according to the ULC listing. Locate end joints over supporting members.
  - .2 Locate vertical joints at least 305 mm from the jamb/head/sill lines of openings.
  - .3 For parallel application space screws at 200 mm O.C. at board edges at 305 mm O.C. on board fields.
- .2 Fasteners:
  - .1 Perimeter screws shall be not less than 10mm from edges and ends and shall be opposite the screws on adjacent boards.
  - .2 Screws shall be driven with a power screw gun and set with countersunk head slightly below the surface of the board.
  - .3 Fasteners for lead sheeting as recommended by manufacturer and approved by Ontario Ministry of Health.
- .3 Joints:
  - .1 Finish all joints.

### **3.6 Fire resistant assemblies**

- .1 Fire resistance rating of gypsum board assemblies and framing shall be as called for on drawings or schedules, and as required to conform with applicable codes and requirements of authorities having jurisdiction.
- .2 Appropriate ULC designs as listed in current ULC list of equipment and materials, Volume II, Building Construction, shall be placed when applicable. Extend partitions full height through ceiling space unless otherwise noted on drawings.
- .3 Vertical bulkheads in ceiling spaces over fire rated glazed partitions, doors and the like shall have same fire rating as the door or partition over which they occur. All such bulkheads shall be of drywall construction unless otherwise noted.
- .4 Use fire rated gypsum board as specified.

- .5 Where lighting fixtures, diffusers, and the like are recessed into fire rated ceilings or bulkheads, provide enclosure to maintain required fire rating. Form removable panel to give access to fixture outlet box.
- .6 Where fire hose cabinets or other fixtures or equipment are recessed in fire rated walls or partitions, provide drywall enclosure or backing to maintain required fire rating, unless otherwise detailed.

### **3.7 Control joints**

- .1 Install control joints using metal control joint strip as specified where:
  - .1 A partition, furring or column fireproofing abuts a structural element, dissimilar wall or partition assembly, or other vertical penetration, or ceiling.
  - .2 Wings of "L", "U" and "T"-shaped ceiling/soffit areas are joined;
  - .3 Construction changes within the plane of the partition or ceiling or soffit.
  - .4 Partition, restrained ceiling or furring run exceeds 9144mm.
  - .5 Unrestrained ceiling dimensions exceed 15240mm in either direction.
  - .6 Expansion or control joints occur in the base exterior wall.
  - .7 Wallboard is installed over masonry control joints.
  - .8 And elsewhere as indicated on the drawings.
- .2 Install in accordance with manufacturer's instructions. Where application is on furring members and double furring members at control joints, place one furring member on each side of the control joint.

### **3.8 Suspended and Furred Ceilings and Bulkheads**

- .1 Erect hanger and runner channels for suspended gypsum board bulkheads in accordance with ASTM C754 and ASTM C841. Ensure hangers are installed as to prevent splaying.
- .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.
- .10 Fur out bulkheads in areas indicated and as required to conceal mechanical, electrical or other services in rooms where drywall finishes are scheduled, and elsewhere if called for on drawings.

### **3.9 Pressed steel (hollow metal) frames**

- .1 Install pressed steel (hollow metal) frames where they occur in gypsum wallboard partitions.
- .2 Anchor frames securely to studs using a minimum of three (3) anchors per jamb for jambs up to 2134 mm high and minimum of four (4) anchors per jamb for jambs over 2134 mm high.

### 3.10 Access doors

- .1 Access doors supplied by Section 10 80 00 and Divisions 20 and 26 shall be built-in by this Section where required in gypsum wallboard installations, in accordance with manufacturer's recommendations, to match and blend with surrounding surfaces. Refer to drawings for locations.

### 3.11 Finishing

- .1 Before proceeding with installation of finishing materials ensure the following:
  - .1 Wallboard is fastened and held close to framing and furring.
  - .2 Fastening heads in wallboard are slightly below surface in dimple formed by driving tool.
- .2 Finish gypsum wallboard in strict accordance with ASTM C840, GA-214 and GA-216 and as follows:
  - .1 Fill and tape joints and internal corners and fill screw depressions in board face and smooth out along corner beads and metal strip with joint compound.
  - .2 Mix joint compound (powder) in accordance with manufacturer's written instructions.
  - .3 Prefill "V" grooves of rounded edges with special setting type joint compound using a 127 mm to 150 mm joint finishing knife. Finish flush with tapered surface ready for tape reinforcing application. Allow prefill material to dry thoroughly before application of embedding compound and tape.
  - .4 Apply joint compound in thin uniform layer. Embed reinforcing tape accurately centred on joint and securely pressed in, leaving sufficient compound under tape to provide proper bond. Immediately apply skim coat over tape application. Allow to dry thoroughly before application of next coat.
  - .5 Apply fill coat finishing the tapered depression flush with board surfaces. Allow to dry thoroughly before application of finish coat.
  - .6 Apply finish coat extending slightly beyond the filler coat and feathered out onto the board surface. Do not apply finish coat to

gypsum board scheduled to be sprayed with acoustic surfacing finish.

- .7 Sand between coats and following the finishing coat, where necessary, and leave surface smooth and ready for painting.
- .8 Finish screw depressions with filler material and finish coat as specified above.
- .9 Joint and depression finish shall in no case protrude beyond the plane of the board surface.
- .10 Furnish corner beads and metal trim flush with board surface using filler and finishing coats feathered out approximately 50 mm and 100mm respectively onto the board surface.
- .11 Provide metal casing beads at exposed edges, at junctions of gypsum/cement board with dissimilar material, at control joints and at junction with columns. Casing beads are required at perimeter of gypsum/cement wallboard ceilings and soffits. Fasten with screws at 305 mm O.C. along entire length.
- .12 Finish gypsum board to receive a minimum Level 4 finish.

### **3.12 Repairs**

- .1 After taping and finishing has completed, and before decoration, repair all damaged and defective work, including non-decorated surfaces.
- .2 Patch holes or openings 13 mm or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- .3 Repair holes or openings over 13 mm, or equivalent size, with 16 mm thick gypsum wallboard secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- .4 Tape and refinish scratched, abraded or damaged finished surfaces including cracks and joints in non-decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

### **3.13 Protection**

- .1 Protect installed products from damage during remainder of construction period.

- .2 Remove and replace panels that are damaged.

### **3.14 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 This section includes supply and installation of the following:
  - .1 Porcelain floor tile
  - .2 Ceramic wall tile.
  - .3 Trims and accessories including edge strips, transition strips, and other accessories required for a complete and finished installation.

### **1.2 Related requirements**

- .1 Section 06 20 00 Finish Carpentry
- .2 Section 07 92 00 Sealants
- .3 Section 09 21 16 Gypsum Wallboard
- .4 Section 09 65 00 Resilient Flooring and Accessories
- .5 Section 09 90 00 Painting

### **1.3 Reference standards**

- .1 American National Standards Institute/Ceramic Tile Institute (ANSI/CTI):
  - .1 ANSI/CTI A108.1-2011, Specification for the Installation of Ceramic Tile: Collection of 20 ANSI/CTI A108, A118 and A136 Series of Standards on Tile Installation
  - .2 American Society for Testing and Materials (ASTM):
    - .1 ASTM C627-18 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
    - .2 ASTM C920-18 Standard Specification for Elastomeric Joint Sealants
    - .3 ASTM C1028-07e1 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
- .3 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-75.1-M88 Tile, Ceramic

- .4 Terrazzo, Tile and Marble Association of Canada (TTMAC):
  - .1 2019/2021 Specification Guide 09 30 00, Tile Installation Manual
  - .2 Hard Surface Maintenance Guide

#### **1.4 Examination**

- .1 Examine all areas and conditions affecting work of this Section and report any discrepancies or defects which would affect finished results.

#### **1.5 Submittals**

- .1 Submit submittals in accordance with Section 01 33 00.
- .2 Samples:
  - .1 Submit sample of each tile type and colour tile.
  - .2 Upon Consultant's request submit samples of base, trim and fittings.
- .3 Material Lists:
  - .1 Prior to ordering any materials submit list of products to be used. Products proposed must be recommended by their manufacturer for purpose intended. Upon Consultant's request submit evidence of manufacturer's endorsement.
  - .2 Take care to ensure compatibility of all materials. Consult the manufacturers in case of doubt.
  - .3 The supplementary materials shall come from the same production batch as installed materials.
- .4 Safety Data Sheets:
  - .1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.
- .5 Maintenance Instructions:
  - .1 Upon completion of the Work, furnish Consultant with copies of maintenance instructions, containing complete detailed and specific instructions for maintaining, preserving and keeping clean the surfaces of this Work and in particular, giving adequate warning of

maintenance practices of materials detrimental to the work of this Section for inclusion in the Operation and Maintenance Manual.

.6 Maintenance Materials:

- .1 Supply 5% extra of each colour of tile and of each tile type for future repairs by the Owner. Place maintenance materials where directed by the Owner and store in their original containers.

**1.6 Quality assurance**

- .1 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the Site to direct the work of this Section at all times. Representative shall meet Consultant's approval.
- .2 Ensure proper use of proprietary materials in strict accordance with the material manufacturer's directions. It shall be the responsibility of the material manufacturer or supplier to furnish these directions to the Contractor and to check periodically at the site to ensure that they are being carried out.

**1.7 Delivery, storage, handling and protection**

- .1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- .4 Restrict traffic by other trades during installation.
- .5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 4" and taped.
- .6 Heavily travelled areas shall have additional 1/2" thick fibreboard sheet protection with taped joints over polyethylene sheet protection as specified above.

- .7 Protect exposed edges of floor tile with same thickness as tile x 4" wide tapered strip of plywood adhered to floor until adjoining floor finish is to be installed.

## **1.8 Site conditions**

- .1 Ambient Conditions: Apply tile after completion of work by other Sections is complete; to surfaces sufficiently dry, clean, firm, level, plumb and free from oil or wax or any other material deleterious to tile adhesion and as follows:
  - .1 Temperature: Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range; unless indicated otherwise by manufacturer, for 48 hours before and during installation until materials are fully set and cured; provide additional heat during winter months or at any other time when there is a risk that surface temperatures may drop below minimum recommended temperatures.
  - .2 Ventilation: Maintain adequate ventilation where Work of this Section generates toxic gases or where there is a risk of raising relative humidity to levels that could damage building finishes and assemblies.

## **1.9 Warranty**

- .1 Defects covered by warranty shall include but not be limited to the following; cracking, crazing, discolouration, staining, pitting, splitting and deformation of tiles and grout.

## **2 Products**

### **2.1 Performance requirements**

- .1 Static Coefficient of Friction: Tile installed on walkway surfaces having following values as determined by testing identical products per ANSI A137.1:
  - .1 Level Surfaces: Minimum 0.6 dry.
- .2 Floor Level Tolerances: Provide materials to attain floor levelness tolerances required by this Section; calculate quantity of materials based



on the difference between the specified tolerance and the initial tolerance specified in Section 03 30 00.

## 2.2 Materials

- .1 Floor Tiles and Bases: Porcelain floor tile for bathrooms:
  - .1 Finish: Matte Finish.
  - .2 Size: 305mm x 610mm
  - .3 Basis of Design Material: Life Series, Porcelain Tile by Olympia Tile and stone, or reviewed equivalent; Colour: Grigio.
- .2 Wall Tiles: Ceramic Tile for washrooms or as indicated on drawings.
  - .1 Finish: Glazed.
  - .2 Size: 100mm x 400mm
  - .3 Basis of Design material: Colour & Dimension Series, glazed ceramic tile by Olympia Tile & Stone, or reviewed equivalent; Colour: Arctic White, Bright.
- .3 Sealants, joint sealants and accessories as specified in Section 07 92 00.
- .4 Trims:
  - .1 Straight Edge Strips: Extruded clear satin anodized aluminum edge strips, 3 mm wide at top edge; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material:
  - .2 Transition Edge Strips: Extruded mill finished clear satin anodized aluminum edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material and sloped transition:
- .5 Accessory Materials:
  - .1 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:
    - .1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturer's

recommendations and as recommended by tile manufacturer.

- .2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, pH controlled cleaning solution mixed in accordance with manufacturer's recommendations.

### **2.3 Mortar setting materials**

- .1 Manufacturers: Mortar and grout materials listed in this Section shall be of a uniform quality for each mortar, and grout component from a single manufacturer and each aggregate from one source or producer as follows:
  - .1 Flextile Ltd.
  - .2 MAPEI Inc.
  - .3 Custom Building Products Ltd.
  - .4 Laticrete International Inc.
  - .5 Or reviewed equivalent
- .2 Surface Preparation Materials:
  - .1 Levelling Bed/Mortar Additive: Performance standard meeting requirements of ANSI A108.1, Type 2; Acceptable material:
    - .1 Flextile Ltd., Mortar Bed with #43 Additive.
    - .2 MAPEI Inc. Mapecem Premix PL50.
    - .3 Custom Building Products Level Quik Underlayment
    - .4 Laticrete 3701 Fortified Mortar Bed
    - .5 Or reviewed equivalent
- .3 Interior Thin Set Floor System: Dry set mortar meeting or exceeding the requirements of ASTM C627 for Heavy installation using latex modified, portland cement mortar meeting requirements of ANSI A108.1:
  - .1 Acceptable mortar materials:
    - .1 Flextile Ltd., #53 Floor Mix
    - .2 MAPEI Inc. Kerabond
    - .3 Custom Building Products Master Blend Thinset
    - .4 Laticrete 253 Thinset
    - .5 Or reviewed equivalent

## **2.4 Grout materials**

- .1 Colours will be selected from manufacturer's full range.
- .2 Latex-Portland Cement Grout for Floors with Joints  $\geq 1/8$ " Interior or Exterior: factory blended stain resistant latex modifiers, portland cement and graded silica sand and dry-set grout and meeting requirements of A108.1:
  - .1 Acceptable Materials:
    - .1 Flextile Ltd., 600/100 Series Sanded Grout
    - .2 MAPEI Inc. Keracolor S Sanded Grout
    - .3 Custom Building Products Polyblend Sanded Grout
    - .4 Laticrete Peracolor Grout
    - .5 Or reviewed equivalent.

## **3 Execution**

### **3.1 Examination**

- .1 Maintain minimum temperature of 13 °C at tile installation area for 24 hours prior to curing and for 24 hours after installation. Do not apply work to frozen surfaces.
- .2 Examine carefully surfaces to which tile is to be installed and report any defects to the Consultant.
- .3 Commencement of installation shall signify complete acceptance of surfaces and conditions.

### **3.2 Preparation**

- .1 Surface Preparation:
  - .1 Make backing surfaces level and true to a tolerance in plane of  $\pm 1/8$ " in 8' for walls and  $\pm 1/8$ " in 10' for floors using levelling bed mortar.

- .2 Surfaces shall be structurally sound, well fastened, clean and free from dust, oil, grease, paint, tar, wax, curing agents, primers, sealers, form release agents or any deleterious substances that may act as bond barriers.
- .3 Backing surfaces shall be dry and fully cured. Dampness must not exceed 5% by volume.
- .2 Examine concrete substrate, repair as required to produce level, clean surface for new tile installation. Repair Work shall include levelling, filling, grinding or cutting, in accordance with Section 03 30 00.
- .3 Work of other trades that are required before new tile installation (i.e. electrical conduit installed below ceramic tile) shall be installed, complete and approved before tile installation.

### **3.3 Installation - general**

- .1 Installation of the tile shall be by thin-set method, as indicated on the drawings and as specified herein;
  - .1 Apply floor tile and prepare floor slabs in strict accordance with tile manufacturers written installation instructions as per the pre-installation conference.
- .2 Unless otherwise specified, execute tile work according to the latest issue of Specification Guide 09 30 00, Tile Installation Manual - published by Terrazzo, Tile and Marble Association of Canada, as the minimum standard except as varied by this Specification.
- .3 Thoroughly clean surfaces to which tile is to be applied.
- .4 Back butter all floor tile.
- .5 Neatly cut tile around fitments, fixtures, access panels, and the like. Splitting of tile is expressly prohibited except where no alternative is possible. Form intersections, corners and returns accurately.
- .6 Finish surfaces flat and level or, sloped and graded as required.
- .7 Joint Widths: Install tile with the following joint widths, unless indicated on drawings:
  - .1 Floor Tile: 1/4", unless otherwise indicated on the Drawings.
  - .2 Make joints consistent width and alignment within tile area.

- .3 Maintain 2/3 of grout joint depth free of setting material.
- .8 Joints in base shall match floor patterns. Joints shall be watertight without voids, cracks or excess grout.
- .9 Lay out tile so that fields or patterns are centred on wall areas or architectural features and so that no tile less than 1/2 size occurs.
- .10 Arrange and set recessed accessories in tile work so that they are evenly spaced, centred with joints and set true with correct projection. Rigidly install accessories.
- .11 Provide manufacturer's standard trim pieces at changes of direction and at terminations. Unless otherwise indicated provide the following corner and edge conditions:
  - .1 Internal horizontal corners: Coved.
  - .2 External vertical and horizontal corners: Bullnosed.
  - .3 Internal vertical corners and unexposed edges: Square.
- .12 Install tiles in patterns and locations as indicated on drawings.
- .13 Install wall tile full wall height unless shown otherwise.
- .14 Coordinate work of this Section with work of other Sections for items requiring to be recessed into work of this Section.
- .15 Sound tiles after setting and remove and replace tiles not fully bedded.
- .16 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.
- .17 Finished tile work shall be clean and free of tiles which are pitted, chipped, cracked or scratched. All damaged tile shall be removed and replaced.
- .18 Where indicated on Drawings or as required, install continuous single piece metal edge trims centred under doors in closed position and other locations where tile meets other floor finishes.

### **3.4 Grouting**

- .1 Grout tiles in accordance with ANSI A108.10 and as specified herein.
- .2 When grouting a fresh laid floor, make certain that traffic and grouting will not cause movement of floor in setting bed. Protect floor by using kneeling boards or gypsum board to defend floor against traffic while grouting.

- .3 Mix grouts and install in strict accordance with the manufacturer's instructions.
- .4 Excess grout shall be removed from the surface of tiles using the edge of a rubber float held at a 45 deg angle, moving it diagonally to the joints. Fill all gaps and air holes.
- .5 Do not allow grout to harden on face of tile. Refer to manufacturer's instructions for thorough removal.
- .6 Floors which required damp curing shall be cured for the required length of time using heavy kraft paper, not polyethylene sheets. Consult manufacturer for instructions.

### **3.5 Control joints and sealing**

- .1 Control joints of a flexible caulking material shall be placed every 4877mm to 6096mm (16 to 20') apart, directly over existing control joints and/or where indicated on drawings or as required in accordance with TTMAC Detail No. 301MJ-2016-2017, Details E, F and G, whichever is applicable. Control joints shall be placed around the floor perimeter at walls, around columns, and where tile abuts other hard materials or vertical surfaces. Saw cutting of tile after installation is prohibited. Tile shall be cut if required and installed along each side of control joints.
- .2 Expansion joints must always be placed directly over all slab expansion joints in accordance with TTMAC Detail No. 301MJ-2016-2017, Details A and B, whichever is applicable.
- .3 Locate expansion, control, contraction, and isolation joints, as indicated below, unless specifically indicated otherwise on the Drawings:
  - .1 Interior: 16' maximum: 1/4" joint width.
- .4 Joints around fixtures, pipes or other fittings shall be sealed with a sealant. Refer to Section 07 92 00 for type of sealants to be used.
  - .1 Colour of sealant shall match grout as selected later by Consultant.

### **3.6 Cleaning and finishing**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

- .2 Clean tiled areas after grouting has cured, using compatible solutions and methods as recommended by the manufacturer.
- .3 Remove latex-Portland cement grout residue from tile as soon as possible.
- .4 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.
- .5 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.
- .6 Flush surface with clean water before and after cleaning.
- .7 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies.

### **3.7 Installation schedule**

- .1 Install tile on concrete floor substrates to TTMAC detail 311F.
- .2 Install tile on gypsum v board walls to TTMAC detail 304W.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 This Section includes requirements for supply and installation of ceilings consisting of acoustic panels, complete with exposed suspension system and trim.

### **1.2 Related requirements**

- .1 Section 09 21 16 Gypsum Wallboard

### **1.3 Reference standards**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM C635/C635M-17 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
  - .2 ASTM C636/C636M-19 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
  - .3 ASTM E1264-19 Standard Classification for Acoustical Ceiling Products
- .2 Underwriters Laboratories of Canada (ULC):
  - .1 CAN/ULC S102-10 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

### **1.4 Submittals**

- .1 Submit submittals in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit product data for each type of product specified.
  - .2 Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling mounted items indicating the following:
    - .1 Ceiling suspension system members.



- .2 Method of attaching suspension system hangers to building structure.
- .3 Ceiling mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special mouldings at walls, column penetrations, and other junctures of acoustic ceilings with adjoining construction.
- .3 Samples for Initial Selection: Manufacturer's colour charts consisting of sections of acoustic panels, suspension systems, and trim showing the full range of colours, textures, and patterns available for each type of ceiling assembly indicated.
- .4 Maintenance and Materials:
  - .1 Provide five percent (5%) of each type of acoustic ceiling panels and two percent (2%) of each suspension system and trim for future repairs. Identify cartons and place where directed by the Owner.
  - .2 Maintenance materials shall be of same production run as installed materials.

### **1.5 Delivery, storage, handling and protection**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

### **1.6 Site conditions**

- .1 Ambient Conditions: Install acoustic unit ceilings only when building is enclosed, has sufficient heat, when overhead mechanical and electrical work is complete, and dust and moisture producing activities are complete; maintain uniform temperatures and relative humidity within range recommended by material manufacturer from the time of installation until Substantial Performance for the project; make adjustments to

temperature and humidity gradually within tolerances indicated by manufacturer.

## **2 Products**

### **2.1 Manufacturers**

.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include the following:

- .1 Armstrong World Industries, Inc.
- .2 Chicago Metallic
- .3 CertainTeed
- .4 CGC Interiors, a USG Company
- .5 Or reviewed equivalent

### **2.2 Design criteria**

.1 Superimposed Loads: Determine superimposed loads applied to suspension systems by components of the building and verify that adequate hangers are installed to support additional loads in conjunction with normal loads of the ceiling system, and as follows:

- .1 Maximum Deflection: Limit deflection to L/360 in accordance with ASTM C635 deflection test.

### **2.3 Materials**

.1 Acoustic Panels (ACP-1): Provide manufacturer's standard panels of configuration indicated in accordance with ASTM E1264 classifications as designated by the nominal values for types, patterns, acoustic ratings, and light reflectance class listed in this Section; with flame spread rating of 25 or less and smoke developed rating of 50 or less when tested in accordance with CAN/ULC S102 and as follows:

- .1 Physical Properties: Type: III; Form: 2; Pattern: C E; Fire Class: A.
- .2 Dimensions: 24" x 24" x 3/4".
- .3 Edge Profile: 15/16 Square Lay-In Edge.
- .4 Colour: White.

- .5 Acoustic and Visual Performance (Minimum Nominal):
  - .1 Noise Reduction Coefficient (NRC): 0.75
  - .2 CAC: 35
  - .3 Light Reflectance: 0.90
- .6 Basis of Design Materials: Mars Healthcare Acoustical Panel, Item No. 88169 by CGC, or reviewed equivalent.
- .2 Metal Suspension System - Acoustical Panel Ceilings: Manufacturer's standard direct hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C635 requirements and as supplied by same materials supplier as acoustic panels for intermediate duty, exposed tee bar and as follows:
  - .1 Tee Bar Grid Face Width: 15/16".
  - .2 Module: Sized as appropriate to acoustic panel size.
  - .3 Hangers, Braces and Ties: Nominal 14 ga. diameter steel wire, galvanized.
  - .4 Exposed Finish: Manufacturer's standard satin, white finish.
  - .5 Corrosion Resistance: Hot-dip galvanized or stainless steel components.
- .3 Tie Wire:
  - .1 3/64" galvanized soft annealed steel wire.
- .4 Accessories:
  - .1 Miscellaneous 'U' clips, splicers, screws, anchors, nails, wire, hold-down clips, and the like, for complete installation.

### **3 Execution**

#### **3.1 Inspection**

- .1 Examine the work upon which the work of this Section depends and report any defects to the Consultant. Do not commence installation until such time as all wet trades have been completed. Commencement of work implies acceptance of surface and conditions.

- .2 Ensure that a uniform minimum temperature of 15 °C and humidity of 20 - 40% before, during and after installation is maintained.

### **3.2 Installation**

- .1 Cooperate with mechanical, electrical, drywall and other trades to accommodate fixtures, and the like. Examine mechanical and electrical drawings to establish hanger layout and ensure that ceiling hanger layout and furring are designed to span ducts, and the like, where required. Supply all hangers, including inserts for hangers and supplementary framing members as required for complete installation.
- .2 Prior to installation of acoustic panels notify the Consultant for inspection and approval of suspension system.
- .3 All installations shall be by skilled mechanics and in strict accordance with system manufacturer's printed directions to produce first-class, flush finished surface in true plane, free from drooping, warped, soil or damaged board or grid.
- .4 Accurately space and level all runners and securely wire to main runner channels or hangers as applicable. Join cross tees to main runners by interlocking ends through preformed slots in web of main steel tees. Where joints occur in main tees, they shall be butted together flush and secured with interlocking tack. Tee-to-tee intersections and tee-to-edge mould connections shall be fitted tight, flush and parallel to ceiling plane without twists or gaps. Provide continuous runners each side of light fixtures and frame around all openings.
- .5 Provide all additional supports, hangers and steel trapeze channel framing required to support fixtures located under mechanical ducts.
- .6 Space hangers to support grid on 4'-0" centres each way securely fastened to structure. Hangers shall not, under any circumstances, be secure to pipes, ducts or any electrical or mechanical items.
- .7 Frame around recessed fixtures, grilles and openings with an allowance for movement.
- .8 Grid systems shall be accurately spaced, square, true in line at correct elevations and level with water or laser beam to a tolerance of 1/8" in 12'-0". Grid shall be symmetrically laid so that border panels are not less than

- half size. Lay out panels square with walls. Obtain Consultant's approval of layout before proceeding.
- .9 The suspension system shall support the ceiling assembly with a maximum deflection of  $1/360$  of the span.
  - .10 Install ceiling suspension system in accordance with ASTM C636 installation procedures.
  - .11 Anchors, where required, shall be self-drilling type, installed by means of an electrically powered drill specifically designed for this purpose. The anchor manufacturer shall evaluate the specific job conditions and advise in writing regarding anchor sizes necessary. The safe working load shall not exceed 25% of the manufacturer's stated average test loads for the anchor.
  - .12 Receive instruction from the anchor manufacturer regarding correct usage and comply with these requirements.
  - .13 "Ramset" or similar powder actuated fastening devices will not be permitted.
  - .14 Attach hangers to inserts and anchors where structural concrete occurs.
  - .15 Hangers shall be looped through the eye bolts of inserts and anchors and around steel joists, securely wire tie the loop of the hanger to the hanger in each case with two strands of tie wire for permanent securement.
  - .16 Do not attach hangers to or through steel deck. Attach hangers to steel joist. Where joist spacing is not suitable and where ducts and other equipment interfere, provide cross channels between joists and securely wire tie in position for support of hangers.
  - .17 Hangers shall be plumb and not pressed against ducts, pipes or conduits. Splayed hangers are not acceptable. Arrange hangers to cause as little interference as possible to ducts and piping.
  - .18 Form hangers tightly and sharply around main runner channels to prevent movement or rotation of the channel within the loop. Securely saddle tie channel to hanger and return loop leg of hanger to the hanger with two strands of tie wire in each case.
  - .19 Kinks or bends shall not be made in hangers as a means of levelling main runner channels.

- .20 Assemble ceiling system in accordance with drawings. Install ceilings centered on room axis unless noted otherwise. Lay patterned ceiling panels in one direction with pattern parallel to the shortest room dimension.
- .21 Cooperate with the mechanical contractor and cut ceiling panels as required to accommodate air handling diffuser throughout the work.
- .22 Place panels on flanges of tees. Finish panels to all vertical surfaces with edge mouldings.
- .23 Provide hold-down clips at acoustical system to hold units tight to grid system within 20'-0" of an exterior door and an operable window.
- .24 Provide special cut furring members and access openings of required size to all locations where access to ceiling space is required.
- .25 Install acoustic ceiling panel types as indicated on drawings and schedules.

### **3.3 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Thoroughly clean all acoustic ceiling surfaces upon completion of the installation.
- .3 Promptly as the work proceeds and on completion, remove all surplus materials and debris resulting from the work of this Section.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 This Section includes, but is not limited to, the following:
  - .1 Resilient tile materials:
    - .1 Luxury Vinyl Tile (LVT)
  - .2 Resilient accessories:
    - .1 Resilient wall bases
    - .2 Resilient accessories for transition strips, area dividers

### **1.2 Related requirements**

- .1 Section 09 21 16 Gypsum Wallboard
- .2 Section 09 65 36.13 Static Dissipative Resilient Flooring
- .3 Section 09 65 43 Linoleum Flooring

### **1.3 References**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM F1066-04(2018) Standard Specification for Vinyl Composition Floor Tile
  - .2 ASTM F1344-15 Standard Specification for Rubber Floor Tile
  - .3 ASTM F1516-13 (2018) Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended)
  - .4 ASTM F1861-16 Standard Specification for Resilient Wall Base
  - .5 ASTM F1869-16a Standard Test Method for Measuring Moisture Vapour Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

### **1.4 Administrative requirements**

- .1 Coordination: Close spaces to traffic during flooring installation and until time period after installation recommended in writing by manufacturer; install flooring and accessories after other finishing operations, including painting and ceiling construction have been completed.

- .2 Pre-Installation Conference: Conduct conference at Project site in accordance with requirements of Section 01 31 19, to verify project requirements, substrate conditions, patterns and layouts, coordination with other Sections affected by work of this Section, manufacturer's installation instructions and manufacturer's warranty requirements.

## **1.5 Submittals**

- .1 Submit submittals in accordance with Section 01 33 00.
- .2 Action Submittals:
  - .1 Product Data: Submit one copy of product data for each type of product specified.
  - .2 Shop Drawings: Submit shop drawings indicating:
    - .1 Location of seams and edges
    - .2 Location of columns, doorways, enclosing partitions, built-in furniture, cabinets, and cut-out locations
    - .3 Type and style of resilient transition strip used between adjacent flooring types
  - .3 Samples for Selection: Submit manufacturer's colour charts and samples for initial selection consisting of full range of colours and patterns available for each type of product indicated.
  - .4 Samples for Verification:
    - .1 Resilient Flooring: Submit samples of each different specified product for verification of colour and pattern in manufacturer's standard size, but not less than 6" x 6" in size for tile, or 6" long for resilient accessories.
- .3 Informational Submittals: Provide the following submittals during the course of the work:
  - .1 Site Quality Control Test Results: Submit results or moisture emission testing of concrete subfloors prior to installation of flooring. Results shall include comparison of manufacturer's recommended moisture content to actual moisture vapour emission rate.



- .4 Maintenance Data and Operating Instructions:
  - .1 Operation and Maintenance Data: Submit manufacturer's written instructions for maintenance and cleaning procedures, include list of manufacturer recommended cleaning and maintenance products, and name of original installer and contact information in accordance with Section 01 78 00.
- .5 Safety Data Sheets:
  - .1 Submit WHMIS safety data sheets for incorporation into the Operation and Maintenance Manual. Keep one copy of WHMIS safety data sheets on site for reference by workers.
- .6 Maintenance Materials:
  - .1 Provide 5% of each colour of tile and 30'-0" lineal feet coil stock of each colour of resilient base specified, boxed and labelled.
  - .2 Store maintenance materials on the premises as directed by the Owner.

## **1.6 Delivery, storage, handling and protection**

- .1 Coordinate deliveries to comply with Construction Schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- .4 Restrict traffic by other trades during installation.
- .5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of kraftpaper.

## **1.7 Environmental conditions**

- .1 Temperature of room, floor surface and materials shall not be less than 21 °C for 48 hours before, during and for 48 hours after installation.

Concrete floors shall be aged for a minimum of 28 days and shall be dry before application of the resilient floor tile.

- .2 Moisture content of floor shall not exceed a maximum of 3 lbs. of water per 1,000 sq. ft. of concrete slab area over a 24 hour period as measured by one of the following methods, as approved by Consultant:
  - .1 Rubber Manufacturer's Association (RMA) moisture test using anhydrous calcium chloride.
  - .2 Does not exceed 3% as measured by Calcium Carbide Hygrometer procedure.
  - .3 Does not exceed 5% as measured by normal Protimeter.
- .3 Avoid exposure to high humidity, cold drafts and abrupt temperature changes.

## **1.8 Warranty**

- .1 Defects covered by the warranty shall include, but not be limited to, bond failure, and extensive colour fading.

## **2 Products**

### **2.1 Luxury Vinyl Tile (LVT)**

- .1 Meeting ASTM F1700 and the following:
  - .1 Class III, Type B embossed surface.
  - .2 Static Coefficient of Friction: ASTM D2047, minimum 0.5 SCOF.
  - .3 Colour: Mixer Ginger Ale: NA612.
  - .4 Size: 457mm x 457mm x 3.2mm.
  - .5 Basis of Design Materials: LVT Flooring Natural Creations, Diamond 10 Technology Mystix by Armstrong Flooring, or reviewed equivalent.

### **2.2 Resilient accessories**

- .1 Resilient Wall Base (RB): Smooth, buffed exposed face and ribbed or grooved bonding surface supplied in maximum practical length, with pre-moulded end stops and external corners to match base, conforming to ASTM F1861 and as follows:

- .1 Type: TP – Thermoplastic Rubber
- .2 Group: 1 – Homogeneous
- .3 Style: B – Cove
- .4 Height: 4”
- .5 Thickness: 1/8”
- .6 Length: Manufacturers standard maximum length
- .2 Fillers and Primers:
  - .1 Types and brands approved, acceptable to flooring material and resilient base manufacturers for the applicable conditions. Use non-shrinking latex compound.
- .3 Resilient Floor Tile Adhesive:
  - .1 As recommended by luxury vinyl tile manufacturer.
- .4 Tape: Self adhesive 3” wide cloth tape.
- .5 Prefabricated Flash Cove Bases: Fabricated from same material and dye lots as resilient sheet flooring, in maximum practical lengths, with 38 mm x 38 mm formed aluminum reinforcing bonded to back of base material.  
Acceptable Product: “FlashCove™ Prefabricated Bases” by FlashCove™ or reviewed equivalent.
  - .1 Riser: 100 mm
  - .2 Toe: 75 mm
- .6 Metal Base Cap: For adhesive installation; stainless steel cap; "chiklet" by FlashCove™ Prefabricated Bases Inc. or reviewed equivalent.
- .7 Prefabricated Flash Cove Base Adhesive: Low-VOC premium cove base adhesive recommended by both flooring and prefabricated flash cove base manufacturer.
- .8 Concrete Moisture Emission Reducer: Provide 1 of following:
  - .1 “Poxycrete” by Duochem Inc.
  - .2 “Flextech 4010 Moisture Barrier” by Flextile Ltd.
  - .3 “Koester VAP I® 2000” by Koester American Corporation.
  - .4 “Sikafloor® 81 EpoCemCA” by Sika Canada Inc.
  - .5 Or reviewed equivalent.

### **3 Execution**

#### **3.1 Examination**

- .1 Testing and Inspections: Test moisture emission rate of concrete subfloor prior to installing flooring, using the calcium chloride test method in accordance with ASTM F1869.
- .2 Examine substrates, areas, and conditions affecting work are in accordance with manufacturer's requirements, and as follows:
  - .1 Verify that floor surfaces are smooth and flat to plus or minus 1/8" over 10'; notify Consultant in writing where floor tolerances are not within acceptable values.
  - .2 Verify that concrete slabs exhibit normal alkalinity of between 5 and 9 and that they are free of carbonization or dusting deleterious to flooring installation or adhesive bond.
  - .3 Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits that could interfere with flooring installation.

#### **3.2 Preparation**

- .1 Comply with resilient flooring manufacturer's written installation instructions for preparing substrates indicated to receive flooring.
- .2 Fill cracks, holes, and depressions in substrates using trowellable levelling and patching compounds in accordance with manufacturers written instructions and as follows:
  - .1 Levelling and patching shall be restricted to correcting minor deviations or imperfections to bring floor surface finish to within flooring manufacturers tolerances for flatness.
- .3 Remove coatings from concrete substrates, including curing compounds and other substances that are incompatible with flooring adhesives, and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer; do not use solvents.
- .4 Broom and vacuum clean substrates immediately before installing flooring.

### 3.3 Installation

- .1 Comply with resilient flooring manufacturer's written installation instructions.
- .2 Unroll flooring and allow stabilizing before cutting and fitting in accordance with manufacturer's installation instructions.
- .3 Apply primer in strict accordance with manufacturer's printed instructions. Permit primer to dry.
- .4 Apply adhesive uniformly with an approved notchooth spreader at the recommended rate. (Mechanical spreader not approved). Do not spread more adhesive than can be covered before initial set takes place. Use waterproof adhesive throughout. Follow manufacturer's instructions.
- .5 Layout tile flooring as follows:
  - .1 Lay tile with joints parallel to building lines [or as indicated on drawings] to produce a symmetrical tile pattern.
  - .2 Install tile flooring so that perimeter tile width is minimum 1/2 full size.
- .6 Layout resilient base as follows:
  - .1 Fit joints tight and vertical.
  - .2 Joints along one plane shall be at minimum 23' spacing, at inconspicuous locations.
  - .3 Mitre internal corners, use pre-moulded sections for external corners and exposed ends.
  - .4 Install base on solid backing. Adhere tightly to wall and floor surfaces.
  - .5 Scribe and fit to door frames and other obstructions.
  - .6 Install outside corners prior to installation of straight sections.
  - .7 Install straight and level to variation of plus or minus 1/8" over 10' straight edge.
  - .8 Do not stretch base during installation.
  - .9 Shave back of base where necessary to produce snug fit to substrate.
- .7 Layout resilient accessories as follows:

- .1 Install edge strips at unprotected and exposed edges where flooring terminates.
- .8 Accurately scribe tile around walls, and other floor conditions.
- .9 Each type of material used shall be from one manufacturer throughout the work and material in each area shall be of same production run.
- .10 Remove and replace loose, damaged and defective tiles where required and as directed by Consultant.

### **3.4 Cleaning, sealing and finishing**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Cleaning, sealing and finishing of resilient tile flooring shall be performed using the cleaning, sealing and finishing materials specified of one manufacturer in accordance with the manufacturer's instructions and recommendations. Allow a minimum of four (4) days to elapse after completion of each resilient flooring installation before commencing cleaning, sealing, and finishing operations.
- .3 Work shall be handed over to the Owner free of blemishes and in perfect condition.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all static dissipative resilient flooring and accessories.

### **1.2 Related requirements**

- .1 Section 09 65 00 Resilient Flooring and Accessories

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
  - .2 ASTM E648-19ae1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  - .3 ASTM E662-19 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  - .4 ASTM F150-06(2018) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring
  - .5 ASTM F710-19e1 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .6 ASTM F1066-04(2018) Standard Specification for Vinyl Composition Floor Tile
  - .7 ASTM F1482-15 Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
  - .8 ASTM F1861-16 Standard Specification for Resilient Wall Base
  - .9 ASTM F1869-16a Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .10 ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

- .2 NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials
- .3 American National Standards Institute (ANSI)
  - .1 ANSI/ESD STM 7.1: Floor Materials-Resistive Characterization of Materials
  - .2 ANSI/ESD STM 97.1: Floor Materials and Footwear-Resistance in Combination with a Person
  - .3 ANSI/ESD STM 97.2: Floor Materials and Footwear Voltage Measurement in Combination with a Person
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 ULC-S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

#### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.
- .3 Submit the manufacturer's standard samples showing the required colours for flooring and applicable accessories.
- .4 If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
- .5 Submit operating and maintenance instructions for installed products, for inclusion in the Operation and Maintenance Manuals specified in Section 01 78 00.

#### **1.5 System description**

- .1 Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.



- .2 Administrative Requirements
  - .1 Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 31 00.
  - .2 Pre-installation Testing: Conduct pre-installation testing as follows:
    - .1 moisture tests
    - .2 bond test
    - .3 pH test
  - .3 Sequencing and Scheduling
    - .1 Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
    - .2 Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

## **1.6 Quality assurance**

- .1 Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.
- .2 Select an installer who is experienced and competent in the installation of resilient static dissipative vinyl composition tile flooring and the use of subfloor preparation products.
  - .1 Engage installers certified by the manufacturer.

## **1.7 Performance requirements**

- .1 Provide flooring material to meet the following electrical properties when installed according to manufacturer's instructions with the required adhesive, copper strips and SDT floor finish:
  - .1 ANSI/ESD STM 7.1 Floor Materials-Resistive Characterization of Materials results between 106 and 109 ohms, point-to-point and point-to-ground.

- .2 ASTM F150 Electrical Resistance of Flooring between 106 and 109 ohms, point-to-point and point-to-ground.
  - .3 ANSI/ESD STM 97.1: Floor Materials and Footwear-Resistance in Combination with a Person results between 106 and 109 ohms (average) with dissipative footwear and when using heel straps.
  - .4 ANSI/ESD STM 97.2: Floor Materials and Footwear Voltage Measurement in Combination with a Person - 30 volts (average) with dissipative footwear at 12% relative humidity.
  - .5 Static Dissipation at 12% RH: Flooring in combination with a person wearing dissipative footwear - 1000 to 100 volts: 0.2 seconds maximum.
- .2 Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
- .1 ASTM E648 Critical Radiant Flux of 0.45 watts/cm<sup>2</sup>. or greater, Class I
  - .2 ASTM E662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
  - .3 ULC S102.2 - Flame Spread Rating and Smoke Developed - Results as tested.

## **1.8 Site conditions**

- .1 Maintain air temperature and structural base temperature at floor installation area above 20° C for 48 hours before, during and after installation.
- .2 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 hours after installation. Whenever possible, ventilate directly to outside. Do not allow contaminated air to re-circulate through the building ventilation system.

## **1.9 Delivery, storage handling and protection**

- .1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.

- .2 Receive and store materials as recommended by materials manufacturer.
- .3 Maintain containers and labels in undamaged condition.

#### **1.10 Maintenance**

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

#### **1.11 Warranty**

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of ten (10) 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 Products**

#### **2.1 Static dissipative resilient floor tile**

- .1 Basis of Design Product:
  - .1 Excelon SDT Static Dissipative Tile flooring manufactured by Armstrong Flooring Inc., or reviewed equivalent.
- .2 The following manufacturers are acceptable subject to compliance with specifications:
  - .1 American Biltrite
  - .2 Continental Flooring Company
  - .3 Polyfloor
  - .4 Or reviewed equivalent

- .3 Provide Static Dissipative Resilient Floor Tile meeting performance requirements specified in 1.7., and meeting the characteristics outlined below:
  - .1 Static dissipative vinyl tile composed of polyvinyl chloride resin, plasticizers, fillers, pigments, and antistatic additive with colours and texture dispersed uniformly throughout its thickness.
  - .2 Tile shall meet size, thickness, indentation, impact, deflection, dimensional stability, resistance to chemicals, squareness, and resistance to heat requirements of ASTM F1066 Standard Specification for Vinyl Composition Tile, Class 2, through pattern.
  - .3 Size: 304 x 304 mm
  - .4 Thickness: 3.2 mm
  - .5 Pattern and Colour: Selected by Consultant from the range currently available from manufacturer.

## **2.2 Wall base materials**

- .1 As specified in Section 09 65 00 – Resilient Flooring and Accessories

## **2.3 Adhesives**

- .1 Static Dissipative Tile Adhesive as recommended by manufacturer with 5.08 cm wide x 60.96 cm long copper ground-connection strips for under the tile.

## **2.4 Accessories**

- .1 Armstrong S-392 Static Dissipative Tile Polish or equivalent for application as initial static dissipative maintenance finish.
- .2 Primers: non-flammable, solvent free, waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.
- .3 Sub-floor filler and leveler shall be white premixed latex compatible with flooring products and adhesive as recommended by flooring manufacturer for specific flooring types.
- .4 For creating a moisture barrier, provide two-part moisture mitigation system.

- .1 Basis of Design Materials: Armstrong S-452 Seal Strong or reviewed equivalent
- .5 For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- .6 Transition strips, mouldings and adaptors shall be rubber or vinyl, with lip to extend under floor tile with tapered edge, colour matched to flooring.
- .7 Provide threshold of thickness and width as shown on the drawings.
- .8 Provide resilient edge strips, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with colour to match or contrast with the flooring, or as selected by the Consultant from standard colours available.
- .9 Metal edge strips: aluminum extruded, smooth, mill finish with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

### **3 Execution**

#### **3.1 Inspection**

- .1 Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test, etc.)
- .2 Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.
- .3 Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- .4 Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might

prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

- .5 Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- .6 Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

### **3.2 Preparation**

- .1 Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with underlayment as recommended by the flooring manufacturer.
- .2 Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discolouration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material.
- .3 Perform subfloor moisture testing in accordance with ASTM F2170 and Bond Tests to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not exceed 75%. MVER shall not exceed 3 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted,

results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

- .4 Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.
- .5 Apply moisture mitigation in accordance with manufacturer's instructions.

### **3.3 Installation**

- .1 Install all resilient flooring in strict accordance with the manufacturer's printed instructions and recommendations.
- .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 Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- .4 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.

### **3.4 Installation of Accessories**

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

### **3.5 Cleaning and protection**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
- .3 Perform initial maintenance according to the latest edition of manufacturer's installation manual.

**End of section**



## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all linoleum flooring.

### **1.2 Related requirements**

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 07 92 00 Sealants
- .3 Section 09 21 16 Gypsum Board
- .4 Section 09 65 00 Resilient Flooring and Accessories

### **1.3 References**

- .1 ASTM International (ASTM)
  - .1 ASTM D2047-17 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
  - .2 ASTM E648-19ae1 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  - .3 ASTM E662-19 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  - .4 ASTM F710-19e1 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .5 ASTM F970-17 Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading
  - .6 ASTM F2034-18 Standard Specification for Sheet Linoleum Floor Covering
- .2 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.

### **1.4 Submittals**

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

- .2 Selection Samples: Two sets of colour chips representing manufacturer's full range of available flooring tile colours.
- .3 Quality Assurance Submittals: Manufacturer's printed installation instructions; include product storage requirements.
- .4 Provide maintenance data for linoleum flooring for incorporation into Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

### **1.5 Quality Assurance**

- .1 Installer shall be competent in the installation of linoleum sheet flooring using heat-welded seams.
- .2 Provide types of flooring and accessories supplied by one manufacturer, including levelling and patching compounds, and adhesives.
- .3 If required, provide flooring material to meet the fire test performance criteria as tested by a recognized independent testing laboratory.

### **1.6 Delivery, storage, handling and protection**

- .1 Deliver materials in good condition to the job site in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- .2 Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- .3 Store all materials in manufacturer's unopened packaging until installation.
- .4 Maintain storage area conditions for all materials in accordance with manufacturer's instructions

### **1.7 Project Conditions**

- .1 Maintain a minimum temperature in the spaces to receive the flooring and accessories of 18 °C and a maximum temperature of 38 °C for at least 48 hours before, during, and for not less than 48 hours after installation.

Thereafter, maintain a minimum temperature of 13 °C in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

- .2 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.

## **1.8 Waste Management and Disposal**

- .1 Refer to Section 01 74 00 – Cleaning and waste management.

## **1.9 Warranty**

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of five (5) 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 Products**

### **2.1 Materials**

- .1 Linoleum: To ASTM F2034, Type I. Homogenous linoleum floor covering, single layer on jute backing. Wood and cork flour, linseed oil, natural resins, pigments. Rolls of 20-30 linear metres.
- .2 Acceptable Manufacturers:
  - .1 Forbo Linoleum: Global 3 Marmoleum
  - .2 Or approved equivalent.
- .3 2.0 m wide, having a nominal total thickness of 3.2 mm. The wear surface shall consist of a homogeneous mixture of linoleum cement (linseed oil, natural tree resins, drying oil catalysts), wood flour, cork flour, colour pigments and filler calendared onto a jute fabric backing. Colours and pattern detail shall be dispersed throughout the thickness of the wear layer

- .4 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I, ASTM E648.
- .5 Smoke Generation Maximum Specific Optical Density of 450 or less, ASTM E662.
- .6 4 colours with design pattern from the currently available range are to be selected by the Consultant.
- .7 Provide manufacturers recommended solid colour linoleum weld rod intended for heat welding of seams. Colour shall be compatible with field colour of flooring or as selected by Consultant from the range currently available to contrast with field colour of flooring.

## **2.2 Adhesives**

- .1 Provide Linoleum Adhesive recommended by manufacturer used.
- .2 Adhesives shall be low VOC type to meet requirements of SCAQMD Rule 1168-03.

## **2.3 Accessories**

- .1 For patching, smoothing, and levelling monolithic concrete subfloor, provide fast-setting cement-based patch and underlayment as recommended by the flooring manufacturer.
- .2 For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- .3 Provide integral flash cove base accessories. Cove Strip/Filler: 15 mm radius provided or approved by floor covering manufacturer.
- .4 Provide transition/reducing strips tapered to meet abutting materials.
- .5 Provide top shield application for occupancy ready.
- .6 Provide threshold of thickness and width as shown on the drawings.
- .7 Provide resilient edge strips, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with colour to match or contrast with the flooring, or as selected by the Consultant from standard colours available.

- .8 Provide metal edge strips of width shown on the drawings and of required 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.

### **3 Execution**

#### **3.1 Inspection**

- .1 Conform to requirements of ASTM F710.
- .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 skim coat 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 tests in accordance with the manufacturer's instructions to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring.
- .4 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**

- .1 Install flooring in strict accordance with the manufacturer's 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 Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- .4 Install cove base to a height of 100 mm.
- .5 Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 45 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 Install flash cove base by certified master mechanic as per manufacturer instructions and where specified on the room finish schedule.

- .9 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 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Perform initial maintenance according to the manufacture's latest edition.
- .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**

## **1 General**

### **1.1 Section includes**

- .1 Provide labour, materials, tools and other equipment, services and supervision required to complete interior and exterior painting.
- .2 Surface preparation for this Section will be limited to priming and back-priming, and specific pre-treatments noted in this Section or as specified in the Master Painters Institute (MPI) Painting Specification Manual.
- .3 All painting to be completed after hours.

### **1.2 Related requirements**

- .1 Other Sections of the specification requiring painting refer to this Section. Coordinate requirements of referencing Sections.

### **1.3 Reference standards**

- .1 Environmental Choice Paints and Surface Coatings, Low VOC Product Listings Program (ECP)
  - .1 Paints and Surface Coatings, Low VOC Product Listings
- .2 The Master Painters Institute (MPI)
  - .1 New Surfaces: Architectural Painting Specification Manual.
- .3 The Society for Protective Coatings (SSPC)
  - .1 Coating Materials Guidelines
  - .2 Surface Preparation Guidelines
  - .3 Application, Inspection and Quality Control Guidelines

### **1.4 Definitions**

- .1 Gloss Levels: Standard coating terms defined by MPI Manual apply to products of this Section as follows:
  - .1 G1: Matte or Flat: Lustreless or matte finish with a gloss range below 10 when measured at 85° to meter and 0 to 5 when measured at 60°.



- .2 G2: Velvet: Matte to low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 0 to 10 when measured at 60°.
  - .3 G3: Eggshell: Low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 10 to 25 when measured at 60°.
  - .4 G4: Satin: Low to medium sheen with a gloss range of minimum 35 when measured at 85° to meter and 20 to 35 when measured at 60°.
  - .5 G5: Semi-Gloss: Medium sheen finish with a gloss range of 35 to 70 when measured at 60° to meter.
  - .6 G6: Gloss: High sheen finish with a gloss range of 70 to 85 when measured at 60° to meter.
  - .7 G7: High Gloss: Reflective sheen having a gloss range in excess of 85 when measured at 60° to meter.
- .2 Gloss Values: Generally, provide paints and coatings having the following sheens when installed on the following substrates:
- .1 Walls: Eggshell (G3) or Satin (G4) as selected by Consultant.
  - .2 Trim and Doors: Semi-gloss (G5).
  - .3 Ceilings: Flat (G1).

## 1.5 Submittals

- .1 Provide required information in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Product Data: Submit list of all painting materials used for the Work to the Consultant for review prior to ordering materials for each paint system indicated, including block fillers and primers.
    - .1 Material List: An inclusive list of required coating materials indicating each material and cross reference specific coating, finish system, and application; identify each material by manufacturer's catalogue number and general classification.
    - .2 Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

- .2 Samples: Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application, and as follows:
  - .1 Drawdown Samples: Provide three (3) drawdown sample charts (cards) for each type, texture and colour of finish specified for verification purposes before ordering paint materials.
- .3 Informational Submittals: Provide the following submittals when requested by the Consultant:
  - .1 Certification: Submit certification reports for paint products indicating that they meet or exceed low VOC and coloured base requirements listed in this Section.

## **1.6 Project closeout submissions**

- .1 Operation and Maintenance Data: Submit copies of paint manufacturer's written maintenance information for inclusion in the operations manual in accordance with Section 01 78 00, including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.
- .2 Maintenance Materials: Deliver maintenance materials to Owner in quantities indicated and in accordance with Section 01 78 00, that match products installed; packaged with protective covering for storage, and identified with labels describing contents and building location and as follows:
  - .1 Paints and Coatings: Minimum of four (4) 4L containers of field colours and four (4) 1 L containers of each accent colour, and all remnants.

## **1.7 Quality assurance**

- .1 Conform to the standards contained in the MPI Manual.

- .2 Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and as follows:
  - .1 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.
  - .2 Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats and as follows:
  - .1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.

## **1.8 Environmental requirements**

- .1 Conform to MPI Manual and manufacturers requirements.
- .2 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.
- .3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- .4 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.

- .5 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.
- .6 To reduce the number of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.
- .7 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

## **2 Products**

### **2.1 Manufacturers**

- .1 Subject to compliance with requirements, manufacturers that have attained the prerequisites for ecologically sustainable labelling mark on their products and may be incorporated into the Work include; but are not limited to, the following:
  - .1 Dulux Paints
  - .2 Sherwin-Williams LLC
  - .3 Benjamin Moore and Co. Limited
  - .4 ICI Paints (Canada) Inc.
  - .5 Or reviewed equivalent

### **2.2 Materials**

- .1 Primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and other painting materials shall be in accordance with the MPI Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .2 Materials such as linseed oil, shellac, and other accessory materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.
- .3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

- .4 Colour and Manufacturer: As selected by the Consultant. Include for five (5) colours and two (2) accent colours in price.

### **3 Execution**

#### **3.1 Preparation of surfaces:**

- .1 Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

#### **3.2 Application**

- .1 Paint when substrates and environmental conditions (heating, ventilation, lighting and completion of other work) are acceptable for applications of products specified in this Section.
- .2 Paint and stain surfaces requiring paint or stain finish to Premium MPI Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.
- .3 Continue paint finishes through behind wall mounted items.
- .4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .5 Apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

#### **3.3 Exterior surfaces**

- .1 Paint exterior surfaces in accordance with the MPI Manual painting systems listed in this Section.
- .2 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, gutters, flashing, etcetera):
  - .1 EXT 5.3D: Wash primer/2 component aliphatic polyurethane G5 finish (high contact areas).
- .3 Stucco: (walls and soffits)
  - .1 EXT 9.1H High-build latex finish.

### **3.4 Interior surfaces**

- .1 Paint interior surfaces in accordance with the MPI Manual painting systems listed in this Section.
- .2 Concrete Masonry Units (smooth and split face block and brick):
  - .1 INT 4.2A: Latex G3 finish.
- .3 Structural Steel and Metal Fabrications:
  - .1 INT 5.1A: Quick dry G5 finish.
- .4 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etcetera):
  - .1 INT 5.3J: Waterborne Primer / Latex G5 finish.
- .5 Dressed Lumber:
  - .1 INT 6.3A: High Performance Architectural Latex G5 finish.
- .6 Wood Clear Polyurethane Finish:
  - .1 INT 6.3K Polyurethane varnish G6 gloss finish.
- .7 Plaster and Gypsum Board (gypsum board, drywall, and other sheet gypsum materials):
  - .1 INT 9.2A: Latex (over latex sealer) G3 finish.

### **3.5 Mechanical and electrical equipment**

- .1 Paint “unfinished” conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:
  - .1 In exposed-to-view exterior and interior areas.
  - .2 In interior high humidity interior areas.
  - .3 In boiler room, mechanical and electrical rooms.
- .2 Leave conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks in unfinished areas.
- .3 Paint inside of ductwork where visible behind louvers, grilles and diffusers beyond sight line with primer and one coat of matt black (non-reflecting) paint.

- .4 Paint the inside of light valances gloss white.
- .5 Refer to Mechanical and Electrical specifications for painting, banding, stencilling of other surfaces/equipment, and generally as follows:
  - .1 Paint gas piping gas standard yellow where visible in-service spaces.
  - .2 Paint both sides and all edges of plywood backboards for equipment before installation.
  - .3 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
  - .4 Do not paint over nameplates.

### **3.6 Site quality control**

- .1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 4' from the painted surface:
  - .1 Runs, sags, hiding or shadowing by inefficient application methods
  - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles
- .2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.
  - .1 Damage due to touching before paint is sufficiently dry or any other contributory cause.
  - .2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
  - .3 Damage or contamination of paint due to windblown contaminants (dust, sand blast materials, salt spray, etcetera)
- .3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the Owner or Consultant:
  - .1 Small affected areas may be touched up
  - .2 Large affected areas or areas without sufficient dry film thickness of paint shall be repainted.

- .3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

### **3.7 Protection**

- .1 Protect newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry.
- .2 Curing periods shall exceed the manufacturers recommended minimum time requirements.
- .3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

### **3.8 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .3 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- .4 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.
- .5 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etcetera), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

**End of section**



## **1 General**

### **1.1 Section includes**

- .1 Furnish materials and accessories to complete the fabrication and installation of all compartments and cubicles.

### **1.2 Related requirements**

- .1 Section 10 28 13 Washroom Accessories

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM A480/A480M-20a Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
  - .2 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 CSA Group (CSA)
  - .1 CSA-B651-12 Accessible Design for the Built Environment.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies
- .4 American National Standards Association (ANSI)
  - .1 ANSI/NEMA LD 3-2005 High-Pressure Decorative Laminates (HPDL)
- .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 plastic toilet compartments for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

### **1.5 Delivery, storage, handling and protection**

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .2 Protect finished surfaces during shipment and installation. Do not remove until immediately prior to final inspection.

### **1.6 Waste management and disposal**

- .1 Refer to Section 01 74 00 – Cleaning and waste management.

## **2 Products**

### **2.1 Approved manufacturers**

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

### **2.2 Design**

- .1 Solid phenolic core overhead braced change cubicle partitions with operational full height vandal resistant hardware and gap free doors and stiles.
  - .1 Basis of Design Materials: Bobrick Model 1092.67G or reviewed equivalent.
- .2 Supply and install all required toilet partitions complete with all required hardware and accessories.
- .3 All cubicles shall have gap free design with zero sight lines.
- .4 Colours will be selected by the Consultant from the manufacturer's standard range of colours.

### **2.3 Materials**

- .1 Materials shall meet NFPA Class B, UBC Class II, CAN/ULC S102 Fire resistance standards as follows:
  - .1 Flame Spread Index: 45 for panels and stiles.
  - .2 Smoke Developed Index: 120 for panels, 95 for stiles.
  - .3 Class B.

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

## **2.4 Hardware**

- .1 Stiles: Floor-Anchored stiles furnished with expansion shields and threaded rods.
  - .1 Leveling Devices: 5 mm thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 10 mm diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
  - .2 Stile Shoes: One-piece, 0.8 mm, 18-8, Type 304 stainless steel, 102 mm height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 19 mm or 25 mm stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- .2 Compliance: Operable with one hand, without tight grasping, pinching, or twisting of the wrist, and force to operate does not exceed five pounds. Door pull: Barrier-free type suited for out-swinging doors, stainless steel. Conform to AODA and Ontario Building Code requirements.
- .3 Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment.
- .4 Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish. Chrome-plated "Zamak", aluminum, or extruded plastic hardware not acceptable.
- .5 Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-

installed, threaded brass inserts. Fasteners secured directly into core not acceptable.

- .6 Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 680 kg per insert.
- .7 Coat hook: combination hook and rubber door bumper, stainless steel. Projecting no more than 29 mm from face of door
- .8 Mounting: Hinges, keepers, latches, clothes hooks and their fasteners concealed inside compartment. Exposed hinges, keepers, latches, clothes hooks and their fasteners on exterior of compartment not acceptable with the exception of accessible compartments.
- .9 Hardware Type: Institutional hardware.
  - .1 Latching: 2 mm sliding door latch, 2 mm keeper; latch slides on shock-resistant nylon track. Twist-style door latch operation not acceptable.
  - .2 Hinges: Full height, 1.6 mm stainless steel with satin finish, self-closing, 3 section hinges.
  - .3 Mounting Brackets: 1.3 mm stainless steel and extend full height of panel.
  - .4 U-Channels: Secure panels to stiles.
  - .5 Angle Brackets: Secure stiles-to-walls and panels-to-walls.

## **2.5 Fabrication**

- .1 Shop fabricate partitions and screens. Take site measurements for areas where partitions are to be located and fabricate partitions to suit site dimensions.
- .2 Fabricate to reviewed shop drawings and manufacturer's standards.
- .3 Change Cubicle Doors and Partitions: 1830 mm high. (Bottom to be 150 mm from finished floor)

### **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 Do work in accordance with CSA-B651.
- .2 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.
- .3 Change cubicles and partitions shall be custom manufactured to restrict sight lines and shall be mounted with bottom of partition 150 mm above floor. Provide full height brackets, angles and stops to prevent sight lines into cubicles.

- .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 00 – Cleaning and waste management.
- .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**

## **1 General**

### **1.1 Section includes**

- .1 Furnish labour, materials and other services to complete the fabrication and installation of:
  - .1 Washroom accessories and framed mirrors including accessories supplied by the Owner
  - .2 Attachment hardware.
- .2 Include all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

### **1.2 Related requirements**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 09 21 16 Gypsum Wallboard
- .3 Section 09 30 00 Tiling

### **1.3 References**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A153/A153M-16a Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
  - .2 ASTM A653/A653M-20 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .3 ASTM A666-15 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
  - .4 ASTM A1008/A1008M-20 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

### **1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 Submittals.



- .2 Shop Drawings: Show and describe in detail, materials, finishes, dimensions, details of connections and fastenings, elevations, plans, sections, metal gauges, hardware and any other pertinent information.
- .3 Coordinate the work of this Section with the placement of internal wall reinforcement.

## **1.5 Delivery, storage and handling**

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.
- .2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- .3 Store materials in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- .4 Unsatisfactory materials shall be removed from the site.
- .5 Adequately protect the structure and work of other Sections during delivery, storage, handling and execution of the work of the Section.
- .6 Provide tools, plant and other equipment required for the proper execution of the work of this Section.

## **2 Products**

### **2.1 Manufacturers**

- .1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests for substitution in accordance with Section 01 33 00 Submittals.
- .2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
  - .1 ASI Watrous - Global Partitions

- .2 Bobrick
- .3 Frost
- .4 Koala Kare
- .5 Dyson
- .6 Or reviewed equivalent

## 2.2 Materials

- .1 Provide one of the products indicated for each designation in the Washroom and Custodial Accessory Schedule below, subject to compliance with specified requirements.
- .2 Stainless Steel: In accordance with ASTM A666, Type 304, with No. 4 finish (satin); minimum nominal thickness as established by product type.
- .3 Sheet Steel: Steel: In accordance with ASTM A1008/A1008M, cold rolled, commercial quality; minimum nominal thickness as established by product type; surface preparation and metal pretreatment as required for applied finish.
- .4 Galvanized Steel Sheet: In accordance with ASTM A653/A653M, minimum Z180 coating designation.
- .5 Galvanized Steel Mounting Devices: In accordance with ASTM A153/A153M, hot dip galvanized after fabrication.
- .6 Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

## 2.3 Fabrication

- .1 Washroom and Custodial Accessories:
  - .1 Surface Mounted:
    - .1 Fabricate units with tight seams and joints, and exposed edges rolled.
    - .2 Hang doors and access panels with continuous stainless steel hinge.
    - .3 Provide concealed anchorage where possible.

- .2 Recessed Mounted:
  - .1 Fabricate units of all welded construction, without mitred corners.
  - .2 Hang doors and access panels with full length, stainless steel hinge.
  - .3 Provide anchorage that is fully concealed when unit is closed.
- .2 Workmanship shall be best grade of modern shop practice known to recognized manufacturers specializing in this work. Joints and intersecting members shall be accurately fitted, made in true planes with adequate fastening. Wherever possible fastenings shall be concealed.
- .3 Isolate where necessary to prevent electrolysis between dissimilar metal to metal or metal to masonry or concrete contact.
- .4 Fabricate and erect work square, plumb, straight, true and accurately fitted. Provide adequate reinforcing and anchorage.
- .5 Drilling shall be reamed and exposed edges left clean and smooth.
- .6 Include anchors and fastenings necessary to anchor work of this Section.
- .7 Coordinate with Section 06 10 00: Rough Carpentry, for wood blocking for attachment of washroom accessories.
- .8 Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six (6) keys to Owner's representative.

### **3 Execution**

#### **3.1 Examination**

- .1 Inspect surfaces over which the work of this Section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those in the Contract Documents and/or detrimental to the proper and timely installation of the work of this Section. The decision regarding corrective measures shall be obtained from the Consultant prior to proceeding with the affected work.

- .2 Commencement of work of this Section implies acceptance of surfaces and conditions.

### **3.2 Installation**

- .1 Make thorough examination of drawings and details, determine the intent, extent, materials, conditions of interfacing with other work and be fully cognizant of requirements.
- .2 Work of this Section shall include complete installation of items specified herein. Installation shall be in strict accordance with manufacturer's printed instructions.
- .3 Securely fasten accessories, level and plumb in the locations shown on the drawings and specified herein. All fastenings shall be concealed.
- .4 Co-ordinate the work of this Section with the work of other Sections to provide the necessary recesses, edge conditions wood blocking for the accessories as required.
- .5 Do all drilling of steel, masonry and concrete necessary for the anchorage of the work.
- .6 Installed grab bars shall be capable of supporting a downward pull of 500 lbs. per lineal foot.
- .7 Relocate existing washroom accessories as indicated.

### **3.3 Adjusting**

- .1 Check mechanisms, hinges, locks and latches, adjust and lubricate to ensure that accessories are in perfect working order.

### **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Upon completion of the work of this Section or when directed by Consultant, remove all protective coatings, and coverings. Clean and polish exposed surfaces.

### 3.5 Washroom and custodial accessory schedule

No.	Description / Model
TTD	Toilet Tissue Dispenser: Supplied by Owner, Installed by Contractor
GB1	<p>Grab Bar: Horizontal 1.214mm (0.048") thickness; 610mm (24") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws:</p> <p>ASI        3801-24P                      Bobrick   B-6806.99x24                      Frost     1001-NP                      Or reviewed equivalent</p>
GB2	<p>Grab Bar: Side "L"-shape grab bar, 760 mm (30") long x 760 mm (30") high 38 mm (1-1/2") dia., stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws:</p> <p>Bobrick   B-6898.99                      Or reviewed equivalent</p>
SD	Wall-Mounted Soap Dispenser: Supplied by Owner, Installed by Contractor
PTD	Automatic Paper Towel Dispenser: Supplied by Owner, Installed by Contractor
MR	<p>Mirror: Framed, 910mm (36") high x 610mm (24") wide, fixed installation for disabled persons, mounted max 1000mm (40") to bottom of frame:</p> <p>ASI        0620-1836                      Bobrick   B-165 x 2436                      Frost     941-1836                      Or reviewed equivalent</p>

<b>No.</b>	<b>Description / Model</b>
SH	Flip-up, wall mounted stainless steel shelf.  Frost 955 Bobrick B-287 ASI 0698 Or reviewed equivalent
CH1	Coat Hook for universal washrooms stalls and showers: Satin finished stainless steel, square profiled robe hook with concealed mounting, provide 2 for each washroom, located as directed by Consultant:  ASI 7308 Bobrick B-76717 Or reviewed equivalent
CH2	Coat Hook Strip: 304 stainless steel, stain finish. Provide one for each operatory, located as directed by consultant.  Frost 1147 ASI 1307-3 Bobrick B-232 x 24 Or reviewed equivalent

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all phenolic lockers.

### **1.2 Related requirements**

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 06 10 00 Rough Carpentry

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM D570-98(2018) Standard Test Method for Water Absorption of Plastics
  - .2 ASTM D1037-12 (2020) Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
  - .3 ASTM D2197-16 Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion
  - .4 ASTM D2794-93(2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
  - .5 ASTM D4976-12a Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
  - .6 ASTM D6578/D6578M-13 (2018) Standard Practice for Determination of Graffiti Resistance
  - .7 ASTM E84-20 Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102 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: 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 Shop Drawings: Provide layout and elevations of lockers with overall dimensions.
- .4 Verification Samples: For finish product specified, two samples, minimum size 150 mm square, representing actual product and colour selected.
- .5 Provide maintenance data for phenolic lockers for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.5 Quality Assurance**

- .1 Provide all lockers from a single manufacturer.
- .2 Water absorption requirements: when tested in accordance with ASTM D570 locker materials shall have a water absorption rate of less than 0.37%.
- .3 Graffiti resistance requirements: When tested in accordance with ASTM D6578, locker materials shall prove resistant to all chemicals tested for a period of 1 to 10 minutes and shall leave no mar or blemish on the surface when cleaned. Locker materials shall have guaranteed surface clean ability from permanent markers and shall have non-ghosting properties.
- .4 Scratch resistance requirements: When tested in accordance with ASTM D2197, locker materials shall prove to be scratch resistant when maximum load values in excess of 10 kilograms.
- .5 Flame spread: When tested in accordance with CAN/ULC S102, lockers, athletic lockers, wardrobe cabinets, school cubbies and locker bench materials shall meet or exceed all requirements for class B flame spread rating and smoke developed.
  - .1 Flame spread shall not exceed 75.
  - .2 Smoke developed shall not exceed 450.
- .6 Impact resistance requirements: When tested in accordance with ASTM D2794, locker materials shall withstand an impact force value in excess of 51.8 kg/cm.



- .7 Screw holding strength: When tested in accordance with ASTM D1037, direct screw withdrawal test, locker materials shall withstand a direct pull force that exceeds 1133 kg per fastener.
- .8 Tensile strength: locker materials shall have a modulus of elasticity of 10 million kPa.
- .9 Shear strength: locker materials shall have a shear strength of 13,800 kPa minimum.
- .10 Compression strength: locker materials shall have a compression strength of 165,000 kPa minimum.

## **1.6 Delivery, storage, handling and protection**

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .2 Inspect lockers upon receipt for visible damage.
- .3 Store products in manufacturer's unopened packaging until ready for installation.

## **1.7 Warranty**

- .1 Warrant the work of this Section against defects of workmanship and material, for a period of ten (10) 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 Products**

### **2.1 Materials**

- .1 Plastic: Plastic laminate faced phenolic core.
- .2 Coat Hooks: Zinc plated forged steel; ball ends.
- .3 Fasteners: Zinc plated manufacturer's standard.
- .4 Hooks: Zinc plated forged steel, ball ends.
- .5 Bolts and Nuts: Zinc plated truss fin head bolts, hex nuts.

- .6 Number plates: provide a number plate for each door or opening, in the sequence as directed by the Owner.

## **2.2 Phenolic Lockers**

- .1 Standard Duty Laminate-Faced Solid Phenolic Lockers:
  - .1 Spectrum 2 tier Z Locker or approved equivalent
- .2 Type of Lockers:
  - .1 Two Tier Z-Locker:
    - .1 Height: 1829 mm.
    - .2 Size: 305 mm wide by 381 mm deep.
- .3 Colour: As selected by the Consultant. Up to four colours will be selected.

## **2.3 Fabrication**

- .1 Components: Solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft and surface sheets fused at high temperature and pressure. Units fabricated using stainless steel fasteners. Exposed edges shall be smooth and chamfered.
  - .1 Doors shall be constructed of 13 mm plastic laminate faced solid phenolic core. Doors shall be fitted with a flush handle, number plate, padlock hasp, and locking device. Door latches shall be mounted at the mid-point of each door. Handles shall be capable of release from the inside of the locker. Hasps shall be mounted within each handle and will accept standard padlock styles. Perimeter ventilation. Doors shall be mounted to Side Panel using Piano Type hinge and Steel Fasteners.
  - .2 End Cover Panels shall be constructed 13 mm solid phenolic core with plastic laminate. Colour as scheduled.
  - .3 Side Panels shall be constructed of 13 mm solid phenolic core plastic laminate.
  - .4 Tops, Bottoms and Shelves shall be constructed of 13 mm solid phenolic core with Speckle-tone material plastic laminate.
  - .5 Slope Tops, Filler Panels and Recessed Locker Trim shall be constructed of 13 mm solid phenolic core with plastic laminate. Provide where scheduled or indicated. Colour as scheduled.

- .2 Hinges: Segmented 120° piano style hinge.
  - .1 Finish: Powder coated in black colour.
- .3 Interior Equipment:
  - .1 Lockers 457 mm deep shall have a coat rod.
- .4 Mounting: Curb mounting.
- .5 Slope Tops: 127 mm for 381 mm deep lockers.

### **3 Execution**

#### **3.1 Examination**

- .1 Do not begin installation until substrates and bases have been properly prepared.
- .2 If substrate and bases are the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

#### **3.2 Installation**

- .1 Install lockers and accessories at locations shown in accordance with manufacturer's instructions.
- .2 Install lockers level and plumb with flush surfaces and rigid attachment to anchoring surfaces.
- .3 Anchor lockers to floor and wall at 1220 mm or less, as recommended by the manufacturer.
- .4 Fasten adjoining locker units together to provide rigid installation.
- .5 Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.
- .6 Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

#### **3.3 Protection**

- .1 Protect installed products until Substantial Performance.

### **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.
- .2 Touch-up factory-finish and repair or replace damaged products before Substantial Performance.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Supply and installation of all miscellaneous specialties as indicated.

### **1.2 Related requirements**

- .1 Section 03 30 00 Cast-in-Place Concrete
- .2 Section 05 50 00 Metal Fabrications
- .3 Section 06 20 00 Finish Carpentry
- .4 Section 10 28 13 Washroom Accessories

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM A312/A312M-19 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- .2 Aluminum Association (AA)
  - .1 Aluminum Association Designation System for Aluminum Finishes

### **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 Delivery, storage, handling and protection**

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.

- .2 Protect finished surfaces during shipment and installation.

## **1.6 Waste management and disposal**

- .1 Refer to Section 01 74 00 – Cleaning and waste management.

## **2 Products**

### **2.1 Materials**

- .1 Items specified herein shall be standard manufactured items, modified if required and as specified to suit conditions of this project.
- .2 Fabricate work true to dimensions, square and plumb, to suit site conditions.
- .3 Thickness of metals shall be adequate for the various conditions with requirements specified as a minimum.
- .4 Finished work shall be free from warping, open seams, weld marks, rattles and other defects. Drilling shall be reamed and exposed edges finished smooth.
- .5 Fastenings shall be concealed or theft-proof type where possible. Exposed fastenings shall be neatly executed and shall be of the same material and finish as the base metal on which they occur.
- .6 Clear Anodic Finish: For work specified to have clear anodic finish, provide an AA-M12C22A31 finish, unless otherwise specified.

### **2.2 Access Doors**

- .1 1.994 mm galvanized steel for non-fire rated applications. Doors in fire rated assemblies shall be of thickness required to meet fire rating requirements. Generally, and unless noted otherwise, fire rated doors shall be UL/ULC rated for 1 ½ hour “B” label with 250 °F temperature rise in 30 minutes. Door shall be provided with a 25 mm recess or 14 mm to suit the thickness of the drywall ceiling. The frame shall be provided with a galvanized steel drywall taping bead on all sides. The hinge shall be a concealed pivoting rod. The latch shall be a flush to the surface, screwdriver operated cam latch. The steel finish shall be 5 stage iron phosphate preparation with prime coat of greybaked enamel.

- .2 Supply access doors to the relevant building trade to provide access in furred ceilings for the following:
  - .1 Servicing equipment
  - .2 Access to plumbing cleanouts
  - .3 Access to shut off valves.
  - .4 Inspection of life safety equipment.
  - .5 Service of operating devices
  - .6 All locations where periodic maintenance is required.
- .3 Access door sizes shall be as follows:
  - .1 Body Entry: 600 x 600 mm
  - .2 For Hand Entry: 450 x 450 mm
  - .3 For Viewing Only: 300mm x 300mm

### **2.3 Deal Trays**

- .1 Stainless steel surface mounted deal tray with brushed stainless steel finish. 305 mm wide x 254 mm deep x 50 mm high.

### **2.4 Speak Thrus**

- .1 Through Glass Two Way Electronic Communicators with removable gooseneck microphone. 115V power supply. complete with mounting hardware.
  - .1 CR Laurence Through Glass Two Way Electronic Communicators Deluxe Model TTU1AJB1 or reviewed equivalent.

### **2.5 Door Louvres**

- .1 Aluminum door louvre with sight-proof chevron blades. All blades, frames and trim members to be 6063-T5 aluminum extrusion, minimum 1.3 mm thick. Fasteners to be stainless steel or aluminum. Frames and trim members to be mitred at corners and rigidly secured by corner brackets. Finish clear anodized. Size as indicated.

### **2.6 Sliding Door Hardware**

- .1 To BHMA A156.14 Sliding and Folding Door Hardware. Medium duty roller track with eight ball bearing nylon wheels per door and lock nut vertical

adjustment. Provide floor guides for all sliding doors. Capacity up to 60 pounds per door. Door pulls to be recessed, 57 mm diameter dull chrome finish cup. Top track to be complete with prefabricated valance to conceal track.

- .1 Track: KN Crowder Model C-2035 CA with fascia or approved equivalent.
- .2 Door Pulls: Hager 2640 X 626 or approved equivalent.

## **2.7 Closet Rods**

- .1 Commercial grade steel; long-lasting, corrosion resistant finish. Meeting or exceeding ANSI/BHMA weight load requirements.
  - .1 Round Closet Rod Tubing, Outside Diameter: 27 mm.
  - .2 2.7 mm wall thickness; inside diameter: 21 mm.
  - .3 Finish: Brilliant Chrome; premium double-plated finish, seamless, pit-free.
  - .4 Size as indicated on the drawings.

## **2.8 Safety / Security Mirror**

- .1 180-degree half-dome.
  - .1 Acrylic eighth-sphere for interior surveillance and collision prevention.
  - .2 Size: 610 mm.

## **2.9 Corner Guards**

- .1 Stainless steel corner guards to 1.613 mm stainless steel. 1220 mm high. Stainless steel corner guard with 89 mm standard legs. Mounted with construction adhesive; stainless steel screws. All necessary fasteners to be supplied by the manufacturer. To be type 304 alloy with #4 satin finish.

## **2.10 Television Mounting Brackets**

- .1 Supplied by Owner for installation by Contractor.

## **2.11 Adjustable Wall Mount Laptop Arm**

- .1 Supplied by Owner for installation by Contractor.



## **2.12 Mailbox**

- .1 18-gauge steel construction. Locking front retrieval door. Includes 2 keys. Galvanized steel with powder-coat finish. Hinged lid. U Line Model H-6078 or reviewed equivalent.

## **2.13 AED Signage**

- .1 Wall mounted Projecting sign "AED", 3 way, 6 ¾ x 8 x 5 ½".
  - .1 U-line Model S-21990 or reviewed equivalent.

## **3 Execution**

### **3.1 Installation**

- .1 Install manufactured items in accordance with manufacturer's printed instructions and recommendations.
- .2 Mount standards to solid backing capable of supporting intended loads. Install standards using fasteners suitable for supporting intended loads.
- .3 Install brackets as indicated on the Drawings.
- .4 Install shelving, and accessories as indicated on the Drawings.
- .5 Coordinate with Section 08 80 05 for installation of speak throughs in tempered glass screens.

### **3.2 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Design, supply and installation of 284 kg capacity patient lift including patient lift and track systems, track support framing assemblies and all anchorage and connections.

### **1.2 Related requirements**

- .1 Section 05 12 23 Structural Steel

### **1.3 Submittals**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: Submit material information data sheets and supporting documentation including product literature, handling and installation instructions, anchorage information, roughing-in dimensions, power requirements and service requirements.
- .3 Samples: Submit samples of each finish specified.
- .4 Shop Drawings:
  - .1 Submit engineered shop drawings for patient lift and track systems, and track support framing assemblies, including anchorage and connections.
  - .2 Clearly indicate materials, finishes, fabrication details, dimensions, thicknesses, plans, elevations, hardware, fastenings, service connections and installation details.
  - .3 Indicate proposed site connections, fasteners and methods.
  - .4 Shop drawings shall show both design and installation requirements.
- .5 Closeout Submittals:
  - .1 Submit closeout documentation in accordance with Section 01 78 00.
  - .2 Operation and Maintenance Data:
    - .1 Submit for incorporation into maintenance manuals.

- .6 Templates: Submit templates for use by installers and fabricators as required for proper location and installation of equipment.

#### **1.4 Quality assurance**

- .1 Retain a professional engineer registered in the Province of Ontario to design the work of this Section; to prepare, seal and sign shop drawings, and to perform field review during and upon completion of installation.
- .2 Work of this Section shall be completed by competent installers with a minimum of five (5) years of experience in the application of products, systems and assemblies specified and with approval and training of equipment manufacturers
- .3 Manufacturer shall have a minimum of ten (10) years of continued experience, having completed other projects of similar or greater magnitude.
- .4 Conduct a pre-installation meeting prior to installation.
- .5 Conduct Quality Control on accordance with Section 01 45 00.
- .6 Manufacturer's field review shall be in accordance with Section 01 45 00.

#### **1.5 Delivery, storage, handling and protection**

- .1 Deliver, handle and store materials in accordance with manufacturer's printed instructions.
- .2 Package or crate, and brace products to prevent distortion in shipment and handling. Label packages and crates and protect finished surfaces by sturdy wrappings.

#### **1.6 Waste management and disposal**

- .1 Refer to Section 01 74 00 – Cleaning and waste management.

### **2 Products**

#### **2.1 Patient Lifts**

- .1 Patient Transfer Lifts and Tracks:

- .1 Overhead lift system managing loads of 284 kg minimum, installed in a mounted rail system with extra attachment points, complete with carriage and safety drum with speed limiter and electrical emergency lowering.
  - .2 Lifting Speed: 50 mm/second.
  - .3 Lifting Range: 2000 mm.
  - .4 Emergency Lowering: Electrical.
  - .5 Motor: 24V, 12A.
  - .6 Batteries: 2-12V 2.6 Ah valve- regulated lead-acid gel batteries.
  - .7 Battery Charger: 100 - 240 V AC, 50-60 Hz.
  - .8 Finish: white.
- .2 Accessories
- .1 Wired hand control.
  - .2 Transfer motor for movement along rail.
  - .3 Multi-station for charging or controlling switches in the rail system, without tools.
  - .4 Carriage adapter to move lift motor between different rail systems, without tools.
  - .5 Sling.

### **3 Execution**

#### **3.1 Installation**

- .1 Install equipment in accordance with the equipment manufacturer's written instructions and in accordance with reviewed shop drawings.
- .2 Submit manufacturer's information and templates required for installation. Assist or supervise, or both, the setting of anchorage devices, and construction of other work incorporated with products specified in work of this section in order that they function as intended.
- .3 Include reinforcing, anchorage and mounting devices required for installation.
- .4 Verify location and mounting heights with Consultant before roughing-in.

- .5 Electrical subcontractor shall be responsible for final hook-up at service connection locations. Coordinate work of this Section with Divisions 26, 27 and 28.

### **3.2 Adjustment**

- .1 Upon completion of installation, inspect finishes and materials for damage and faulty installation. Make good or replace damaged finishes or materials as directed by Consultant and at no cost to the Owner.
- .2 Verify that installed products function properly and adjust accordingly to ensure satisfactory operation.
- .3 Do not remove protective coatings until final cleaning.

### **3.3 Testing**

- .1 Test and commission equipment in accordance with equipment manufacturer's written instructions.

### **3.4 Equipment Demonstration.**

- .1 Before acceptance of system, arrange for demonstration of equipment with authorized representatives of Owner, to be performed by a competent representative of the equipment manufacturer to assure proper function, operation and explanation. Give Owner's representative a minimum of 48 hours advance notice in writing of demonstration date.
- .2 Conduct comprehensive demonstration for Owner's staff on operation and care of equipment.

### **3.5 Cleaning**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and waste management.

**End of section**

## **1 General**

### **1.1 Contract Drawings**

- .1 The Drawings for the Fire Suppression Work are diagrammatic performance drawings, intended to convey the scope of Work, and indicate general arrangement and approximate location of apparatus, fixtures, and pipe runs. The Drawings do not intend to show architectural and structural details.
- .2 Do not scale drawings, but obtain information involving accurate dimensions to structure from dimensions shown on architectural and structural drawings, or by site measurements. Consult general construction drawings as well as detail drawings to become familiar with all conditions affecting the Work and verify spaces in which the Work will be installed.
- .3 Make, at no additional cost to the Owner, any changes or additions to materials and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).
- .4 Alter at no additional cost to the Owner, the location of materials and/or equipment as directed, provided that the changes are made before installation and do not necessitate additional material.
- .5 Install all ceiling mounted components (sprinklers) in accordance with reflected ceiling drawings reviewed by the Consultant.
- .6 Leave space clear and install all work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by another Division of Work or Contract. Verify spaces in which work is to be installed. Install all pipe runs, etc., to maintain headroom and clearances and to conserve space in shafts and ceiling spaces.
- .7 Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied under other Divisions of Work or Contracts.

## 1.2 Installation requirements

- .1 The Consultant's Drawings and instructions govern the general location of all items.
- .2 Install all equipment and apparatus to allow free access for maintenance, adjustment, and replacement.
- .3 Install all Products and services in accordance with the manufacturer's requirements and/or recommendations.
- .4 Do not use explosive activated tools.
- .5 Install all services capped for future to allow easy access for future tie-in.
- .6 All equipment installed in parking structure floor slabs, ramps and driving areas shall meet all requirements of CAN/CSA – S413 with regard to corrosion protection:
  - .1 The use of dissimilar materials shall be avoided, or if unavoidable, electric contact shall be prevented.
  - .2 Embedded materials used for pipes and other hardware shall be:
    - .1 Non metallic, or;
    - .2 A low copper aluminum alloy or an equally corrosion resistant metal, coated on surfaces in contact with concrete to prevent galvanic corrosion with steel reinforcing, or;
    - .3 Protected against the corrosive effects of de-icing chemicals by an effective and durable coating.
- .7 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise, install all products and services to follow building planes. Installation shall permit free use of space and maximum headroom.
- .8 Cap off and seal all open ends of installed piping and conduits to prevent entrance of foreign matter.

- .9 Do not install piping in a location or manner, which might result in freezing.

### **1.3 Temporary services**

- .1 Refer to Section 01 51 00 regarding temporary services, Contractor's shop, storage and other facilities.
- .2 Do not use any of the permanent fire suppression systems during construction, unless specific written permission is obtained from the Consultant or unless allowed elsewhere in the Contract Documents.
- .3 The use of permanent facilities for temporary construction service shall not affect in any way the commencement of the warranty period. The warranty period shall commence as specified in CCDC – 2, as amended by the supplementary conditions.

### **1.4 Services to equipment supplied by others**

- .1 Provide all necessary connections required for equipment supplied by the Owner and other Divisions. Examine all Drawings and Specifications and identify all requirements.
- .2 Provide valves, unions, caps, and vibration isolation for all services.
- .3 The Contractor shall be responsible to verify, adjust, and coordinate the type, size, and location of services required for all equipment supplied by the Owner and other Divisions.

### **1.5 Cutting and patching**

- .1 Inform all other Divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting and patching, including layout, x-rays, ferros scanning at premium time. Obtain the permission of the Consultant before doing any cutting.
- .2 Do all necessary cutting and patching of existing work. X-ray all proposed floor-opening locations prior to core drilling. Refer to Section 21 00 55 – Work in Existing Buildings.



- .3 Obtain the Consultant's approval before doing any cutting and patching. Any structural modifications must not affect structural, fire barrier or vapor barrier integrity.

## **1.6 Painting**

- .1 Provide all exposed ferrous metal work and Products, except piping, with at least one (1) factory prime coat or paint one prime coat on site. Clean up or wire brush all equipment before painting. Unless otherwise noted finish painting will be done under Division 09 – Finishes of these Specifications.
- .2 If not factory coated or galvanized, clean, wire brush and paint all ferrous supports and hangers concealed in ceiling spaces of kitchens or other similar high humidity areas.
- .3 Repaint or refinish all damaged factory applied finishes.
- .4 Provide oil-base red oxide primer applied as per manufacturer's recommendations.

## **1.7 Manufacturer's certification**

- .1 Submit letters from the manufacturers of all equipment certifying that their technical representatives have inspected and tested their equipment, have approved the methods of installation and operation. Where existing systems are extended, provide letters covering both new and existing equipment and connections.
- .2 These letters shall state the names of persons present at the inspection and testing, methods used and a list of functions performed with location and room numbers where applicable.
- .3 Refer to the respective equipment sections for requirements for letters.

## **1.8 Warranty**

- .1 Refer to General Conditions of the Contract and Specimen Warranty Form.

- .2 Furnish all extended warranty for equipment as required in the Specifications.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 21 00 01 – General Requirements shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Provide shop drawings for access doors and panels.

### **1.3 Materials and equipment**

- .1 Use only new materials and equipment of Manufacturer as specified or shown on the Drawings. Ensure that equipment and materials for similar applications are of the same Manufacturer.
- .2 If the Contractor wishes to substitute materials of Manufacturers other than those named, he shall state in his Tender the name and a complete description of the materials to be substituted, along with the amount of change in the Contract price.
- .3 Ensure that materials not specified to a specific Manufacturer are of high commercial standard and quality.

## **2 Products**

### **2.1 Access doors and panels**

- .1 In plaster, gypsum board, tiled or masonry walls for exposed flush installation, provide 203mm by 203mm (8" x 8") prime coated 16 ga. access door with 18 ga. mounting frame, continuous concealed hinge, and screwdriver operated stainless steel cam latch, similar to Acudor UF-5000.
- .2 In plaster or tiled walls for recessed installation, provide 305mm by 305mm (12" x 12") 16 ga. access door recessed by 25mm (1"). Door to be complete with 14 ga. mounting frame, concealed pivoting rod type hinge, and flush-to-surface screwdriver operated stainless steel cam latch, similar to Acudor AT-5020.

- .3 In gypsum board surfaces or in acoustic tiles for recessed installation, provide 305mm by 305mm (12" x 12") 16 ga. access door recessed by 25mm (1"). Door to be complete with 14 ga. mounting frame with drywall taping bead on all sides, concealed pivoting rod type hinge, and flush-to-surface screwdriver operated stainless steel cam latch, similar to Acudor DW-5015.
- .4 In fire rated walls, provide 305mm by 305mm (12" x 12") 16 ga. rated access door, ULC listed "B" label for 1-1/2 or 2 hours. Door to be complete with 16 ga. mounting frame, concealed hinge, spring closer, and knurled knob operated universal self-latching bolt, similar to Acudor FB-5060.

### **3 Execution**

#### **3.1 Inserts, sleeves, escutcheons and curbs**

- .1 Use only factory made, threaded, or toggle type inserts as required for supports and anchors, properly sized for the load to be carried. Place inserts only in portions of the main structure and not in any finishing material.
- .2 Use factory made expansion shields where inserts cannot be placed, but only where permission is given by the Consultant.
- .3 Do not use powder-activated tools except with written permission from the Consultant.
- .4 Supply and locate inserts, holes, anchor bolts, and sleeves in time when walls, floors, and roof are erected.
- .5 Sleeves shall be concentric with pipe and be minimum of 50mm (2") larger than pipe size.
- .6 Pass insulation unbroken where pipe is insulated, except through fire rated walls and floors. Size sleeves to provide 13mm (1/2") clearance all around.
- .7 Use the following sleeving material for pipe sleeves:

- .1 Through interior walls use Schedule 10 steel pipes, machine cut, flush with finished structure. Check room-finish schedules.
- .2 Through exterior walls above grade use Schedule 10 steel pipes, machine cut, flush with finished structure inside and to suit flashing on outside.
- .3 Through exterior walls below grade and other waterproof walls use extra heavy weight cast iron or PVC sleeves, machine cut. Check flashing details for further information.
- .4 Through waterproof floors, through janitor's closets, mechanical rooms, compartment mechanical rooms, showers, kitchens, washrooms, and through roofs, use Schedule 40 sleeves, machine cut. As an alternative, copper DWV sleeves up to and including 150mm (6") sleeve size and rolled 32 ounce copper sleeves for larger than 150mm (6") sleeve size may be used. Extend sleeves 100mm (4") above finished floor upwards and cut flush with underside of floor. Refer to flashing details through waterproof floors.
- .5 Through other interior floors use Schedule 10 steel pipes, machine cut, flush with finished structure on both sides. Check room-finish schedules for further information.
- .6 Ensure that watertight concrete curbs, 100mm (4") high by 100mm (4") wide with 19mm ( $\frac{3}{4}$ ") chamfered edges, are furnished around pipes passing through waterproof floors except where furred in. Read Division 03 – Concrete for further information.
- .8 Pack spaces between the insulated pipe and the sleeve or where uninsulated, between the pipe and the sleeve, with ULC listed fire rated foam. Maintain vapour barrier on cold lines. Seal the annular space both sides as follows:
  - .1 For horizontal sleeves in exposed areas, use a seal equal to or better fire rated than the wall to be sealed. Use "Fire barrier" as distributed by Double A/D Distributors Ltd. (UL No. 4 U 18.7 approved).

- .2 For horizontal concealed sleeves through firewalls and through walls separating areas of different air pressure, use a permanently resilient (silicone base or equal) sealing compound.
- .3 For vertical sleeves through roofs, janitor's closets, equipment rooms, and where required to provide fire rated separation, use permanently resilient (silicone base or equal) sealing compound, non-flammable and waterproof. Ensure that the seal is compatible with floor and ceiling finishes. Check the room-finish schedules for further information.
- .4 All fire stop materials and methods must be approved in accordance with CAN4-S115-M85, and be ULC listed.
- .5 Seal is not required for other sleeves.
- .9 Cover exposed floor and wall pipe sleeves in finished areas with satin finish chrome or nickel plated solid brass or with satin finish stainless steel escutcheons with non-ferrous set screws. Split cast plates of the screw locking type may be used. Do not use stamped steel friction type split plates.

### **3.2 Access doors and panels**

- .1 Install all concealed mechanical equipment requiring adjustment or maintenance in locations easily accessible through access panels or doors. Install systems and components to result in a minimum number of access panels. Indicate access panels on "As Built" drawings.
- .2 Provide the respective Division of Work with panels, doors, or the frames therefore; complete with all pertinent information for installation. Arrange with and deliver to the Division in whose work they occur to install them. Ensure that access doors are installed in a manner to match the building material grids where applicable.
- .3 Prepare detailed and coordinated drawings showing location and type of all access doors. Submit these drawings to Consultant to review.
- .4 Size all access doors to provide adequate access and commensurate with the type of structure and architectural finish, minimum size 150mm (6") by

150mm (6). Should it be necessary for persons to enter, provide a minimum 600mm (24") by 450mm (18") size doors.

- .5 Ensure proper fire rating of access doors in fire separations, fire-rated walls, and ceilings.
- .6 Lay-in type tiles, properly marked, may serve as access panels.

### **3.3 Workmanship**

- .1 Install pipes parallel and perpendicular to the building planes and concealed in chases, behind furring or above ceiling, except in unfinished areas. Install all exposed systems neatly and group together, to present a neat appearance.
- .2 Install all equipment and apparatus requiring maintenance, adjustment, or replacement with sufficient clearance for servicing.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 21 00 01 – General Requirements, shall apply to and govern this section.

### **1.2 Co-ordination between new and existing installations**

- .1 Check and co-ordinate all systems in the new building addition which are extended to or from existing systems to ensure their proper operation.
- .2 Provide interfacing components between new and existing systems as necessary for proper performance and operation.

### **1.3 Penetrations in existing structure**

- .1 Do all cutting and core drilling for the Work of this Division. Obtain Consultant's approval before proceeding.
- .2 Provide sleeves and follow Consultant's instructions where necessary to completely penetrate existing floors, walls, ceiling, roof, or structural members.
- .3 X-ray all proposed penetrations of concrete slabs to locate hidden services before penetrating existing structure. Advise Consultant of any interference.
- .4 Do all necessary patching and repairing. Maintain integrity of fire ratings.
- .5 Flash all parts passing through or built into a roof, outside wall or waterproof floor.
- .6 If any fire proofing material or insulation on building structure is damaged where fire suppression equipment has been removed or added, Contractor to repair at this Division's expense.



**1.4 Use of existing material and equipment**

- .1 Test existing equipment, which is to remain in areas being renovated for proper operation. Identify required repairs in written report to Consultant.
- .2 Clean, test for proper operation and repair existing equipment to be relocated before being put back into service. Identify required repairs in written report to Consultant.
- .3 Repair or replace, without adjustment to the Contract price, all existing equipment, which is damaged in process of relocation.
- .4 Unless noted otherwise provide additional equipment of the same type and manufacturer where required to supplement existing equipment.
- .5 Review existing equipment on site to determine operating conditions prior to Tender.

**1.5 Salvage materials**

- .1 Remove from the site all materials in renovated areas of the existing building, which are not to remain or be reused, unless noted as remaining the property of the Owner.

**1.6 Existing services**

- .1 Disconnect and remove all existing products, which are abandoned.
- .2 Remove all piping, which is abandoned except inaccessible piping in furred-in space. Cut and cap piping below finished surfaces.
- .3 Allow for all work necessary to complete the alterations, rerouting and/or repositioning of existing services and equipment, and all interconnections of new and existing systems.
- .4 Verify the location and size of all existing services before proceeding with the work.
- .5 Keep all sprinkler, standpipe and other fire and life safety protection systems in operation at all time.

### **1.7 Interruption of services**

- .1 Co-ordinate all work with the use of the building by the Owner.
- .2 Maintain all fire suppression services to all parts of the building, which are in use. Provide temporary services as necessary.
- .3 Obtain Owner's written approval before interrupting any service.
- .4 Request permission to interrupt services in writing not less than two (2) weeks in advance and state time(s) and duration(s) of interruptions.

### **1.8 Premium time**

- .1 Include cost of premium time in Tender Price for work during nights, weekends or other time outside normal working hours necessary to maintain all fire suppression services in operation.
- .2 Maintain fire protection at all times in accordance with governing authorities' rules and regulations.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 21 00 01 - General Requirements, shall apply to and govern this section.
- .2 Pipe support for sprinkler systems shall be designed and installed to NFPA-13 standard and the Owner's Insurance Underwriters approval.

### **1.2 Shop drawings**

- .1 Provide shop drawings for all hanger and support products.

## **2 Products**

### **2.1 Pipe attachments**

- .1 For pipe attachments, adhere to the following:
  - .1 For uninsulated fire standpipe piping – ULC and FM approved –, use Taylor Fig. 41 swivel ring hanger, or approved equivalent.
  - .2 For uninsulated steel pipes, use Taylor Fig. 22Z, or approved equivalent, adjustable clevis up to and including DN100 (4") pipe size, and Taylor Fig. 24, or approved equivalent, adjustable clevis for sizes DN125 (5") and larger.
  - .3 For uninsulated copper pipes, use Taylor Fig. 56, or approved equivalent, autophoretic coated clevis hanger up to and including DN100 (4") pipe size.
  - .4 For uninsulated copper tubing, use Taylor Fig. 43, or approved equivalent, autophoretic coated swivel ring hanger up to and including DN25 (1") pipe size.
  - .5 For insulated pipes where the insulation is around the hanger and continuous vapour barrier is not required, use the same hangers as for uninsulated pipes.

- .6 For insulated pipes where hanger is around insulation, provide galvanized sheet metal insulation shield minimum 250mm (10") long, 1.3mm (18 gauge), between covering and Taylor Fig. 22Z or Fig. 24 clevis, or Taylor Fig. 24L, or approved equivalent, extended clevis, sized to include insulation.

## 2.2 Upper attachments

- .1 Provide upper attachments as follows:
  - .1 Standard beam clamp for normal service, Taylor Fig. 425, or approved equivalent.
  - .2 Top beam clamp (NFPA approved), Taylor Fig. 408, or approved equivalent.
  - .3 C clamp with locknut, Taylor Fig. 301, or approved equivalent.
  - .4 Side beam bracket for light duty side mounting, Taylor Fig. 202, or approved equivalent.

## 2.3 Pipe support

- .1 For vertical adjustment of hanger rods, provide Taylor Fig. 68 forged steel turnbuckle, or approved equivalent.
- .2 Where trapeze hanger is used for a group of pipes, use Taylor Fig. 12 U bolts, or approved equivalent, except where roller type hanger is indicated on the drawings or in the specifications.
- .3 For roller type hangers on both hot and cold pipes, provide Taylor Fig. 70 to 75 protection saddles, or approved equivalent, to suit covering thickness. Use Taylor Fig. 93, or approved equivalent, adjustable roller hanger for pipe sizes up to and including DN150 (6") over insulation. For pipes DN200 (8") and larger over insulation, use Taylor Fig. 95, or approved equivalent, adjustable 2-rod roller hanger. On trapeze hangers and where pipe is supported from below, use Taylor Fig. 280S adjustable pipe roller stand, or approved equivalent.

- .4 For vertical pipe support, provide Taylor Fig. 82Z, or approved equivalent, zinc plated steel riser clamp for steel pipe, and Taylor Fig. 86 autophoretic coated steel riser clamp for copper pipe.
- .5 For guides on vertical pipes, use manufactured pipe alignment guides (e.g. Flexonics). For horizontal pipes, use Taylor Fig. 255, or approved equivalent, pipe alignment guide. Field fabricated guides with rolled T-section welded to the pipe and guiding shoe, are also acceptable.

### **3 Execution**

#### **3.1 General**

- .1 Provide supports required for the erection and support of the work. Construct supports of steel, masonry, or concrete, as noted or required. Ensure that steel supports in contact with water or high humidity are galvanized members bolted together using cadmium plated bolts, all others primed steel.
- .2 Ensure that housekeeping pads or concrete bases are provided for floor-mounted equipment. Make the minimum size, 100mm (4") high for bases or pads, keyed to the floor slab, extending at least 100mm (4") all around the equipment, with 19mm ( $\frac{3}{4}$ ) chamfered edges. Where concrete is provided by Division 03 – Concrete, provide all anchor bolts and setting templates to Division 03 – Concrete.
- .3 Support suspended equipment from the bottom. Support tanks and other equipment with cast or welded steel saddles having proper curvature and inherent beam strength. Read Division 05 – Metals, for further information.
- .4 Provide supports and suspended bases having ample strength to safely carry the load under all operating conditions and during testing. Submit support and base details to the Consultant for review. Design supports except springs with a minimum factor of safety of five (5) based on ultimate tensile strength at operating temperature.
- .5 Ensure that the load onto structures does not exceed the maximum loading as shown on structural drawings or as directed by the Consultant.

- .6 Take special care in locating hangers and supports to avoid introduction of undue reaction forces onto the structure of the building, to flanges of pumps and equipment, to expansion joints and to the pipe.
- .7 Install all piping supported from hangers or supports in a manner to ensure that building construction is not weakened or over-stressed, that pipes are secure, vibration free, free to expand and contract and properly graded, and that vertical adjustment of horizontal piping is possible after erection.

### 3.2 Hangers

- .1 For structure attachments, adhere to the following:
  - .1 Support hangers directly from the structure only. Do not support pipes or equipment from other pipes, ducts, equipment, suspended ceiling, steel decks, etc.
  - .2 Suspend hanger rods generally from certified inserts in concrete or by beam clamps. Before welding to steel structure members obtain prior permission of welding method from the Consultant and ensure that loads do not exceed the limit set by the Consultant. Ensure that hanging from floors and roofs made from pre-cast concrete members is from inserts originally cast into the members and provided by this contractor, or by rods passing between the members connected to a steel plate resting on the upper surface.
- .2 Sliding guides must have sliding surfaces cleaned of all dirt, paint or corrosion and, except for Teflon, have coating of graphite paste added during erection. Adjust guides to allow for free sliding at operating conditions. After assembly, provide these guides with temporary protective cover or wrapping added to keep them free of debris during extent of construction work. When piping is ready to be put into service, remove this protective covering, blow out guides clean of all debris and add paste where applicable. Care must be taken that ample clearance is provided so as not to obstruct free sliding of guide.

- .3 Install copper, brass, and stainless steel pipes with 3mm ( $1/8$ " ) thickness of di-electric packing between the pipe and the pipe attachment or use Taylor plastic coated pipe attachments.
- .4 Install guides on pipes with expansion movement next to expansion joints. Consult expansion joint manufacturer's recommendations and follow his instructions for number and spacing of guides. Use a minimum of two guides on each side of expansion joints.
- .5 Set hanger rods on steel and copper lines with expansion movement out of plumb in ambient temperature position, a distance equal to one-half pipe movement calculated from anchor point. Base movement on 25mm (1") expansion per 30m (100 ft) of pipe length and 37°C (67°F) temperature difference. Use toggle type insert of beam clamp for such locations.
- .6 Use roller type hanger only where shown on the drawings.
- .7 Install all hangers close to points where pipes change direction or where branch piping drops or rises from main.
- .8 Install vertical riser suitably anchored and guided with manufactured or fabricated guides to maintain accurate vertical position. Protect insulated pipes with 2.2mm (12 gauge) galvanized steel jacket at guides. Guide pipes with expansion movement and definite anchor points up to and including DN100 (4") sizes, at every floor or 3m (10 ft). Guide larger pipes at every second floor or 7.6m (25 ft).
- .9 Use lockwasher with single nut on all bolted connections for pipe supports, anchors, guides, and support steel, or use double nuts.
- .10 During hydrostatic test on all air and vapour piping supported by springs or counterweights, install temporary rigid supports, blocking, etc., or lock the spring against movement to prevent excessive strain on piping or equipment.
- .11 For rod hangers use round steel threaded rod supports on horizontal pipes, spaced at the following maximum intervals and having the minimum diameter as directed.

## .1 For Steel Pipes:

Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN15 (1/2)	1,524 (5)	9 (3/8)	9 (3/8)
DN20 (3/4)	1,829 (6)	9 (3/8)	9 (3/8)
DN25 (1)	2,134 (7)	9 (3/8)	9 (3/8)
DN32 (1- 1/4)	2,438 (8)	9 (3/8)	9 (3/8)
DN40 (1- 1/2)	2,743 (9)	9 (3/8)	9 (3/8)
DN50 (2)	3,048 (10)	9 (3/8)	9 (3/8)
DN65 (2- 1/2)	3,353 (11)	13 (1/2)	9 (3/8)
DN80 (3)	3,658 (12)	13 (1/2)	9 (3/8)
DN100 (4)	4,268 (14)	16 (5/8)	13 (1/2)
DN125 (5)	4,877 (16)	16 (5/8)	13 (1/2)
DN150 (6)	5,182 (17)	19 (3/4)	16 (5/8)
DN200 (8)	5,791 (19)	22 (7/8)	19 (3/4)
DN250 (10)	6,706 (22)	22 (7/8)	19 (3/4)
DN300 (12)	7,010 (23)	22 (7/8)	19 (3/4)
DN375 (15) and over	max. 7,620 (25)	to suit weight	to suit weight

## .2 For Copper Tubing:

Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN15 (1/2)	1,524 (5)	9 (3/8)	9 (3/8)
DN20 (3/4)	1,829 (6)	9 (3/8)	9 (3/8)
DN25 (1)	1,829 (6)	9 (3/8)	9 (3/8)



Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN32 (1- ¼)	2,134 (7)	9 (¾)	9 (¾)
DN40 (1- ½)	2,438 (8)	9 (¾)	9 (¾)
DN50 (2)	2,743 (9)	9 (¾)	9 (¾)
DN65 (2- ½)	3,048 (10)	13 (½)	9 (¾)
DN80 (3)	3,048 (10)	13 (½)	9 (¾)
DN100 (4)	3,658 (12)	16 (⅝)	13 (½)

- .12 Do not use pipe hooks, chains, or perforated straps.
- .13 Use angle or channel iron welded frames for trapeze hangers.

### 3.3 Anchors

- .1 Design pipe anchors to restrain the movement of pipes in all directions.
- .2 Take special care in locating anchors to avoid introduction of undue reaction forces into the structure of the building, to flanges of pumps and equipment, and to the pipe.
- .3 Fabricate anchors and guides of structural steel channels, angles or plates secured to building structure. Size cylindrical type guides for full pipe insulation.
- .4 Submit a detailed design including reaction forces, prepared in conjunction with the expansion joint manufacturer for anchors and their proposed connection to the structure. Do not proceed with installation until after receipt of reviewed drawings.

### 3.4 Equipment support

- .1 Place all suspended equipment on welded steel bases of up to 150mm (6") profile steel, stiffened with 3mm (1/8") checkered steel plate. Coordinate with Division 05 – Metals.

- .2 Place floor plates on 100mm (4") concrete housekeeping pads. Ensure that the load on the structure does not exceed 488 kg per square meter (100 lbs. per square feet) projected floor area within the perimeter of the supports.

**END OF SECTION**

## 1 General

### 1.1 General

- .1 Section 21 00 01 - General Requirements, shall apply to and govern this section.

## 2 Products

- .1 Not Used

## 3 Execution

### 3.1 Pipe systems

- .1 After finished painting is complete, identify each pipe with stencils and stencil paint. Alternatively, use SMS Coil-Mark or adhesive style building service pipe markers.
- .2 Use capital letters minimum 51mm (2") high for DN80 (3") diameter piping or larger, including insulation, and 19mm ( $\frac{3}{4}$ ") size capital letters on smaller diameters.
- .3 Use flow arrows to indicate direction of flow. Use double arrow where flow is reversible. Arrow shall be solid black or white; minimum 152mm (6") long by 51mm (2") wide for DN80 (3") diameter piping or larger, including insulation, and 102mm (4") long by 19mm ( $\frac{3}{4}$ ") wide on smaller diameters.
- .4 Locate identification and flow arrows as follows:
  - .1 Behind each access door.
  - .2 At each change of direction and take-off.
  - .3 Not more than 12.2m (40 ft) apart on all pipes exposed and/or located behind accessible ceiling.
  - .4 On both sides of sleeves.

- .5 Adjacent to valves.
- .6 Above each floor or platform for vertical exposed pipes approximately 1,524mm (5 ft.) above floor.
- .5 Stenciling to be performed in a neat, quality manner. Upon completion of project, provide one complete set of stencils used for Owner.
- .6 Use wording shown on Legend on Drawings or as instructed by the Consultant. Special system designations and abbreviations shall be submitted to Consultant for approval prior to use.
- .7 Colour coding to be as per the following schedule. For all other services, provide colour coding in conformance with CAN/CGSB-24.3 and ANSI A131.

**MARKER LEGEND****CLASSIFICATION  
COLOUR**

Description and Service	Primary	Secondary
Fire Protection Water	Red	White
Sprinkler Water	Red	White

- .8 Use primary colours for full length of piping or in minimum 914mm (36") long sections; use minimum 457mm (18") long sections on each side of valves. Use secondary colours in min. 51mm (2") wide bands.
- .9 Install pipe identification in accordance with the manufacturer's recommendations.

**3.2 Valves**

- .1 Supply and attach to each valve (except fixture stops) a lamacoid tag 32mm (1-¼") in diameter or 38mm (1-½") square, similar to SMS RP/SP-1500 series. The system code to be 5mm (<sup>3</sup>/<sub>16</sub>") high characters on the top line, valve numbers to be 9mm (<sup>3</sup>/<sub>8</sub>") high on the bottom line. Tags to be colour coded in conformance with piping system colours as per CAN/CGSB-24.3.
- .2 Attach tag to valve with a brass chain.

- .3 Schedule the valve numbers using a sequential numbering system. Coordinate valve numbers with the annunciator panel numbering system.
- .4 Prepare and submit valve directories and charts giving number, size, location, purpose, and normal position (opened or closed) for each valve.
- .5 Provide two (2) framed copies of the valve charts and locate where directed by the Consultant.
- .6 All control, drain, and test connection valves shall be provided with signs indicating their purpose.

### 3.3 Equipment

- .1 Identify all pumps, controls, starters, switches, pushbuttons, and all other equipment as to service by a white lamacoid engraved nameplate on black background. Submit sample plates and lettering to the Consultant. Attach plates only after all painting work is completed. Use mechanical fastening devices acceptable to the Consultant.
- .2 Manufacturer's nameplates shall be affixed to all equipment, serial number and all information usually provided, including voltage, cycle, phase, motor power, etc., name of the manufacturer and his address. All stamped etched or engraved lettering on plates shall be perfectly legible. Do not paint over nameplates and, where apparatus is to be concealed, attach the nameplates in an approved location on the equipment support or frame.
- .3 Identify all equipment with the corresponding remote controls.
- .4 Equipment plates shall have 9mm ( $3/8$ " ) capital letters; starter plates shall have 3mm ( $1/8$ " ) capital letters. All plates shall be sized to accommodate required description. Locate plates conspicuously and secure with self-tapping sheet metal screws where possible, or with double sided adhesive tape. Recognizable abbreviations will be acceptable, other proposed abbreviations to be approved by Consultant.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 21 00 01 - General Requirements, shall apply to and govern this Section.
- .2 All equipment and accessories shall be I.A.O., UL, ULC, or FM labelled and/or approved.
- .3 All systems shall be designed to NFPA-13 standards and the Owner's Insurance Underwriters approval.

### **1.2 Scope of Work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 Wet sprinkler systems.
- .2 Contract starts at flanged connection 300mm (12") above floor supplied and installed by Section 21 05 29 – Bases, hangers and supports.
- .3 Apply and pay for all permits.
- .4 Provide all electrical supervision devices for each shutoff valve in system.
- .5 Provide all additional working plans or load calculations as may be required by the bodies having jurisdiction. Include all costs pertaining to the review of these plans and calculations. All working plans and calculations shall be submitted to the Owner's insurer and local Fire Department for approval as required prior to construction commencement.
- .6 All pipe sizes, head location, head quantity, and layout of new systems shown on Drawings are to assist tender coordination only. It is the responsibility of the Contractor to ensure adequate head coverage, head quantities, pipe sizing, zoning, and valving for the system as per NFPA 13 hazard occupancies, Owner's Insurers' standards, and authorities having jurisdiction. Install additional heads, valves, and resize piping as required

at no additional cost to the Owner. Size reduction of sprinkler main shall not be accepted unless approved by the Consultant. Re-routing of sprinkler main shall be approved in advance by the Consultant.

- .7 Identify all changes to the fire alarm system resulting from sprinkler shop drawings. All cost related to changes initiated by the Sprinkler Designer shall be the responsibility of Division 21 – Fire Suppression.
- .8 Obtain flow and pressure available from city main and obtain approval from IAO before commencing work. Verify flow and pressure data shown on contract documents with local authorities. Undertake flow test were required, at no additional cost to the Owner. Conduct test in accordance with IAO Standards.

### **1.3 Quality assurance**

- .1 The system installation shall be carried out by a sprinkler company who is a member in good standing of the Canadian Automatic Sprinkler Association.

### **1.4 Layout drawings**

- .1 Sprinkler layout as shown on the Drawings is diagrammatic. Refer to latest Architectural Drawings for final layout of wall, partitions, and occupancy areas.
- .2 Sprinkler contractor must check and verify all dimensions and conditions on the job, and ensure that the Work can be performed as indicated. Report all discrepancies to the Consultant before proceeding with the Work.
- .3 Prepare complete sprinkler layout drawings, arranging piping runs and sprinkler heads in proper relation to other equipment such as light fixtures, ducts, etc., to ensure clear ceiling heights indicated on Drawings. Coordinate location of sprinkler heads in suspended ceilings with the location of lighting, grilles, diffusers, and similar items. Maintain maximum headroom in areas with no ceilings.
- .4 Layout drawings shall also include all hydraulic calculations.

- .5 Obtain approval of the sprinkler layout drawings by an Insurers' Advisory Organization, Factory Mutual, and the Consultant before any work is started.
- .6 Sprinkler layout drawings shall take into consideration, architectural, structural, mechanical and electrical layouts of the building and sprinkler mains and branches must be arranged to not interfere with any of the aforementioned.
- .7 Submit drawings, support details, and weights to structural engineer for review.
- .8 Sprinkler heads are to be installed symmetrically in ceiling tiles.
- .9 Layout drawings are to be sealed by a Registered Professional Engineer, registered in the Province of Ontario.
- .10 Submit drawings to the Consultant for review only after they have been approved by the local authorities and the Owner's Insurer.

### **1.5 Submittals**

- .1 Submit shop drawings for the following:
  - .1 Sprinkler system layout, including hydraulic calculations
  - .2 Sprinkler components including heads, hangers, couplings etc.
- .2 Layout drawings shall be approved by local Fire Department and Owner's Insurer prior submission to Consultant. All costs related to obtaining agency approval shall be borne by this Contractor.
- .3 Submit samples of all sprinkler heads to be used to the Consultant.
- .4 Forward to the Owner on completion of the contract the final unconditional acceptance certificates of the authorities.

### **1.6 Design requirements**

- .1 Size piping on basis of hydraulic design.



- .2 Do all necessary hydraulic design, piping calculations, and submit to governing authorities for approval.

## 1.7 Hydraulic calculations

- .1 Office Areas.
  - .1 System shall be hydraulically designed.
  - .2 Hazard classification – Light Hazard.
  - .3 Rate of water application (density) 0.068 L/s/m<sup>2</sup> (0.1 gpm/ft<sup>2</sup>) over 139 m<sup>2</sup> (1,500 ft<sup>2</sup>).
  - .4 Pipe sizes shall be based on 16.3 m<sup>2</sup> (175 ft<sup>2</sup>) per head.
  - .5 The reflected ceiling layout as prepared by the Consultant shall not be altered or revised by this requirement. The number and location of heads shown shall remain as shown as a minimum.
- .2 Service Spaces (Electrical Rooms, Telecom Rooms, Garbage Room, Loading Dock etc.).
  - .1 System shall be hydraulically designed.
  - .2 Hazard Classification – Ordinary Hazard Group 1.
  - .3 Rate of water application (density) 0.102 L/s/m<sup>2</sup> (0.15 gpm/ft<sup>2</sup>) over 139 m<sup>2</sup> (1,500 ft<sup>2</sup>).
- .3 Clinic Areas.
  - .1 System shall be hydraulically designed.
  - .2 Hazard classification – Light Hazard.
  - .3 Rate of water application (density) 0.068 L/s/m<sup>2</sup> (0.1 gpm/ft<sup>2</sup>) over 139 m<sup>2</sup> (1,500 ft<sup>2</sup>).
  - .4 Pipe sizes shall be based on 16.3 m<sup>2</sup> (175 ft<sup>2</sup>) per head.

- .5 The reflected ceiling layout as prepared by the Consultant shall not be altered or revised by this requirement. The number and location of heads shown shall remain as shown as a minimum.

## **2 Products**

### **2.1 Valves**

- .1 Alarm valves shall be Grinnell Model 'A', or reviewed equivalent, with A-2 trimmings including electric alarm switch and excess pressure pump. Valves shall be complete with external bypass, test bypass, pressure gauges, and drain connections. Pipe relief and drain valves to hub drain.
- .2 Dry-pipe valve shall be Grinnell Model 'E-2', or reviewed equivalent, with A-2 trimmings, compressed air connection, alarm switches, accelerator, drain connection, pressure gauges, alarm test bypass, air compressor and air maintenance devices.

### **2.2 Electric supervision**

- .1 Provide each O.S. & Y. gate valve with an electric monitor switch.
- .2 The sprinkler system shall be electrically supervised to indicate a trouble signal on the building fire alarm system annunciator for each of the following:
  - .1 Movement of control valve handle.
  - .2 Loss of excess water pressure required to prevent false alarms in a wet pipe system.
  - .3 Loss of air pressure in a dry pipe system.
  - .4 Loss of air pressure in a pressure tank.
  - .5 Loss of electrical power or phase reversal in any automatically starting electrical fire pump.
  - .6 Fire pump running.
  - .7 Sprinkler zone flow alarm.

- .8 Pre-action system first and second stage alarms.
- .9 CO<sub>2</sub> system activation.

### **2.3 Pressure reducing valves**

- .1 Provide ULC (FM) listed pressure reducing stations where shown on Drawings. Stations shall be complete with isolating valves, strainer, pressure gauges, cast iron body and bronze trim.
- .2 Select valves for inlet and outlet pressures as shown on Drawings.

### **2.4 Test and drain fittings**

- .1 For each system, provide National Fire A59 or Victaulic Style 720 combined test and drain fitting with orifice sized according to the installed sprinkler heads.
- .2 Pipe discharge to outside or the nearest floor drain. Outside drains shall be complete with DN65 (2-1/2") connections with cap and chain. Wall plate shall match the siamese connection.

### **2.5 Sprinkler heads**

- .1 Acceptable sprinkler head manufacturers Victaulic, Viking, Tyco, Reliable and Globe, or reviewed equivalent.

### **2.6 Pipe and fittings**

- .1 Piping shall follow one of the following configurations.
  - .1 Schedule 40 threaded c/w cast iron and/or malleable iron fittings.
  - .2 Schedule 40 cut grooved or roll grooved c/w mechanical couplings rated at a minimum 175 psi.
  - .3 Schedule 10 roll grooved c/w mechanical couplings rated at a minimum of 175 psi.
- .2 Fittings shall be standard screwed iron fittings.

- .3 Fittings shall be standard welding fittings if approved by authorities having jurisdiction.
- .4 Mechanical couplings such as Victaulic may be used. Couplings shall be ULC listed and FM approved.

## **2.7 Pressure gauges**

- .1 Pressure gauges shall be ULC listed.
- .2 Provide pressure gauges of the Bourdon type, minimum one percent accuracy through the entire range, complete with bronze Bourdon tube, brass socket, brass rotary movement, bronze bushings, tube and movement independently mounted from case, stainless steel case and ring, inherent shock protection. Furnish gauges having 114mm (4-½") dial, black graduations, black case, silver brazed joints, and adjustable black pointer.
- .3 Select gauges to suit fluid working pressure and, if possible, test pressure. If test pressure falls outside safe instrument range, attach a note to this effect on the installation instructions. Ensure that the normal working pressure occurs approximately at mid scale.
- .4 Install each gauge complete with DN6 (1/8") or DN8 (1/4") bar stock valve, rated 150°C (300°F) and 6,895 kPa (1,000 psi). Provide pressure snubber on all pump services. Install pressure gauges as noted.
- .5 Submit a schedule in shop drawing form showing service, location, range, make, and catalogue number for gauges.

## **3 Execution**

### **3.1 Pipe and fittings**

- .1 Provide unions or flanges at all connections to equipment or fixtures requiring servicing or replacement.
- .2 Provide Underwriter approved hangers, and support all piping from building structure. Under no circumstances shall piping be hung from

ductwork or steel roof-deck. Provide secondary steel supports where piping under ducts cannot be supported directly from structure. Where pipes are hung from joists, they shall be hung from top cord.

- .3 Sprinkler mains and branch headers shall be routed to avoid electrical, battery, UPS, elevator machine, diesel generator, switch gear and telephone rooms, unless prior approval is obtained from Consultant.

### **3.2 Extra stock of sprinkler heads**

- .1 Provide one (1) wall mounted steel cabinet with sprinkler wrench and six (6) heads of each type used in the installation. Cabinet shall have baked on enamel finish.

### **3.3 Electrical work**

- .1 All wiring from the alarm valve, monitor switches and flow switches shall be done by Division 26 - Electrical.
- .2 All power wiring shall be by Division 26 - Electrical.
- .3 Provide all other field wiring required.

### **3.4 Testing, adjusting, flushing, boiling out and cleaning**

- .1 After system is complete, flush and test entire system in accordance with NFPA-13.
- .2 Test all sprinkler lines hydrostatically at 2 times the working pressure or as required by the authorities but at not less than 1,380 kPa (200 psi), for a period of not less than four (4) hours without any drop in pressure. Do testing before piping is buried or furred in and before pressure sensitive devices are installed in the pipework. Correct all defects disclosed by tests. Retest until all results are acceptable.
- .3 If any leaks are discovered by the above tests, remove and replace the faulty portions of the systems and repeat the test. Repeat this procedure until the system is accepted by the consultant's representative on the site. Do not caulk threaded joints.

- .4 Check horizontal pipe with an accurate level for any alterations in pitch. Inspect laterals and cross arms, eliminate pockets.
- .5 Flush the system at full flow rate for ten (10) minutes, or until all foreign materials have been removed and the work is clear. Provide a standard certificate that flushing has been properly carried out and submit to Consultant.

### **3.5 Demonstration**

- .1 Prior to final acceptance, the Contractor shall provide operational training in all aspects of the system to the Owner's key personnel. Training shall include emergency procedures, safety requirements, and demonstration of the system, including all interfaces with the Fire Alarm.

### **3.6 Closeout documentation**

- .1 Contractor to provide the following closeout documents.
  - .1 NFPA-13 Above Ground Test Certificate
  - .2 Copy of NFPA 25
  - .3 As-built drawings.

**End of section**

## **1 General**

### **1.1 Contract Drawings**

- .1 The Drawings for the Plumbing Work are diagrammatic performance drawings, intended to convey the scope of Work, and indicate general arrangement and approximate location of apparatus, fixtures, and pipe runs. The Drawings do not intend to show architectural and structural details.
- .2 Do not scale drawings, but obtain information involving accurate dimensions to structure from dimensions shown on architectural and structural drawings, or by site measurements. Consult general construction drawings as well as detail drawings to become familiar with all conditions affecting the Work and verify spaces in which the Work will be installed.
- .3 Make, at no additional cost to the Owner, any changes or additions to materials and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).
- .4 Alter at no additional cost to the Owner, the location of materials and/or equipment as directed, provided that the changes are made before installation and do not necessitate additional material.
- .5 Install all ceiling mounted components in accordance with reflected ceiling drawings reviewed by the Consultant.
- .6 Leave space clear and install all work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by another Division of Work or Contract. Verify spaces in which work is to be installed. Install all pipe runs, etc., to maintain headroom and clearances and to conserve space in shafts and ceiling spaces.
- .7 Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied under other Divisions of Work or Contracts.

**1.2 Installation requirements**

- .1 The Consultant's Drawings and instructions govern the general location of all items.
- .2 Install all equipment and apparatus to allow free access for maintenance, adjustment and replacement.
- .3 Install all Products and services in accordance with the manufacturer's requirements and/or recommendations.
- .4 Do not use explosive activated tools.
- .5 Install all services capped for future to allow easy access for future tie-in.
- .6 All equipment installed in parking structure floor slabs, ramps and driving areas shall meet all requirements of ULC S413 with regard to corrosion protection:
  - .1 The use of dissimilar materials shall be avoided, or if unavoidable, electric contact shall be prevented.
  - .2 Embedded materials used for floor drains, pipes and other hardware shall be:
    - .1 Non metallic, or;
    - .2 A low copper aluminum alloy or an equally corrosion resistant metal, coated on surfaces in contact with concrete to prevent galvanic corrosion with steel reinforcing, or;
    - .3 Protected against the corrosive effects of de-icing chemicals by an effective and durable coating.
- .7 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise, install all products and services to follow building planes. Installation shall permit free use of space and maximum headroom.
- .8 Cap off and seal all open ends of installed piping and conduits to prevent entrance of foreign matter.
- .9 Do not install piping in a location or manner, which might result in freezing.



**1.3 Temporary services**

- .1 Refer to Section 01 51 00 regarding temporary services, Contractor's shop, storage and other facilities.
- .2 Do not use any of the permanent plumbing systems during construction, unless specific written permission is obtained from the Consultant or unless allowed elsewhere in the Contract Documents.
- .3 The use of permanent facilities for temporary construction service shall not affect in any way the commencement of the warranty period. The warranty period shall commence as specified in CCDC – 2, as amended by the supplementary conditions.

**1.4 Services to equipment supplied by others**

- .1 Provide all necessary connections required for equipment supplied by the Owner and other Divisions. Examine all Drawings and Specifications and identify all requirements.
- .2 Provide valves, unions, caps, and vibration isolation for all services.
- .3 The Contractor shall be responsible to verify, adjust and coordinate the type, size and location of plumbing services required for all equipment supplied by the Owner and other Divisions.

**1.5 Cutting and patching**

- .1 Inform all other Divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting and patching, including layout, x-rays, ferros scanning at premium time. Obtain the permission of the Consultant before doing any cutting.
- .2 Do all necessary cutting and patching of existing work. X-ray all proposed floor-opening locations prior to core drilling. Refer to Section 22 00 55 – Work in Existing Buildings.
- .3 Obtain the Consultant's approval before doing any cutting and patching. Any structural modifications must not affect structural, fire barrier or vapor barrier integrity.

**1.6 Excavation and backfilling**

- .1 All excavation and backfilling required for the plumbing work will be done under Division 31 – Earthwork, except as noted below. Refer to soil report regarding the type of soil.
- .2 Ensure that bottom of pipe trench is graded as required.
- .3 In firm, undisturbed soil, excavation will be carried out under Division 31 – Earthwork, to within 150mm (6") of the bottom of pipes. Excavate under this Division to desired grade, lay pipes directly on the soil and shape soil to fit the lower  $\frac{1}{3}$  segment of all pipes and pipe bells. Ensure even bearing along the barrels.
- .4 In rock and shale and where noted, excavation will be carried out under Division 31 – Earthwork, to 150mm (6") below and minimum 200mm (8") to either side of the pipe. Fill back under this Division, a bedding of 9mm ( $\frac{3}{8}$ ") crushed stone or granular 'A' gravel.
- .5 In unstable soil, in fill and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls of building and at catch basins, excavation will be carried out to 200mm (8") below the pipe under Division 31 – Earthwork. Compact to maximum possible density under this Division of Work and support the pipe by a 200mm (8") thick concrete cradle spanning full length, between firm supports. Install reinforcing steel in cradle or construct piers at maximum 2400mm (8 ft) spacing. Provide a minimum of one pier per length of pipe, down to solid load bearing strata. Use same method where pipes cross. Do all excavation for such piers.
- .6 Provide support over at least the bottom  $\frac{1}{3}$  segment of the pipe in all bedding methods.
- .7 Before backfilling, obtain approval from Consultant.
- .8 Backfill trenches within the building to a compacted level of 300mm (12") above the top of pipes with clean, sharp sand in individual layers, maximum 150mm (6") thick, hand compacted to a density of 95% Modified Proctor.

- .9 Backfill trenches outside the building to a compacted level of 300mm (12") above the top of the pipes with individual layers of material up to 150mm (6") thick, hand compacted to a density of 95% Modified Proctor, using Granular 'A' gravel.
- .10 Obtain written approval of all backfilling done under this Division from Consultant before work commences on additional backfilling under Division 31 – Earthwork.

### **1.7 Manufacturer's certification**

- .1 Submit letters from the manufacturers of all equipment certifying that their technical representatives have inspected and tested their equipment, have approved the methods of installation and operation. Where existing systems are extended, provide letters covering both new and existing equipment and connections.
- .2 These letters shall state the names of persons present at the inspection and testing, methods used and a list of functions performed with location and room numbers where applicable.
- .3 Refer to the respective equipment sections for requirements for letters.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 – General Requirements shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Provide Shop Drawings for:
  - .1 Access doors and panels.

### **1.3 Materials and equipment**

- .1 Use only new materials and equipment of Manufacturer as specified or shown on the Drawings. Ensure that equipment and materials for similar applications are of the same Manufacturer.
- .2 If the Contractor wishes to substitute materials of Manufacturers other than those named, he shall state in his Tender the name and a complete description of the materials to be substituted, along with the amount of change in the Contract price.
- .3 Ensure that materials not specified to a specific Manufacturer are of high commercial standard and quality.

## **2 Products**

### **2.1 Access doors and panels**

- .1 In plaster, gypsum board, tiled or masonry walls for exposed flush installation, provide 203mm by 203mm (8" x 8") prime coated 16 ga. access door with 18 ga. mounting frame, continuous concealed hinge, and screwdriver operated stainless steel cam latch, similar to Acudor UF-5000.
- .2 In plaster or tiled walls for recessed installation, provide 305mm by 305mm (12" x 12") 16 ga. access door recessed by 25mm (1"). Door to be complete with 14 ga. mounting frame, concealed pivoting rod type

hinge, and flush-to-surface screwdriver operated stainless steel cam latch, similar to Acudor AT-5020.

- .3 In gypsum board surfaces or in acoustic tiles for recessed installation, provide 305mm by 305mm (12" x 12") 16 ga. access door recessed by 25mm (1"). Door to be complete with 14 ga. mounting frame with drywall taping bead on all sides, concealed pivoting rod type hinge, and flush-to-surface screwdriver operated stainless steel cam latch, similar to Acudor DW-5015.
- .4 In fire rated walls, provide 305mm by 305mm (12" x 12") 16 ga. rated access door, ULC listed "B" label for 1-1/2 or 2 hours. Door to be complete with 16 ga. mounting frame, concealed hinge, spring closer, and knurled knob operated universal self-latching bolt, similar to Acudor FB-5060.

### **3 Execution**

#### **3.1 Flashing**

- .1 Provide galvanized or aluminum sleeves for piping through roof.
- .2 Ensure that the flashing suits roof and extends minimum 450mm (18") on all sides. Leave flashing as directed by the Contractor, to be built into roofing, rendering a watertight connection.
- .3 Provide counter flashing on pipes passing through roofs to fit over flashing or curb. Coordinate with Roofing Contractor.
- .4 Sleeve pipes through waterproof floors.
- .5 Pay special attention to the waterproofing conditions of basement walls and floors. Co-operate at all times with the water proofing trade and do not cut or destroy any waterproofing seal without the consent of the waterproofing trade. Provide piping sleeves passing through waterproof walls with asphalt roofing felt wrapped around to leave 25mm by 50mm (1" x 2") recess on both sides of the wall. These recesses and the space between pipe and sleeve shall be caulked by this Division in accordance with the requirements of Division 07 – Thermal and Moisture Protection.

### 3.2 Inserts, sleeves, escutcheons AND curbs

- .1 Use only factory made, threaded, or toggle type inserts as required for supports and anchors, properly sized for the load to be carried. Place inserts only in portions of the main structure and not in any finishing material.
- .2 Use factory made expansion shields where inserts cannot be placed, but only where permission is given by the Consultant.
- .3 Do not use powder-activated tools except with written permission from the Consultant.
- .4 Supply and locate inserts, holes, anchor bolts, and sleeves in time when walls, floors and roof are erected.
- .5 Sleeves shall be concentric with pipe and be minimum of 50mm (2") larger than pipe size.
- .6 Pass insulation unbroken where pipe is insulated, except through fire rated walls and floors. Size sleeves to provide 13mm (½") clearance all around.
- .7 Use the following sleeving material for pipe sleeves:
  - .1 Through interior walls use Schedule 10 steel pipes, machine cut, flush with finished structure. Check room-finish schedules.
  - .2 Through exterior walls above grade use Schedule 10 steel pipes, machine cut, flush with finished structure inside and to suit flashing on outside.
  - .3 Through exterior walls below grade and other waterproof walls use extra heavy weight cast iron or PVC sleeves, machine cut. Check flashing details for further information.
  - .4 Through waterproof floors, through janitor's closets, mechanical rooms, compartment mechanical rooms, showers, kitchens, washrooms, and through roofs, use Schedule 40 sleeves, machine cut. As an alternative, copper DWV sleeves up to and including 150mm (6") sleeve size and rolled 32-ounce copper sleeves for

- larger than 150mm (6") sleeve size may be used. Extend sleeves 100mm (4") above finished floor upwards and cut flush with underside of floor. Refer to flashing details through waterproof floors.
- .5 Through other interior floors use Schedule 10 steel pipes, machine cut, flush with finished structure on both sides. Check room-finish schedules for further information.
  - .6 Ensure that watertight concrete curbs, 100mm (4") high by 100mm (4") wide with 19mm ( $\frac{3}{4}$ ") chamfered edges, are furnished around pipes passing through waterproof floors except where furred in. Read Division 03 – Concrete for further information.
  - .8 Pack spaces between the insulated pipe and the sleeve or where uninsulated, between the pipe and the sleeve, with ULC listed fire rated foam. Maintain vapour barrier on cold lines. Seal the annular space both sides as follows:
    - .1 For horizontal sleeves in exposed areas, use a seal equal to or better fire rated than the wall to be sealed. Use "Fire barrier" as distributed by Double A/D Distributors Ltd. (UL No. 4 U 18.7 approved).
    - .2 For horizontal concealed sleeves through firewalls and through walls separating areas of different air pressure, use a permanently resilient (silicone base or equal) sealing compound.
    - .3 For vertical sleeves through roofs, janitor's closets, equipment rooms, and where required to provide fire rated separation, use permanently resilient (silicone base or equal) sealing compound, non-flammable and waterproof. Ensure that the seal is compatible with floor and ceiling finishes. Check the room-finish schedules for further information.
    - .4 All fire stop materials and methods must be approved in accordance with CAN4-S115-M85, and be ULC listed.
    - .5 Seal is not required for other sleeves.

- .9 Cover exposed floor and wall pipe sleeves in finished areas with satin finish chrome or nickel plated solid brass or with satin finish stainless steel escutcheons with non-ferrous set screws. Split cast plates of the screw locking type may be used. Do not use stamped steel friction type split plates.

### **3.3 Access doors and panels**

- .1 Install all concealed plumbing equipment requiring adjustment or maintenance in locations easily accessible through access panels or doors. Install systems and components to result in a minimum number of access panels. Indicate access panels on "As Built" drawings.
- .2 Provide the respective Division of Work with panels, doors or the frames therefore; complete with all pertinent information for installation. Arrange with and deliver to the Division in whose work they occur to install them. Ensure that access doors are installed in a manner to match the building material grids where applicable.
- .3 Prepare detailed and coordinated drawings showing location and type of all access doors. Submit these drawings to Consultant to review.
- .4 Size all access doors to provide adequate access and commensurate with the type of structure and architectural finish, minimum size 150mm (6") by 150mm (6). Should it be necessary for persons to enter, provide a minimum 600mm (24") by 450mm (18") size doors.
- .5 Ensure proper fire rating of access doors in fire separations, fire-rated walls and ceilings.
- .6 Lay-in type tiles, properly marked, may serve as access panels.

### **3.4 Drip pans**

- .1 Construct drip pans of min. 1.0mm (20 gauge) galvanized steel sheet with sealed connections. Provide drain lines from drip pans to nearest hub drain, funnel floor drain, janitor's sink or appropriate approved location.
- .2 Provide drip pans at the following locations:



- .1 Beneath all pipes passing through electrical, battery, UPS, elevator machine, diesel generator, and telephone rooms, over horizontal runs of bus ducts, and in locations as indicated on Drawings.

### **3.5 Workmanship**

- .1 Install pipes parallel and perpendicular to the building planes and concealed in chases, behind furring or above ceiling, except in unfinished areas. Install all exposed systems neatly and group together, to present a neat appearance.
- .2 Install all equipment and apparatus requiring maintenance, adjustment, or replacement with sufficient clearance for servicing.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 – General Requirements, shall apply to and govern this Section.

### **1.2 Co-ordination between new and existing installations**

- .1 Check and co-ordinate all systems in the new building addition which are extended to or from existing systems to ensure their proper operation.
- .2 Provide interfacing components between new and existing systems as necessary for proper performance and operation.

### **1.3 Penetrations in existing structure**

- .1 Do all cutting and core drilling for the Work of this Division. Obtain Consultant's approval before proceeding.
- .2 Provide sleeves and follow Consultant's instructions where necessary to completely penetrate existing floors, walls, ceiling, roof or structural members.
- .3 X-ray all proposed penetrations of concrete slabs to locate hidden services before penetrating existing structure. Advise Consultant of any interference.
- .4 Do all necessary patching and repairing. Maintain integrity of fire ratings.
- .5 Flash all parts passing through or built into a roof, outside wall or waterproof floor.
- .6 If any fire proofing material or insulation on building structure is damaged where mechanical equipment has been removed or added, Contractor to repair at this Division's expense.

**1.4 Use of existing material and equipment**

- .1 Test existing equipment, which is to remain in areas being renovated for proper operation. Identify required repairs in written report to Consultant.
- .2 Clean, test for proper operation and repair existing equipment to be relocated before being put back into service. Identify required repairs in written report to Consultant.
- .3 Repair or replace, without adjustment to the Contract price, all existing equipment, which is damaged in process of relocation.
- .4 Unless noted otherwise, provide additional equipment of the same type and manufacturer where required to supplement existing equipment.
- .5 Review existing equipment on site to determine operating conditions prior to Tender.

**1.5 Salvage materials**

- .1 Remove from the site all materials in renovated areas of the existing building, which are not to remain or be reused, unless noted as remaining the property of the Owner.

**1.6 Existing services**

- .1 Disconnect and remove all existing products, which are abandoned.
- .2 Remove all piping, which is abandoned except inaccessible piping in furred-in space. Cut and cap piping below finished surfaces.
- .3 Plug and cap all abandoned drain and vent points in systems, which are being reused. Plug and cap to the approval of the local authorities.
- .4 Allow for all work necessary to complete the alterations, rerouting and/or repositioning of existing services and equipment, and all interconnections of new and existing systems.
- .5 Verify the location and size of all existing services before proceeding with the work.

- .6 Maintain heating and cooling in the building as required to protect the building and equipment or to provide comfort conditions for the occupants.
- .7 Keep all sprinkler, standpipe and other fire and life safety protection systems in operation at all time.

### **1.7 Interruption of services**

- .1 Co-ordinate all work with the use of the building by the Owner.
- .2 Maintain all plumbing services to all parts of the building which are in use. Provide temporary services as necessary.
- .3 Obtain Owner's written approval before interrupting any service.
- .4 Request permission to interrupt services in writing not less than two (2) weeks in advance and state time(s) and duration(s) of interruptions.

### **1.8 Premium time**

- .1 Include cost of premium time in Tender Price for work during nights, weekends or other time outside normal working hours necessary to maintain all plumbing services in operation.

### **1.9 Fire protection**

- .1 Maintain fire protection at all times in accordance with governing authorities' rules and regulations.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Division 26 - Electrical will do all power wiring for equipment provided by Division 22.
- .2 Division 26 - Electrical will do all line side power wiring for equipment provided by Division 22 - Plumbing, up to the respective starter, motor control center, control panel, disconnect or VFD, also provided by Division 22 - Plumbing. Load side power wiring shall be by Division 22 - Plumbing.
- .3 Division 22 - Plumbing shall provide all disconnect switches for plumbing equipment as required by code. Provide weatherproof switches for all outdoor locations.
- .4 Field control wiring of local safeties and interlocks for packaged equipment shall be provided under the respective Sections unless otherwise specified.
- .5 Conduit and wiring materials and methods shall be in strict accordance with the requirements of Division 26 - Electrical.
- .6 Check all wiring diagrams and control diagrams submitted in shop drawing form. Before submitting these shop drawings to the Consultant, submit these drawings to Division 26 - Electrical Contractor for approval. Have these drawings stamped by Division 26 - Electrical Contractor as verification of their approval before forwarding to the Consultant. Co-operate in the commissioning of all electrically driven equipment with Division 26 - Electrical.

## **2 Products**

### **2.1 General**

- .1 Conduit and wiring materials and methods shall be in strict accordance with the requirements of Division 26 - Electrical.

## **3 Execution**

### **3.1 General**

- .1 Refer to Division 26 - Electrical.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Submit Shop Drawings for:
  - .1 All plumbing valves.

## **2 Products**

### **2.1 General**

- .1 All valves shall be of one manufacture unless stated otherwise and should have the manufacturer's name and pressure ratings clearly marked on body. Valves to conform to the current of ANSI, ASTM, ASME, and applicable Manufacturer's Standardization Society Specification (MSS).
- .2 Bronze valves up to and including 1034kPa (150 psi) steam pressure to be manufactured to ASTM B62-93 standard. Bronze valves up to 1379kPa (200 psi) and 2068kPa (300 psi) steam pressure to be manufactured to ASTM B61-93 standard. Bronze valves used in water systems may be cast bronze to ASTM B584-87 alloy CDA-836.
- .3 Iron body valves shall be ductile iron manufactured to ASTM A536-84 Grade 65-45-12 or cast iron ASTM A126-95 Class B standard where ductile iron is not available.
- .4 All valves shall have a CRN registration number.
- .5 Valve Materials
  - .1 Bronze: to ASTM B62 or B61 as applicable
  - .2 Brass: to ASTM B283 C3770

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- .3 Cast Iron: to ASTM A126, Class B
  - .4 Forge Steel: to ASTM A105N
  - .5 Cast Steel: to ASTM A216WCB
  - .6 Valve Markings
    - .1 All pressure ratings, manufacturers' trademark and size to conform as per MSS-SP-25.
  - .7 End Connections
    - .1 Threaded ends: to ASME B1.20.1
    - .2 Solder ends: to ASME B16.18
    - .3 Flanged ends: to ASME B16.1 (Class 125)
    - .4 Face To Face dimensions: to ASME B16.10
    - .5 Fanged ends: to ASME B16.5
    - .6 Butt Weld Ends: to ASME 16.25
    - .7 Socket Weld Ends: to ASME B.16.11
  - .8 Testing & Design
    - .1 MSS-SP-80 - Bronze, Gate & Check Valves
    - .2 MSS-SP-110 - Ball Valves
    - .3 MSS -SP-70, 85, 71 - Cast Iron Gate, Globe & Check Valve
    - .4 MSS-SP-72 - American Valve
    - .5 MSS-SP-67 - Kitz, Apollo, Toyo, Demco & WKM E, Butterfly Valves
    - .6 API 602 - Forge Steel Valves (Design)
    - .7 API 598 - Cast Steel Valves, Forge Steel Valves (Testing)



- .8 API 609 - WKM High Performance BFV
- .9 API 600 - Cast Steel Valves (Design)

## 2.2 Valves for low pressure service

- .1 This section applies to valves used in domestic cold water, domestic hot water and natural gas systems up to 1,034 kPa (150 psi) system operating pressure.
- .2 Gate Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 125, all bronze, with solid wedge disc, rising stem.
    - .1 Threaded ends - Newman Hattersley Fig. T607M
      - Toyo 293
      - Kitz 24
      - Crane 428
    - .2 Soldered ends - Newman Hattersley Fig. T609M
      - Toyo 299
      - Kitz 44
      - Crane 1334
  - .2 For application where non-rising stem is required.
    - .1 Threaded ends - Newman Hattersley Fig. A40M
      - Toyo 280A
      - Kitz 40
      - Crane 438
    - .2 Soldered ends - Newman Hattersley Fig. A41M
      - Toyo 281A
      - Kitz 41
      - Crane 1324
  - .3 65mm (2-1/2") dia. and over - shall be Class 125, iron body/bronze mounted, with O.S. & Y., solid wedge design.

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- .1 Flanged ends - Newman Hattersley Fig. 504
    - Toyo 421
    - Kitz 72
    - Jenkins Fig. 454J
    - Crane 465 ½
  
  - .4 For application where non-rising stem is required.
    - .1 Flanged ends - Newman Hattersley Fig. 501
      - Toyo 415
      - Kitz 75
      - Jenkins Fig. 452J
      - Crane 461
  
  - .3 Globe Valves (or approved equivalent)
    - .1 50mm (2") dia. or less - shall be Class 125, all bronze, with rising stem, fitted with PTFE disc.
      - .1 Threaded ends - Newman Hattersley Fig. A50M
        - Toyo 220
        - Kitz 03
        - Crane 7TF
      - .2 Soldered ends - Newman Hattersley Fig. A51M
        - Toyo 212
        - Kitz 10
        - Crane 1310
  
    - .2 65mm (2-½") dia. and over - shall be Class 125, iron body/bronze mounted, O.S. & Y.
      - .1 Flanged ends - Newman Hattersley Fig. T731
        - Toyo 400A
        - Kitz 76
        - Crane 351
  
      - .2 Alternative - Jenkins Fig. 2342J (renewable bronze seat and disc)

- .4 Check Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 125, all bronze, Y pattern swing check.
    - .1 Threaded ends - Newman Hattersley Fig. A60M
      - Toyo 236
      - Kitz 22
      - Crane 37
    - .2 Soldered ends - Newman Hattersley Fig. A61M
      - Toyo 237
      - Kitz 23
      - Crane 1342
    - .3 If lift check valve required.
      - .1 Threaded ends - Newman Hattersley Fig. 42 (horizontal)
        - Newman Hattersley Fig. 49 (vertical)
        - Kitz 36 (vertical)
        - Jenkins Fig. 117ATJ (horizontal)
        - Jenkins Fig. 119J (vertical)
        - Crane 29 (vertical)
        - Crane 27TF (horizontal)
  - .2 65mm (2-1/2") dia. and over - shall be Class 125, iron body/bronze mounted or stainless steel, with bolted bonnet.
    - .1 Flanged ends - Newman Hattersley Fig. T651
      - Toyo 435A
      - Kitz 78
      - Jenkins Fig. 587J
      - Duo Check II (Wafer style)
      - Mueller 71 series
      - Crane 373
    - .2 Grooved ends - Victaulic Series 712 (horizontal) or 716 (vertical)

- .3 If silent check valve is required - cast iron body, bronze trim, EPDM seat, spring loaded center guided disc, stainless steel spring and shaft.
  - .4 Flanged ends - Apco or Smolenski  
- Mueller
  - .5 Grooved ends - Victaulic 716 - 65mm (2-½") to 300mm (12")
  - .6 - Victaulic W715 - 350mm (14") to 600mm (24")
- .5 Ball Valves (or approved equivalent)
- .1 50mm (2") dia. or less - shall be rated for 1034kPa (150 psi) steam, 4137kPa (600 psi) non-shock cold water or oil, with full or standard port brass or bronze body, brass chrome plated ball, Teflon seats and packing.
    - .1 Threaded ends - Newman Hattersley Fig. 1969F  
- Toyo 5044A  
- Kitz 58  
- Jenkins Fig. 201J  
- Apollo 77C-100  
- MAS B-3  
- Crane CSC9202  
- Victaulic Series 722
    - .2 Soldered ends - Newman Hattersley Fig. 1999  
- Toyo 5049A  
- Kitz 59  
- Jenkins Fig. 202J  
- Apollo 77C-200  
- MAS B-4  
- Crane CSC9222

Note: Ball valves may be used in lieu of gate valves for pipe sizes of 50mm (2") dia. or less.

- .2 Gas ball valves:

- .1 50mm (2") dia. or less - shall be rated for 1034kPa (150 psi) steam, 4137kPa (600 psi) non-shock cold water or oil, with full or standard port brass or bronze body, brass chrome plated ball, Teflon seats and packing, lever handle, CSA approved (CGA 3.16).
- .1 Threaded - Newman Hattersley Fig. 170M
  - Toyo 5044A
  - Kitz 58
  - MAS B3
- .2 65mm (2-1/2") dia. and over - shall be Class 150, carbon steel body, stainless steel ball and stem, Teflon packing and gaskets, locking lever and/or gear.
  - .1 Flanged - Newman Hattersley Fig. 171M
    - Kitz 150 SCTAM (1 piece)
    - Kitz 150 SCTBZM (2 piece, full port)
- .6 Plug Valves (or approved equivalent)
  - .1 DN80 (3") dia. or less - shall be bronze eccentric plug valve, 1,379kPa (200 psi) non-shock cold water or oil, with memory stop and drip cap, grooved, flanged or screwed ends, as appropriate for piping system.
    - .1 - DeZurik PEC Series
  - .2 DN100 (4") dia. up to DN300 (12") dia. - shall be bronze eccentric plug valve, 1,379kPa (200 psi) non-shock cold water or oil, with handwheel gear, and grooved, flanged or screwed ends, as appropriate for piping system.
    - .1 - DeZurik PEC Series
      - Victaulic Series 377
      - (grooved ends, rated to 1,270 kPa (175 psi))

### 2.3 Valves for medium pressure service

- .1 This section applies to valves used in domestic cold water, and domestic hot water systems up to 1,724 kPa (250 psi) system operating pressure.

- .2 Gate Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 150, all bronze, with solid wedge disc, rising stem.
    - .1 Threaded ends - Newman Hattersley Fig. T607M
      - Toyo 298
      - Kitz 42
      - Crane 431UB
    - .2 Soldered ends - Newman Hattersley Fig. T609M
      - Kitz 43
      - Crane 1334
    - .3 For application where non-rising stem is required.
    - .4 Threaded ends - Newman Hattersley Fig. A40M
      - Toyo 204
      - Kitz 46
      - Crane 437
    - .5 Soldered ends - Newman Hattersley Fig. A41M
      - Kitz 64
      - Crane 1324
  - .2 65mm (2-½") dia. and over - shall be Class 150, cast carbon steel, with bolted bonnet, O.S. & Y., ½ Stellite trim, graphite packing.
    - .1 Flanged ends - Newman Hattersley Fig. C1481
      - Bonney Forge 1-11-RF
      - Kitz 150 SCLS
      - Crane 47XUF
      - Beric 101-RF-AA08-H
- .3 Globe Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 150, all bronze, with rising stem, fitted with PTFE disc.
    - .1 Threaded ends - Newman Hattersley Fig. A50M
      - Toyo 221

- Kitz 09
- Crane 7TF
- .2 Soldered ends - Newman Hattersley Fig. A51M
  - Kitz 10
  - Crane 1310
- .2 65mm (2-½") dia. and over - shall be Class 150, cast carbon steel, with bolted bonnet, O.S. & Y., ½ Stellite trim, graphite packing.
  - .1 Flanged ends - Newman Hattersley Fig. C1881
    - Bonney Forge 1-31-RF
    - Kitz 150 SCJS
    - Crane 143XU
    - Beric 201-RF-AA08-H
- .4 Check Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 150, all bronze, Y pattern swing check.
    - .1 Threaded ends - Newman Hattersley Fig. A60M
      - Toyo 238
      - Kitz 29
      - Crane 137
    - .2 Soldered ends - Newman Hattersley Fig. A61M
      - Kitz 30
      - Crane 1342
    - .3 If lift check valve required.
      - .1 Threaded ends - Newman Hattersley Fig. 42 (horizontal)
        - Newman Hattersley Fig. 49 (vertical)
        - Kitz 36 (vertical)
        - Crane 27TF (horizontal)

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- .2 65mm (2-½") dia. and over - shall be Class 150, cast carbon steel, with bolted cover, ½ Stellite trim, stainless steel inserted flexible graphite gasket. Valve shall be silent check.
    - .1 Flanged ends - Newman Hattersley Fig. C1981
      - Bonney Forge 1-61-RF
      - Kitz 150 SCOS
      - Centreline 800 series
      - Duo Check II lug type
      - Mueller Series 72
      - Beric 301-RF-AAO8-X
    - .2 Grooved ends - Victaulic Series 712 (horizontal) or 716 (vertical)
  - .5 Ball Valves (or approved equivalent)
    - .1 50mm (2") dia. or less - shall be rated for 1034kPa (150 psi) steam, 4137kPa (600 psi) non-shock cold water or oil, full port brass or bronze body, brass chrome plated ball, Teflon seats and packing.
      - .1 Threaded ends - Newman Hattersley Fig. 1969F
        - Toyo 5044A
        - Kitz 58
        - Jenkins Fig. 201J
        - Apollo 77C-100
        - MAS B3
        - Crane CSC9202
        - Victaulic Series 722
      - .2 Soldered ends - Newman Hattersley Fig. 1999
        - Toyo 5049A
        - Kitz 59
        - Jenkins Fig. 202J
        - Apollo 77C-200
        - MAS B4
        - Crane CSC9222



## 2.4 Valves for high pressure service

- .1 This section applies to valves used in domestic cold water, and domestic hot water systems over 1,724 kPa (250 psi) system operating pressure.
- .2 Gate Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 300, all bronze, with solid wedge disc, rising stem.
    - .1 Threaded ends - Kitz 37  
- Toyo 318
  - .2 65mm (2-1/2") dia. and over - shall be Class 300, cast carbon steel, with O.S. & Y., bolted bonnet, 1/2 Stellite trim, graphite packing.
    - .1 Flanged ends - Bonney Forge 3-11-RF  
- Kitz 300 SCLS  
- Beric 103-RF-AA08-H
- .3 Globe Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 300, bronze body, with rising stem.
    - .1 Threaded ends - Kitz 17S (stainless steel disc)  
- Toyo 335 (bronze trim)
  - .2 65mm (2-1/2") dia. and over - shall be Class 300, cast carbon steel, with O.S. & Y., bolted bonnet, 1/2 Stellite trim, graphite packing.
    - .1 Flanged ends - Bonney Forge 3-31-RF  
- Kitz 300 SCJS  
- Beric 203-RF-AA08-H
- .4 Check Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be Class 300, all bronze.
    - .1 Threaded ends -Kitz 19  
- Toyo 360

- .2 65mm (2-½") dia. and over –shall be Class 300, cast carbon steel, with bolted cover, stainless steel inserted flexible graphite gasket.
  - .1 Flanged ends - Bonney Forge 3-61-RF
    - Kitz 300 SCOS
    - Beric 303-RF-AA08-X
- .5 Ball Valves (or approved equivalent)
  - .1 50mm (2") dia. or less - shall be rated for 1034kPa (150 psi) steam, 4137kPa (600 psi) non-shock cold water or oil, full port brass or bronze body, brass chrome plated ball, Teflon seats and packing.
    - .1 Threaded ends - Newman Hattersley Fig. 1969F
      - Toyo 5044A
      - Kitz 58
      - Jenkins Fig. 201J
      - Apollo 77C-100
      - MAS B3
      - Crane CSC9202
      - Victaulic Series 722
    - .2 Soldered ends - Newman Hattersley Fig. 1999
      - Toyo 5049A
      - Kitz 59
      - Jenkins Fig. 202J
      - Apollo 77C-200
      - MAS B4
      - Crane CSC9222

### 3 Execution

#### 3.1 General

- .1 Valves shall be the same size as the line in which installed.
- .2 Valves shall be located in such a manner that the top works, operators, and bonnets may be easily removed.

- .3 Seats and seals used in potable water systems shall be ANSI classified in accordance with NSF-61.
- .4 Stems of valves shall be positioned for maximum ease in use, but in no event in a manner causing a hazard, nor with stem down unless specifically shown as such.
- .5 Provide valves where shown on the Drawings, or on schematic diagrams, or in details, or as specified.
- .6 Provide drain valves at all low points. Drain valves shall be ball or gate valves, complete with cap and chain.

### **3.2 Gate valves**

- .1 Provide gate valves:
  - .1 Where indicated on Drawings and in the Specification.
  - .2 On all branch lines.
  - .3 As isolation of each floor for all services.
  - .4 At the base of all risers.

### **3.3 Globe or eccentric plug valves**

- .1 Provide globe and/or eccentric plug valves:
  - .1 Where indicated on Drawings and in the Specification.
  - .2 On all bypass systems.
  - .3 Where required for throttling control.

### **3.4 Check valves**

- .1 Provide check valves:
  - .1 Where indicated on Drawings and in the Specification.
  - .2 On the discharge of all pumps.

- .3 On the discharge of multiple equipment.

### **3.5 Ball valves**

- .1 Install ball valves in the following locations:
  - .1 Where indicated on Drawings and in the Specification.
  - .2 At each single plumbing fixture.
  - .3 At each single item of equipment.
- .2 For pipe sizes DN50 (2") and smaller, ball valves may be substituted for gate and globe valves.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Provide Shop Drawings for:
  - .1 Hangers and supports

## **2 Products**

### **2.1 Pipe attachments**

- .1 For pipe attachments, review Section 22 07 00 – Plumbing Insulation, of these Specifications. Otherwise, adhere to the following:
  - .1 For uninsulated steel pipes, use Taylor Fig. 22Z, or approved equivalent, adjustable clevis up to and including 100mm (4") pipe size, and Taylor Fig. 24 adjustable clevis for sizes 125mm (5") and larger.
  - .2 For uninsulated copper pipes, use Taylor Fig. 56, or approved equivalent, autophoretic coated clevis hanger up to and including 100mm (4") pipe size.
  - .3 For uninsulated copper tubing, use Taylor Fig. 43, or approved equivalent, autophoretic coated swivel ring hanger up to and including 25mm (1") pipe size.
  - .4 For insulated pipes where the insulation is around the hanger and continuous vapour barrier is not required, use the same hangers as for uninsulated pipes.
  - .5 For insulated pipes where hanger is around insulation, provide galvanized sheet metal insulation shield minimum 250mm (10")

long, 1.3mm (18 gauge), between covering and Taylor Fig. 22Z or Fig. 24 clevis, or Taylor Fig. 24L extended clevis, or approved equivalent, sized to include insulation.

## **2.2 Upper attachments**

- .1 Provide upper attachments as follows:
  - .1 Standard beam clamp for normal service, Taylor Fig. 425, or approved equivalent.
  - .2 Top beam clamp (NFPA approved), Taylor Fig. 408, or approved equivalent.
  - .3 C clamp with locknut, Taylor Fig. 301, or approved equivalent.
  - .4 Side beam bracket for light duty side mounting, Taylor Fig. 202, or approved equivalent.

## **2.3 Pipe support**

- .1 For vertical adjustment of hanger rods, provide Taylor Fig. 68 forged steel turnbuckle, or approved equivalent.
- .2 Where trapeze hanger is used for a group of pipes, use Taylor Fig. 12 U bolts, or approved equivalent, except where roller type hanger is indicated on the Drawings or in the Specifications.
- .3 For roller type hangers on both hot and cold pipes, provide Taylor Fig. 70 to 75 protection saddles, or approved equivalent, to suit covering thickness. Use Taylor Fig. 93 adjustable roller hanger, or approved equivalent, for pipe sizes up to and including 150mm (6") over insulation. For pipes 200mm (8") and larger over insulation, use Taylor Fig. 95 adjustable 2-rod roller hanger, or approved equivalent,. On trapeze hangers and where pipe is supported from below, use Taylor Fig. 280S adjustable pipe roller stand, or approved equivalent,.
- .4 For vertical pipe support, provide Taylor Fig. 82Z, or approved equivalent, zinc plated steel riser clamp for steel pipe, and Taylor Fig. 86, or approved equivalent, autophoretic coated steel riser clamp for copper pipe.

- .5 For guides on vertical pipes, use manufactured pipe alignment guides (e.g. Flexonics). For horizontal pipes, use Taylor Fig. 255 pipe alignment guide, or approved equivalent. Field fabricated guides with rolled T-section welded to the pipe and guiding shoe, are also acceptable.

### **3 Execution**

#### **3.1 General**

- .1 Provide supports required for the erection and support of the Plumbing Work. Construct supports of steel, masonry or concrete, as noted or required. Ensure that steel supports in contact with water or high humidity are galvanized members bolted together using cadmium plated bolts, all others primed steel.
- .2 Ensure that housekeeping pads or concrete bases are provided for floor mounted equipment. Make the minimum size 100mm (4") high for bases or pads, keyed to the floor slab, extending at least 100mm (4") all around the equipment, with 19mm ( $\frac{3}{4}$ ) chamfered edges. Where concrete is provided by Division 03 – Concrete, provide all anchor bolts and setting templates to Division 03 – Concrete.
- .3 Support suspended equipment from the bottom. Support tanks and other equipment with cast or welded steel saddles having proper curvature and inherent beam strength. Read Division 05 – Metals, for further information.
- .4 Provide supports and suspended bases having ample strength to safely carry the load under all operating conditions and during testing. Submit support and base details to the Consultant for review. Design supports except springs with a minimum factor of safety of five (5) based on ultimate tensile strength at operating temperature.
- .5 Ensure that the load onto structures does not exceed the maximum loading as shown on structural drawings or as directed by the Consultant.
- .6 Take special care in locating hangers and supports to avoid introduction of undue reaction forces onto the structure of the building, to flanges of pumps and equipment, to expansion joints and to the pipe.

- .7 Install all piping supported from hangers or supports in a manner to ensure that building construction is not weakened or over-stressed, that pipes are secure, vibration free, free to expand and contract and properly graded, and that vertical adjustment of horizontal piping is possible after erection.

### 3.2 Hangers

- .1 For structure attachments, adhere to the following:
  - .1 Support hangers directly from the structure only. Do not support pipes or equipment from other pipes, ducts, equipment, suspended ceiling, etc.
  - .2 Suspend hanger rods generally from certified inserts in concrete or by beam clamps. Before welding to steel structure members obtain prior permission of welding method from the Consultant and ensure that loads do not exceed the limit set by the Consultant. Ensure that hanging from floors and roofs made from pre-cast concrete members is from inserts originally cast into the members and provided by this contractor, or by rods passing between the members connected to a steel plate resting on the upper surface.
- .2 Sliding guides must have sliding surfaces cleaned of all dirt, paint or corrosion and, except for Teflon, have coating of graphite paste added during erection. Adjust guides to allow for free sliding at operating conditions. After assembly, provide these guides with temporary protective cover or wrapping added to keep them free of debris during extent of construction work. When piping is ready to be put into service, remove this protective covering, blow out guides clean of all debris and add paste where applicable. Care must be taken that ample clearance is provided so as not to obstruct free sliding of guide.
- .3 Install copper, brass, and stainless steel pipes with 3mm ( $1/8$ " ) thickness of di-electric packing between the pipe and the pipe attachment or use Taylor plastic coated pipe attachments.
- .4 Install guides on pipes with expansion movement next to expansion joints. Consult expansion joint manufacturer's recommendations and follow his



instructions for number and spacing of guides. Use a minimum of two guides on each side of expansion joints.

- .5 Set hanger rods on steel and copper lines with expansion movement out of plumb in ambient temperature position, a distance equal to one-half pipe movement calculated from anchor point. Base movement on 25mm (1") expansion per 30m (100 ft) of pipe length and 37°C (67°F) temperature difference. Use toggle type insert of beam clamp for such locations.
- .6 Use roller type hanger only where shown on the drawings.
- .7 Install all hangers close to points where pipes change direction or where branch piping drops or rises from main.
- .8 Install vertical riser suitably anchored and guided with manufactured or fabricated guides to maintain accurate vertical position. Protect insulated pipes with 2.2mm (12 gauge) galvanized steel jacket at guides. Guide pipes with expansion movement and definite anchor points up to and including 100mm (4") sizes, at every floor or 3m (10 ft). Guide larger pipes and vertical cast iron pipes at every second floor or 7.5m (25 ft).
- .9 For horizontal cast iron, glass, or polypropylene pipes where packed or friction type mechanical joints are used, provide a support at every joint in straight runs with maximum 1.5m (5 ft) between supports. Where fittings are joined together (elbows, wyes, etc.) provide a separate support for a minimum of every second fitting.
- .10 For horizontal cast iron, pipes where screwed or bolted type joints are used, the spacing or supports may be increased not to exceed 2.4m (8 ft) between supports, but provide a support for every joint and every second fitting as described above.
- .11 Use lockwasher with single nut on all bolted connections for pipe supports, anchors, guides and support steel, or use double nuts.
- .12 During hydrostatic test on all piping supported by springs or counterweights, install temporary rigid supports, blocking, etc., or lock the

spring against movement to prevent excessive strain on piping or equipment.

- .13 Use spring hangers where vertical movement of the horizontal pipes may occur due to expansion or contraction. Refer to Section 22 05 47 – Vibration Isolation, for further information.
- .14 For rod hangers use round steel threaded rod supports on horizontal pipes, spaced at the following maximum intervals and having the minimum diameter as directed.

.1 For Steel Pipes:

Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN15 (½)	1,524 (5)	9 (¾)	9 (¾)
DN20 (¾)	1,829 (6)	9 (¾)	9 (¾)
DN25 (1)	2,134 (7)	9 (¾)	9 (¾)
DN32 (1-¼)	2,438 (8)	9 (¾)	9 (¾)
DN40 (1-½)	2,743 (9)	9 (¾)	9 (¾)
DN50 (2)	3,048 (10)	9 (¾)	9 (¾)
DN65 (2-½)	3,048 (10)	13 (½)	9 (¾)
DN80 (3)	3,658 (12)	13 (½)	9 (¾)
DN100 (4)	4,268 (14)	16 (⅝)	13 (½)
DN125 (5)	4,877 (16)	16 (⅝)	13 (½)
DN150 (6)	5,182 (17)	19 (¾)	16 (⅝)
DN200 (8)	5,791 (19)	22 (⅞)	19 (¾)
DN250 (10)	6,706 (22)	22 (⅞)	19 (¾)
DN300 (12)	7,010 (23)	22 (⅞)	19 (¾)
DN375 (15) and over	max. 7,620 (25)	to suit weight	to suit weight

.2 For Copper or Stainless Steel Tubing:

Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN15 (½)	1,524 (5)	9 (¾)	9 (¾)
DN20 (¾)	1,829 (6)	9 (¾)	9 (¾)
DN25 (1)	1,829 (6)	9 (¾)	9 (¾)
DN32 (1-¼)	2,134 (7)	9 (¾)	9 (¾)
DN40 (1-½)	2,438 (8)	9 (¾)	9 (¾)
DN50 (2)	2,743 (9)	9 (¾)	9 (¾)
DN65 (2-½)	3,048 (10)	13 (½)	9 (¾)
DN80 (3)	3,048 (10)	13 (½)	9 (¾)
DN100 (4)	3,658 (12)	16 (⅝)	13 (½)

- .15 Do not use pipe hooks, chains, or perforated straps.
- .16 Use angle or channel iron welded frames for trapeze hangers.
- .17 For all drain pipe installed under structural slab on disturbed soil (up fill), suspend piping via galvanized clevis hangers embedded in structural slab. Hanger spacing shall be per pipe manufacturer recommendations, with minimum of two (2) hangers per pipe length.

### 3.3 Anchors

- .1 Design pipe anchors to restrain the movement of pipes in all directions.
- .2 Take special care in locating anchors to avoid introduction of undue reaction forces into the structure of the building, to flanges of pumps and equipment, to expansion joints and to the pipe.
- .3 Fabricate anchors and guides of structural steel channels, angles or plates secured to building structure. Size cylindrical type guides for full pipe insulation.
- .4 Submit for review by Consultant prior to installation, a detailed design prepared in conjunction with the expansion joint manufacturer for anchors,

guides, and their proposed connection to the structure, including reaction forces and loads imposed on structure. All drawings must be signed by a Professional Engineer registered in the Province of Ontario. Do not proceed with installation until after receipt of reviewed drawings.

### **3.4 Equipment support**

- .1 Place all suspended equipment on welded steel bases of up to 150mm (6") profile steel, stiffened with 3mm (1/8") checkered steel plate. Coordinate with Division 05 – Metals.
- .2 Place floor plates on 100mm (4") concrete housekeeping pads. Ensure that the load on the structure does not exceed 488 kg per square meter (100 lbs. per square feet) projected floor area within the perimeter of the supports.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 All necessary vibration isolation elements for piping and equipment, and vibration isolation bases for equipment to prevent noise levels from exceeding the room criteria listed in Table 34, Chapter 47 of the ASHRAE 2003 HVAC Applications Handbook.
  - .2 Manufacturer of vibration isolation equipment shall have the following responsibilities:
    - .1 Determine vibration isolation sizes and locations.
    - .2 Provide piping and equipment isolation systems as scheduled or specified.
    - .3 Guarantee specified isolation system deflection.
    - .4 Provide installation instructions, drawings, and field supervision to assure proper installation and performance.
  - .3 In addition to the Work covered under this Section, comply with description of individual systems and general requirements under other Sections of the Specifications.

### **1.3 Submittals**

- .1 The Contractor shall supply to the vibration control manufacturer approved drawings of all equipment to be isolated.

- .2 The vibration control manufacturer shall supply shop drawings of all vibration control components to be used on the project.
- .3 As a minimum provide the following information:
  - .1 Catalogue cuts and data sheets on specific vibration isolators to be utilized showing compliance with the specifications.
  - .2 An itemized list showing the items of equipment or piping to be isolated, the isolator type of model number selected, isolator loading and deflection, and reference to specific drawings showing base and construction where applicable.
  - .3 Written approval of the base design to be used, obtained from the equipment manufacturer.
  - .4 Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.
  - .5 Drawings showing equipment base constructions for each machine, including dimensions, structural member sizes, and support point locations.
  - .6 Drawings showing methods of suspension, support guides for piping.
  - .7 Drawings showing methods for isolation of pipes piercing walls and slabs.
  - .8 Concrete and steel details for base including anchor bolt locations.
- .4 Submit letter from manufacturer certifying that vibration isolation equipment have been installed in accordance with his recommendations and the Contract Documents, and that it operates to his satisfaction.

#### **1.4 Quality assurance**

- .1 It is the objective of this Specification to provide the necessary design for the control of excessive noise and vibration in the Building due to the operation of machinery or equipment, and/or due to interconnected piping

or conduit. The installation of all vibration isolation units, and associated hangers and bases, shall be under the direct supervision of the vibration isolation manufacturer's representative.

- .2 All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
- .3 All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.
- .4 The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than "10%.
- .5 All neoprene mountings shall have a Shore hardness of 30 to 60 "5, after minimum aging of 20 days or corresponding oven-aging.
- .6 All grooved joint couplings and specialties shall be the products of a single manufacturer.

## **2 Products**

### **2.1 General**

- .1 All vibration isolation devices shall be the product of a single manufacturer.

### **2.2 Type B Spring isolators**

- .1 Isolators shall be same as Type A, except:
  - .1 Provide built-in resilient vertical limit stops.
  - .2 Provide tapped holes in top plate for bolting to equipment.

.3 Isolators shall be capable of supporting equipment at a fixed elevation during equipment erection.

.2 Type B spring isolators to be Mason Type SLR, or approved equivalent.

### 2.3 Type H Combination spring/elastomer hanger rod isolators

.1 Isolators shall incorporate the following:

.1 Spring and neoprene isolator elements in a steel box retainer.

.2 Characteristics of spring and neoprene as described in Type C and Type D hanger isolators.

.2 Type H isolator to be Mason Type 30N, or approved equivalent.

### 2.4 Mounting types and static deflection schedule

Equipment Types	Base Type	Isolator Type	Static Deflection mm (in.)
Floor Supported	-	B	25mm (1")
Suspended	-	H	32mm (1-1/4")

.1 Notes:

.1 (1) Base as recommended and/or provided by manufacturer.

.2 (2) Same as connected pump.

.3 (3) Spring isolator complying with Type A.

## 3 Execution

### 3.1 General

.1 Have all materials and systems for vibration isolation designed and supplied by one company, referred to in this Article as the 'manufacturer'. Install in accordance with manufacturer's written instructions. Vibration isolators must not cause any change or position of equipment or piping resulting in piping stresses or misalignment.



- .2 Provide through the manufacturer all vibration isolation equipment work and measures to prevent the transmission of objectionable vibration to the building structure and from one area to another area. Provide all necessary drawings indicating isolator locations and base dimensions. Have the installation directed and supervised by the manufacturer. Supply to the manufacturer the necessary copies of all drawings of equipment to be isolated.
- .3 Consider the areas classified as follows for selection of vibration control devices:
  - .1 Mechanical rooms or equipment locations in basement or sub-basement areas only and not bordering areas regularly occupied are 'non-critical'.
  - .2 Mechanical rooms or equipment locations bordering habitable suites, boardrooms, conference rooms, and private offices are 'ultra-critical'. This shall include all mechanical penthouses and all mechanical compartment rooms.
- .4 All piping DN40 (1-½") and over located in mechanical equipment rooms, and for a minimum of 12.2m (40 ft) or 100 x pipe diameters, whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of noise and vibration isolation hangers, Type H with 32mm (1-¼") static deflection.
- .5 All piping to be isolated shall freely pass through walls and floors without rigid connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping, and maintain 20mm (¾") to 32mm (1-¼") clearance around the outside surfaces. This clearance space shall be tightly packed with fiberglass, and caulked airtight after installation of piping.
- .6 No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified.
- .7 Electrical conduit connections to isolated equipment shall be flexible to allow free motion of isolated equipment.

- .8 Do not install any equipment, piping, or conduit, which makes rigid contact with the building unless permitted in this Specification. Building includes, but is not limited to, slabs, beams, columns, studs, and walls.
- .9 Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.
- .10 Bring to the Consultant's attention prior to installation any conflicts with other trades, which will result in unavoidable rigid contact with equipment or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- .11 Obtain inspection and approval of any installation to be covered or enclosed, prior to such closure.
- .12 Thrust restraints shall consist of Mason Type WB or approved equal with the same deflection as specified for the spring mountings. The spring element shall be designed so it can be preset for thrust and adjusted to allow for a maximum of 6mm (¼") movement at start, stop, and normal operation.
- .13 Diagonal restraints shall be attached at the centerline of thrust, and shall be Mason Type WB, or as approved.
- .14 Vertical piping loads, including water strainers, valves between pump base elbow supports and the suction and discharge header piping, shall be supported by the pump base spring isolators without stress or strain to the pump housing.
- .15 Correct, at no additional cost, all installations, which are deemed defective in workmanship or materials.

### **3.2 Piping isolators**

- .1 All piping isolators are included under this Section.
- .2 Isolate piping outside the shafts as follows:

- .1 All water piping in machine rooms, including strainers, filters, valves and associated equipment with water systems.
- .2 Piping and associated equipment where exposed on roof.
- .3 Water piping within 12.2m (40 ft) or 100 x pipe diameters, whichever is greater, from connected rotating equipment.
- .3 The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, the main structural elements of the building.
- .4 The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.
- .5 Hanger rods shall be aligned to clear the hanger box.
- .6 Horizontal suspended pipe DN50 (2") and smaller and all steam piping shall be suspended by Type E isolator with a minimum 6mm (¼") deflection. Water pipe larger than DN50 (2") shall be supported by Type H isolator with a minimum 32mm (1-½") static deflection.
- .7 Horizontal pipe floor supported at slab shall be supported via Type A or B, with a minimum static deflection of 25mm (1") or same deflection as isolated equipment to which pipe connects whichever is the greater.
- .8 Vertical riser pipe supports shall utilize Type H hanger or similar spring and neoprene detail.
- .9 Pipe guides, where required, shall utilize resilient pipe guides, Mason Type ADA or equivalent, to avoid direct contact of piping with building.
- .10 Pipe sway braces, where required, shall utilize two (2) neoprene elements (type D to accommodate tension and compression forces).
- .11 Pipe extension and alignment connectors: Provide connector at riser takeoffs, cooling and heating coils, and elsewhere as required to accommodate thermal expansion and misalignment.

### 3.3 Isolator position

- .1 Close to building structure.

- .2 Between building structure and supplementary steel if required.
- .3 Suspend isolators from rigid and massive support points.
- .4 Supplementary steel to be sized for a maximum deflection of 1.6mm ( $1/16$ "") at center span.
- .5 Support piping in shafts and floor supports entering shaft with Type B isolators or Type H hangers depending on piping loads and support point space conditions within shafts.
- .6 Guide piping in shafts as required with approved mounting designs incorporating Mason Type ADA mountings to building. Prevent direct contact of piping with building structure.

### **3.4 Manufacturers review**

- .1 On completion of installation of all vibration isolation devices herein specified, the noise control manufacturer shall inspect the completed system; check the vibration levels in the areas as requested by the Consultant, and report in writing any installation error, improperly selected isolation devices, or other faults in the system that could affect the performance of the system. A written report shall be submitted outlining corrective work necessary to comply with the above specifications. Corrective work shall be the responsibility of the Division 22 – Plumbing Contractor.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Products**

- .1 Not Used

## **2 Execution**

### **2.1 Pipe systems**

- .1 After finished painting is complete, identify each pipe with stencils and stencil paint. Alternatively, use SMS Coil-Mark or adhesive style building service pipe markers.
- .2 Use capital letters minimum 51mm (2") high for DN80 (3") diameter piping or larger, including insulation, and 19mm ( $\frac{3}{4}$ ") size capital letters on smaller diameters.
- .3 Use flow arrows to indicate direction of flow. Use double arrow where flow is reversible. Arrow shall be solid black or white; minimum 152mm (6") long by 51mm (2") wide for DN80 (3") diameter piping or larger, including insulation, and 102mm (4") long by 19mm ( $\frac{3}{4}$ ") wide on smaller diameters.
- .4 Locate identification and flow arrows as follows:
  - .1 Behind each access door.
  - .2 At each change of direction and take-off.
  - .3 Not more than 12.2m (40 ft) apart on all pipes exposed and/or located behind accessible ceiling.
  - .4 On both sides of sleeves.
  - .5 Adjacent to valves.

- .6 Above each floor or platform for vertical exposed pipes approximately 1,524mm (5 ft.) above floor.
- .5 Stenciling to be performed in a neat, quality manner. Upon completion of project, provide one complete set of stencils used for Owner.
- .6 Use wording shown on Legend on Drawings or as instructed by the Consultant. Special system designations and abbreviations shall be submitted to Consultant for approval prior to use.
- .7 Colour coding to be as per the following schedule. For all other services, provide colour coding in conformance with CAN/CGSB-24.3 and ANSI A131.

**MARKER LEGEND****CLASSIFICATION  
COLOUR**

<b>Description and Service</b>	<b>Primary</b>	<b>Secondary</b>
Cold Water	Green	
Domestic Hot Water	Green	
Domestic Hot Water Recirculation	Green	
Waste Water	Green	
Plumbing Vent	Green	

- .8 Use primary colours for full length of piping or in minimum 914mm (36") long sections; use minimum 457mm (18") long sections on each side of valves. Use secondary colours in min. 51mm (2") wide bands.
- .9 Install pipe identification in accordance with the manufacturer's recommendations.

**2.2 Valves**

- .1 Supply and attach to each valve (except fixture stops) a lamacoid tag 32mm (1-1/4") in diameter or 38mm (1-1/2") square, similar to SMS RP/SP-1500 series. The system code to be 5mm (3/16") high characters on the top line, valve numbers to be 9mm (3/8") high on the bottom line. Tags to

be colour coded in conformance with piping system colours as per CAN/CGSB-24.3.

- .2 Attach tag to valve with a brass chain.
- .3 Schedule the valve numbers using a sequential numbering system.
- .4 Prepare and submit valve directories and charts giving number, size, location, purpose, and normal position (opened or closed) for each valve.
- .5 Provide two (2) framed copies of the valve charts and locate where directed by the Consultant.
- .6 All control, drain, and test connection valves shall be provided with signs indicating their purpose.

### **2.3 Equipment**

- .1 Identify all pumps, controls, starters, switches, pushbuttons, and all other equipment as to service by a white lamacoid engraved nameplate on black background. Submit sample plates and lettering to the Consultant. Attach plates only after all painting work is completed. Use mechanical fastening devices acceptable to the Consultant.
- .2 Manufacturer's nameplates shall be affixed to all equipment, serial number and all information usually provided, including voltage, cycle, phase, motor power, etc., name of the manufacturer and his address. All stamped etched or engraved lettering on plates shall be perfectly legible. Do not paint over nameplates and, where apparatus is to be concealed, attach the nameplates in an approved location on the equipment support or frame.
- .3 Identify all equipment with the corresponding remote controls.
- .4 Equipment plates shall have 9mm ( $3/8$ " ) capital letters; starter plates shall have 3mm ( $1/8$ " ) capital letters. All plates shall be sized to accommodate required description. Locate plates conspicuously and secure with self-tapping sheet metal screws where possible, or with double-sided adhesive tape. Recognizable abbreviations will be acceptable, other proposed abbreviations to be approved by Consultant.

**End of section**



## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Submit shop drawings for the following equipment:
  - .1 Cleanouts

## **2 Products**

### **2.1 Cleanouts and cleanout access covers**

- .1 Provide cleanouts where shown on plans on all drainage and waste systems and as required by the Local Plumbing Code, including the following:
  - .1 Where there is a change of direction of 45 degrees or more.
  - .2 Not more than 15m (50'-0") apart on straight runs for DN100 (4") and less; 30m (100'-0") for DN150 (6") and greater.
  - .3 At the base of every stack and rainwater leader.
  - .4 Where drains leave the building.
  - .5 On footing drains where shown on the drawings.
- .2 Bring cleanouts below floor up to finished floor with a 'Y' and 1/8th bend. Locate all cleanouts for easy access and in areas of least traffic, as directed by Consultant.
- .3 Make cleanouts full size of drain up to and including 100mm (4") drains. For drains larger than 100mm (4"), use 100mm (4") cleanouts.

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- .4 Cleanouts in floor – cast iron body, removable positive gasket seal closure, 150mm (6") adjustable round cover. J.R.Smith Series 4000; Zurn ZN1400 Series; Mifab C1100-R Series, Watts CO-200 Series.
    - .1 Finished areas with nickel bronze top. J.R.Smith 4020; Zurn ZN1400-NH; Mifab C1100-R-1, Watts CO-200-R-1.
    - .2 Tiled areas with nickel bronze top. J.R.Smith 4140; Zurn ZN1400-NH-X; Mifab C1100-T-1, Watts CO-200-T-1.
    - .3 Concrete areas with extra heavy cast iron top. J.R.Smith 4220; Zurn Z1400-NH; Mifab C1100-XR-4, Watts CO-200-RX-4.
  - .5 Cleanouts in walls.
    - .1 Face-of-wall access cover for openings in tile, masonry and plaster walls with round C.P. bronze frame and secured cover. J.R.Smith 4720, Watts CO-300 Series.
    - .2 Flush-with-wall access cover for plaster and wet wall constructions with round C.P. bronze frame and secured cover. J.R.Smith 4725; Zurn Z1463; Mifab C1440-R6, Watts CO-300 Series.
    - .3 Access doors in tile, masonry and plaster walls, and in acoustic tile: refer to Section 15050 – Basic Materials and Methods.
    - .4 Urinal cleanout – wall access cleanout with bronze plug, S.S. bolt and wingnut, and 100mm (4") polished S.S. secured cover. J.R.Smith SQ4-1819; Zurn Z1666-1; Mifab C1440-RD-3, Watts CO-440-RD.
  - .6 Cleanouts at the base of each stack and rainwater leader – cast iron cleanout tee and countersunk iron plug with gasket seal, less cover. J.R.Smith 4510; Zurn Z1445-HBXSP; Mifab C1460, Watts CO-460.
  - .7 Cleanouts for concealed cast iron stacks – cast iron cleanout tee and countersunk iron plug with gasket seal, S.S. round cover and screw. J.R.Smith 4530; Zurn Z1446-HBXSP; Mifab C1460-RD-3, Watts CO-460-RD.

- .8 Cleanouts for exposed and concealed copper stacks to be by pipe manufacturer.

### **3 Execution**

#### **3.1 Cleanouts and cleanout access covers**

- .1 Cleanouts on drains outside building shall be brought up to grade with a DN100 (4") 'Y' and 1/8th bend in medium weight soil pipe with solid brass recess plug-in top. Provide necessary support for soil pipe and set cleanout flush with grade in a 300mm by 300mm by 150mm (12" x 12" x 6") concrete pad.
- .2 In all areas with seamless flooring and plastic terrazzo finishes provide special flanges. These flanges shall be 100mm (4") larger in diameter than the drain or cleanout top of sleeve diameter, and located approximately 5mm ( $3/16$ ") below the top flanges to be of the same material as the drain or cleanout finish.
- .3 Provide special flanges for cleanouts as described above:

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 General requirements**

- .1 Test, balance and adjust all systems to the Drawings and Specifications, in accordance with the intent and requirements of the ASHRAE Guide - Testing, Adjusting and Balancing (Chapter 37, 2003 ASHRAE Application Handbook).

### **1.3 Qualification**

- .1 The Testing, Balancing and Adjusting (TAB) Contractor must be a member in good standing with the National Environmental Balancing Bureau (NEBB) or the Associated Air Balance Council.

### **1.4 Scope of work**

- .1 The TAB Contractor shall:
  - .1 Within fourteen (14) days after award of contract, submit proof of certification for AABC or NEBB.
  - .2 Within thirty (30) days after award of contract, submit a report to the consultant summarizing the TAB Contractor's comments and recommendations regarding their review of the contract documents. Meet with the Contractor, Owner and Consultant as necessary to discuss.
  - .3 Within thirty (30) days after contract award, submit an outline of proposed TAB procedures, or alternatively, provide a copy of the latest edition of AABC or NEBB Procedural Standards.
  - .4 Conduct ongoing reviews of all related construction documentation, including co-ordination drawings and shop drawings.

- .5 Visit the site a minimum of once per month during construction, commencing when the pipe installation starts. Submit a written report to the Consultant, including date of visit, areas observed, and any anticipated problems, which could adversely affect the TAB work.
- .6 Prior to commencing the TAB work, the TAB Contractor shall submit the list of instruments he will use on the project, together with a record of calibration dates and procedures.
- .7 Perform all prebalancing work as specified in respective procedures.
- .8 Furnish all TAB labour, instruments and services necessary to complete the TAB work for water systems to achieve the required water flow rates. Adjust and set all pumps, balancing valves and other flow devices to achieve optimum water distribution in all parts of the water systems.
- .9 Document any deficiencies that prevent the system from being properly balanced and advise Division 22 – Plumbing Contractor. Rebalance all affected systems following correction by the Division 22 – Plumbing Contractor at no additional cost to the Owner.
- .10 Record the existing capacities of all existing pumps, remaining as part of the renovated work, before demolition occurs. Provide a separate report to the Consultant summarizing all measurements.
- .11 Balance all existing water systems altered under this project in accordance with values on the drawings and/or predemolition measurements made by the TAB Contractor.
- .12 Report on any noise and vibration problems that are discovered during the course of balancing.
- .13 Submit a Balancing Report to the Consultant.
- .14 Repeat the balancing procedures for up to 10% of the system at the request of the Consultant. Should the retest data differ by more than  $\pm 5\%$  from the originally reported values, the TAB Contractor

shall be obligated to repeat the balancing of the entire system or systems at no additional cost to the Owner, if so requested by the Consultant.

- .15 Include for premium time where schedule requires that TAB work be undertaken after hours.

## 1.5 Co-ordination

- .1 The Division 22 – Plumbing Contractor shall be responsible to ensure that all systems are complete and ready for testing, balancing and adjusting by the TAB Contractor. The Division 22 – Plumbing Contractor shall:
  - .1 Confirm the complete operational readiness of the building.
  - .2 Allow access to all components requiring testing, balancing, and servicing. This includes permanently installed ladders and catwalks.
  - .3 Maintain a construction schedule that allows the test and balance (TAB) firm to complete contract work prior to occupancy.
  - .4 Verify the installation conformity to the design drawings and specifications.
  - .5 Promptly correct deficiencies of materials and work that may delay completion of the TAB work.
  - .6 Provide operation and maintenance manuals. Manuals must include the following:
    - .1 The manufacturers' method for adjusting and setting components for correct operation under actual load conditions.
    - .2 The manufacturers' recommended tolerance for maximum and minimum operating conditions.
    - .3 The recommended correction or  $A_k$  factors, to allow adjustment of flow, rpm, etc.

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- .4 A list of spare parts, identification numbers, and diagrams of their proper locations.
  - .5 Pressure drops for hydronic flows through the component or unit at design flow rate.
  - .7 Start up all plumbing systems, according to the following conditions:
    - .1 Proper lubrication of rotating parts is verified.
    - .2 Motors have the correct rotation.
    - .3 Vibration isolators and bases are properly installed and are the correct type.
    - .4 Verification that motors, starters, and variable speed controllers with overload safety devices are the correct size and are operating properly.
    - .5 Verification that automatic controls are installed correctly and include all components specified, including interlocks, control valves, actuators, and sensors.
    - .6 Verification that pumps and related components are properly installed and operate correctly.
    - .7 Verification that strainers are clean and that the system is vented and free of air.
    - .8 Verification that heat exchangers are piped correctly and are clean.
    - .9 The motor, amps, volts, and rpm, are compared with nameplate data and are adjusted within a motor-rated hp or amperes.
    - .10 Verification that pump power and speed are within design range.
    - .11 Verification that the controls are complete and operational.
  - .2 During testing and balancing; the Division 22 – Plumbing Contractor shall:

- .1 Operate and maintain all systems requiring balancing during the balancing period.
  - .2 Ensure that the control system responds to the testing and balancing requirements. Provide all necessary personnel, equipment and software to make adjustments to controls as required to achieve design condition.
  - .3 Furnish and install motors as required to accomplish design requirements.
  - .4 Provide all equipment, labour, instruments and incidentals and pay for all power and fuel to carry out the tests.
- .3 Start-Up Report:
- .1 The Contractor shall provide a copy of a detailed start-up report, including initial tabulated data required for the start-up of systems, to the test and balance agency for reference in the balancing work.
- .4 Joint effort of Contractors:
- .1 Upon completion of balancing, the TAB Agency shall provide flows, pressures, and temperatures to the control contractor for final calibration of the automatic control system. The Control Contractor shall provide access to computerized data and equipment and/or provide operating personnel.

## **2 Products**

- .1 Not Used

## **3 Execution**

### **3.1 General**

- .1 TAB work shall be undertaken in accordance with the following descriptions. Procedures not specifically described herein or requiring amplification shall be in accordance with AABC or NEBB standards, as applicable.



### 3.2 Water system balancing

- .1 Water flows shall be balanced by venturi and calibrated orifices with portable type flow meters, where provided by the Division 22 – Plumbing Contractor, or calibrated meters provided by the TAB Contractor.
- .2 Pump flow capacities shall be determined by venturies, orifices, or multi-duty valves. All settings of balancing valves shall be permanently marked after balance is complete.
- .3 The TAB Contractor shall compare design documents with the shop drawings. If discrepancies are found, TAB Contractor shall submit a request for information to resolve the discrepancies.
- .4 Pump Test and Data.
  - .1 Tabulate tests and data: (Confirm in field)
    - .1 Pump number and service.
    - .2 Location.
    - .3 Area served and type of system served.
    - .4 Manufacturer, model, serial number of pump.
    - .5 Motor nameplate power (watts), amperage, voltage, phase, Hertz, frame type and service factor.
    - .6 Pump and motor rpm.
    - .7 Pump suction and discharge pressure at operating conditions.
    - .8 System flow.
  - .2 Tabulate from field tests:
    - .1 Pump and motor rpm.
    - .2 Motor amperage for each phase.
    - .3 Voltage for each phase.

- .3 Tabulate from pump field test:
  - .1 Total flow.
  - .2 Discharge and suction pressure for operating and shut off conditions.
  
- .5 Heat Transfer Equipment Tests and Data
  - .1 Tabulate design conditions from documents and installed conditions from shop drawings.
    - .1 Identification, location and service.
    - .2 Transferred heat (kW).
    - .3 Manufacturer.
    - .4 Model and serial number.
    - .5 Pipe size (mm).
    - .6 Design pressure differential (kPa / psi) and flow rates (L/s / USgpm).
    - .7 Design leaving and entering conditions.
  - .2 Tabulate from field tests:
    - .1 Pressure differential (kPa / psi).
    - .2 Total flow (L/s / USgpm).
    - .3 Entering and leaving temperature and conditions.

### 3.3 Demonstration

- .1 At the request of the Consultant, the Balancing Contractor shall repeat the balancing procedure for any system or portion of a system. The Balancing Contractor shall repeat the balancing procedure on 10% (as selected by the Consultant) of systems. If the data is within  $\pm 5\%$  of the reported data, the system shall be considered acceptable and the report accepted. If the

data is not within  $\pm 5\%$  of the reported data, the Consultant can request that the entire system or systems be rebalanced.

### 3.4 Reports

- .1 Submit written reports, during the course of construction, of potential developing problems relating to the work being provided under other sections of the specifications where such problems may adversely effect the proper balancing of the equipment or systems.
- .2 Submit written reports for review upon completion of each major phase of the balancing work.
- .3 The TAB Contractor shall prepare and submit three (3) copies of the Balancing Report to the Consultant for review and evaluation prior to final acceptance of the project. The Balancing Report shall include the data outlined above, but may be expanded or modified to be compatible with the requirements of the installed equipment and systems.
  - .1 The cover of the TAB Report must show the "AABC" or "NEBB" Logo, Name and Address of the project, Architect, Mechanical Engineer, Installing Contractor, Date the report is issued, Address and Phone Number of the TAB Contractor. The AABC/NEBB Seal and Signature of the TAB Supervisor who is in charge of the reported project must be submitted on the "Certification" Report Form (TAB 2-98)/
  - .2 Identification of all types of instruments used and their last dates of calibration shall be submitted with the Final Report.
  - .3 Once Consultant's comments have been incorporated in the report, submit four (4) copies of the Final Report to the Consultant.

### 3.5 Quality assurance

- .1 The AABC/NEBB Tab Contractor shall guarantee that all work will be performed in accordance with the applicable AABC/NEBB Standards and Procedures. The TAB Contractor Certification Number must be provided to the Consultant.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 – General Requirements, shall apply to and govern this section.
- .2 All insulation shall comply with minimum R-value requirements listed in ASHRAE Energy Standard 90.1, latest edition.
- .3 All insulation materials and installation must meet the requirements of applicable codes and standards, and be appropriately labeled.

### **1.2 Submittals**

- .1 Submit Shop Drawings for:
  - .1 Insulation products.
  - .2 Recovery jackets.
- .2 Submit samples of all insulation materials to Consultant mounted on a board, and labeled for intended services, including 'K' factors. Obtain Consultant's comments prior to ordering insulation and proceeding with the installation.

### **1.3 Scope of work**

- .1 Piping insulation.
- .2 Equipment insulation, including tanks.
- .3 Adhesives, tie wires, tapes.
- .4 Recovery jackets.

## 2 Products

### 2.1 Material and installation

- .1 Unless otherwise noted, insulating materials are based on Knauf Fiber Glass GmbH.
- .2 All insulation materials, adhesive sealants and coatings, shall be ULC listed, non-hygroscopic, and mould-proof.
- .3 Insulation materials shall not flame, smolder, glow or smoke at their service temperatures.
- .4 Use insulation material rated as follows:
  - .1 For fluids up to 121°C (250°F): rated at 121°C (250°F).
  - .2 For fluids over 121°C (250°F): rated at 232°C (500°F).
  - .3 For cold fluids: rated for -40°C (-40°F) and 121°C (250°F).
- .5 Cover expansion joints first with a 0.7mm (24-gauge) galvanized metal sleeve and then insulate to provide equivalent thickness to that on adjoining pipe.
- .6 Apply all insulation in a manner to facilitate replacing and/or servicing of equipment.
- .7 All insulation system materials inside the building must meet the requirements of NFPA 90A, with a flame spread rating of less than 25, and smoke developed rating of less than 50, when tested in accordance with CAN/ULC-S102.
- .8 Make good and refinish cracks, undulation or any other deficiencies occurring in the insulation or vapour barrier. Priming or painting of insulation will be done under Division 09 – Finishes.
- .9 Canvas jackets shall comprise 1.83kg/m<sup>2</sup> (6oz./sq.ft) plain weave cotton fabric sealed with dilute fire retardant, waterproof, ULC listed lagging adhesive.

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- .10 PVC recovery jackets shall be 0.51mm (0.020") thick with longitudinal slip joints and 0.51mm (0.020") thick one piece premolded PVC fittings, off-white in colour.
  - .11 Aluminum recovery jackets shall be 0.4mm (26ga.) thick smooth aluminum jackets with longitudinal slip joints with 0.5mm (24ga.) thick preformed fittings with factory attached protection liner on interior surface.
  - .12 The following areas are designated as "exposed" where the term is applied to covering:
    - .1 Mechanical and electrical equipment rooms, penthouses, parking garage, loading dock, shipping/receiving areas.
    - .2 Mechanical plenum spaces.
    - .3 Below suspended ceiling level in occupied areas or below slab where no ceiling occurs.
    - .4 Duct shafts and/or pipe shafts serviced via "walk-in" type access doors.
    - .5 Crawl spaces, tunnels.
  - .13 Cover pipes exposed to weather or dampness with 75mm (3") thick insulation and a final application of Denso waterproof self-adhesive fiberglass tape adequately overlapped to render it water tight. The following areas are designated as "exposed to weather or dampness" and are applicable for this treatment:
    - .1 Air intake, relief, and exhaust plenums directly connected to the outside of the building.
    - .2 Underground service trenches.
    - .3 Buried below ground level.
    - .4 Areas subject to high humidity.
    - .5 Piping exposed on the roof.

## 2.2 Cold piping

- .1 Cover 'cold' piping with rigid type fiberglass dual temperature 72kg/m<sup>3</sup> (4.5lbs/ft<sup>3</sup>) nominal density insulation with factory applied fire resistive fibreglass reinforced vapour barrier jacket and aluminum foil vapour barrier with self-sealed lap. Butt joints sealed with butt strips or aluminum tape. Recover pipe in exposed areas with canvas or PVC jacket.
- .2 Piping insulation thickness shall be as specified on mechanical drawings.
- .3 Wrap valves and inline components with 19 kg/m<sup>3</sup> (1.15lbs/ft<sup>3</sup>) density flex duct insulation, under compression at 2 to 1 ratio. Recover in exposed areas with canvas or PVC jackets.
- .4 Insulate over flanges and mechanical couplings with specified insulation and thickness, sized to suit flange diameters. Fill spaces between insulation and adjoining pipe insulation with similar material. Recover in exposed areas with canvas or PVC jackets.
- .5 Cover the first 150mm (6") of hanger rods directly connected to the piping, with block or sectional insulation. Finish to match jacket on piping. Recover in exposed areas with canvas jacket.
- .6 Cover all insulated electrically traced piping and equipment exposed to the outside, with weatherproof aluminum jacket.

## 2.3 Hot piping

- .1 Cover 'hot' piping with rigid type fiberglass 72kg/m<sup>3</sup> (4.5lbs/ft<sup>3</sup>) nominal density insulation with factory applied fire resistive fibreglass reinforced white kraft paper jacket bonded to aluminum foil vapour barrier with self-sealed lap. Hold insulation in place with flare type staples. Recover pipe in exposed areas with canvas or PVC jacket.
- .2 Piping insulation thickness shall be as specified on mechanical drawings
- .3 Wrap valves and inline components with 19 kg/m<sup>3</sup> (1.15lbs/ft<sup>3</sup>) density flex duct insulation, under compression at 2 to 1 ratio. Recover in exposed areas with canvas or PVC jackets.



- .4 Insulate over flanges and mechanical couplings with specified insulation and thickness, sized to suit flange diameters. Fill spaces between insulation and adjoining pipe insulation with similar material. Recover in exposed areas with canvas or PVC jackets.

### **3 Execution**

#### **3.1 Application**

- .1 Do not apply insulation before piping and equipment has been tested and accepted.
- .2 All insulation shall be supplied and installed by a qualified insulation applicator in accordance with the latest MICA Commercial and Industrial Insulation Standard.
- .3 All insulation shall be applied in full accordance with the insulation manufacturer's recommendations, and shall present a neat, workmanlike appearance upon completion.
- .4 Use insulation, wrapping, vapour barriers and adhesive materials having flame spread, fuel contributed and smoke developed ratings in accordance with rulings and regulations of authorities. Follow all rules, regulations, and instructions of the Fire Marshall's office and all authorities having jurisdiction.
- .5 Do not apply any insulation or finishing when the ambient temperature in the space is less than 10°C (50°F).
- .6 Apply insulation only on clean and dry surfaces.
- .7 Apply all covering in a neat and workmanlike manner to present a clean appearance upon completion of job. Use insulation materials on cold piping, and equipment that are non-hygroscopic and are complete with a continuous vapour barrier. Wheatpaste must not be used. Acceptable insulation adhesive, coating, and sealant manufacturers are Benjamin Foster, Minnesota Mining, and Bakelite Thermosets Company.
- .8 All aluminum and PVC recovery jackets shall be removable and reusable.

- .9 Supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapour sealed to prevent condensation.
- .10 Ensure insulation is continuous through non-fire rated walls and floors. Terminate insulation neatly on either side of a fire rated barrier. Fill space between pipe and construction with fire retardant sealant. Insulation or recovery jacket shall not penetrate fire-rated construction.
- .11 Insulate electrically traced piping and equipment only after pipe tracing has been installed and tested.
- .12 Apply all insulation in a manner to facilitate replacing and/or servicing of equipment. All insulation for equipment shall be removable and reusable.
- .13 Repair/replace all insulation damaged during construction with the thickness, quality, and finish of original insulation.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 Domestic cold water piping, including connections to all fixtures and equipment, capped connections, and connections to municipal water supply.
  - .2 Domestic hot water piping, including connections to all fixtures and equipment and capped connections.

### **1.3 Regulatory Requirements**

- .1 In addition to specific requirements for pipe fittings as further specified in this document and where applicable, the equipment shall comply with the Boiler and Pressure Vessels Act and CSA Standard B51.
- .2 In compliance with the Act and relevant Codes, all fittings shall be registered by the manufacturer, and shall be identified by the appropriate Canadian registration number.
- .3 Where fittings are provided without the appropriate Canadian registration number, the Contractor shall obtain a copy of the manufacturer's Statutory Declaration as provided to the authorities having jurisdiction.
- .4 All welding and fabrication shall be to the requirements of the ANSI/ASME B31.1 code for pressure piping and CSA standard B51 code for the Construction and Inspection of Boilers and Pressure Vessels.
- .5 All copper piping shall be certified to ASTM Standard B88 for Seamless Copper Water Tube.

## **2 Products**

### **2.1 Pipes and fittings**

- .1 For 860 kPa (125 psi) or less operating pressure use 860 kPa (125 psi) rated fittings. For 860 kPa to 1,730 kPa (125 psi to 250 psi) operating pressure use 1,730 kPa (250 psi) rated fittings.
- .2 Buried water lines:
  - .1 Piping shall be type 'K' soft copper without joints beneath slab.
- .3 Domestic cold water, hot water, and hot water recirculation piping shall be type 'L' hard copper with wrought copper or cast brass fittings and 95/5 solder joints.

## **3 Execution**

### **3.1 General**

- .1 Ream all piping and keep plugged to prevent entry of dirt. Use pipes, which conform to CSA and ASTM standards.
- .2 Install piping in a workmanlike manner and in accordance with the practices of the trade.
- .3 Consider the piping shown on the Drawings as diagrammatic, for clearness in indicating the general runs and connections and that the piping may, or may not, in all parts be shown in the true position. This does not relieve the responsibility for the proper erection of the systems of piping in every respect suitable for the work intended.
- .4 Ensure that fabrication, welded or otherwise, meets the requirements of the ASA B31.1 Code for Pressure Piping, the CSA B51 Code for Boiler, Pressure Vessel, and Pressure Piping, and all requirements of the Boilers and Pressure Vessels Act of the Province of Ontario.
- .5 Use only fittings, or other materials to be incorporated in the work, which are approved by the Boiler Inspection Branch of the Department of Labour, for the class of work for which they are used.

- .6 Thoroughly clean the inside of fittings and outside of pipe with steel wool and coat with flux, before soldering any copper pipe work joint. Remove the working parts of valves before soldering commences, and replace after soldering is complete.
- .7 Provide swing joints in runouts to units, off horizontal mains.
- .8 Use di-electric connections for cathodic protection wherever pipes of dissimilar material are connected together. When connecting grooved end steel to copper piping, use Victaulic dielectric waterway, Style 47-GG, or approved equivalent.
- .9 All traps and fittings shall be of same material or equal in quality and thickness to the pipe to which they are connected.
- .10 Provide unions or flanges at all connections to equipment or fixtures requiring servicing or replacement.
- .11 In copper pipes, provide wrought copper unions with soldered joints for pipe up to and including 50mm (2"), and 1,035 kPa (150 psi) cast brass flanges for pipes 65mm (2-1/2") or larger.
- .12 Install all grooved end components as per manufacturers latest recommendation. All grooved products shall be of one manufacturer.
- .13 Provide thrust restraints on mechanical pipe joints where required to accommodate axial thrust.

### **3.2 Equipment connections**

- .1 Install piping connection to equipment, to prevent any strain on pipe and equipment and to facilitate removal equipment without disconnecting more than the minimum of pipework or shutting down any other piece of equipment.
- .2 Install equipment and apparatus requiring servicing and/or replacing with unions or flanges.
- .3 Install valves, and automatic valve assemblies prefabricated and in uniform arrangement.

- .4 Install piping, automatic control valves, thermostat wells, orifice plates, etc., and any other appurtenances, supplied by other Sections of this specification or by the Owner for insertion in piping and equipment.
- .5 Provide di-electric fittings between dissimilar metals where corrosion may occur.

### **3.3 Connections for other trades**

- .1 Provide valved hot and/or cold water to all equipment supplied by others, requiring same and connect.
- .2 Provide quick fill valved connections for chilled water, hot water, and condenser water systems.

### **3.4 Testing**

- .1 After all pipes have been placed in position and all branches installed, but before fixtures have been set or connected, test the tightness of all joints and the soundness of all pipes.
- .2 Make all tests before piping is furred in.
- .3 Notify Consultant at least 48 hours before commencing with test, and give Consultant a written certificate confirming these tests.
- .4 Test all water lines hydrostatically at 1-1/2 times the working pressure but at not less than 1,380 kPa (200 psi), for a period of not less than four (4) hours without any drop in pressure. Do testing before piping is buried or furred in and before pressure sensitive devices are installed in the pipework. Correct all defects disclosed by tests. Retest until all results are acceptable.
- .5 If any leaks are discovered by the above tests, remove and replace the faulty portions of the systems and repeat the test. Repeat this procedure until the system is accepted by the Consultant's representative on the site. Do not caulk threaded joints.
- .6 Check horizontal pipe with an accurate level for any alterations in pitch. Inspect laterals, cross arms, and eliminate pockets. Correct any cases of water hammer.

### **3.5 Flushing and cleaning**

- .1 Inspect the systems, and remove any heavy debris and excessive oil and dirt.
- .2 Flush all completed systems with clear water at the highest obtainable pressure and velocity.
- .3 During flushing and cleaning, maintain all isolating and control valves in the open position.
- .4 Sterilize domestic hot and cold water piping. Provide chemical and bacteriological test data to prove that sterilization has been carried out.
- .5 Flush, chlorinate and reflush all outside water mains in accordance with AWWA C651-99 Specifications.

### **3.6 Completion**

- .1 Provide a declaration, signed by a responsible officer of the Company indicating that the following procedures and tests have been performed in accordance with the drawings and specifications. Provide two (2) copies of the signed declaration to the Consultant.
  - .1 Water pressure test performed and leak free.
  - .2 Plumbing inspections made and issue necessary certificates.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Submit shop drawings for the following equipment:
  - .1 Shock absorbers
  - .2 Backflow preventers
  - .3 Thermostatic mixing valves

## **2 Products**

### **2.1 Shock absorbers**

- .1 Provide P.P.P. Inc 'SS' Series shock absorbers on all hot and cold water lines servicing groups of fixtures, individual fixtures and equipment. Protect all fixtures and equipment in accordance with Plumbing and Drainage Institute Standard PDI-WH201 and manufacturer's instructions.

### **2.2 Backflow preventer**

- .1 Provide backflow preventers as specified on mechanical drawings, or approved equal.

### **2.3 Thermostatic mixing valves**

- .1 Provide thermostatic mixing valves as specified on mechanical drawings, or approved equal.



### **3 Execution**

#### **3.1 Unions, flanges, di-electric couplings**

- .1 Provide unions or flanges at all connections to equipment of fixtures requiring servicing or replacing.
- .2 In copper pipes, provide wrought copper unions with soldered joints for pipes up to and including DN50 (2") sizes and 1,034 kPa (150 psi) cast brass flanges for pipes DN100 (4") or larger.
- .3 Install approved dielectric isolation in following specified systems:
  - .1 Domestic cold water systems
  - .2 Expansion pipes where make-up is connecting to the expansion tank
  - .3 In all other locations where specifically noted or shown
- .4 Install approved dielectric isolation at the transition between noble materials such as copper, brass bronze, high alloy castings, or stainless steel and low alloy ferrous materials such as black iron, galvanized iron, or cast iron. These dielectric isolators must be installed in such a way that they are not shorted out by accidental contacts to process equipment, building steel, instrumentation tubing, or electrical neutrals. Ensure that dielectric unions are constructed of materials that are compatible galvanically with the systems to which they are connected, e.g. a dielectric union for installation between copper and iron must be constructed with a body of iron and a tailpiece of copper or brass.

#### **3.2 Shock absorbers**

- .1 Provide P.P.P. Inc 'SS' Series shock absorbers on both hot and cold water systems. Install in an upright position at all quick closing valves, solenoids, groups of plumbing fixtures and isolated fixtures. Locate and size as required and in accordance with the plumbing and drainage institute standard No. WH201 P.D.I. and as per manufacturer's instruction.

**3.3 Backflow preventers**

- .1 Provide backflow preventer for all potential cross connections including domestic water connections where shown on drawings, and as required by Provincial Plumbing code and local authority having jurisdiction. As a minimum standard, installation shall be in conformance with CAN/CSA-B64.10-01.
- .2 Provide bronze body, spring loaded, soft seated, silent check valve upstream of backflow preventers. Up to and including DN50 (2"): Watts Series 600, Conbraco 61-500, Zurn Wilking Model 40. DN65(2-1/2") and above: Apco Series 300, Mueller.
- .3 Installation of silent check valve upstream of double check valves servicing main domestic water line is not required.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 Sanitary system, including drains, and vents.
  - .2 Floor drains and fittings.

### **1.3 Regulatory Requirements**

- .1 In addition to specific requirements for pipe fittings as further specified in this document and where applicable, the equipment shall comply with the Boiler and Pressure Vessels Act and CSA Standard B51.
- .2 In compliance with the Act and relevant Codes, all fittings shall be registered by the manufacturer, and shall be identified by the appropriate Canadian registration number.
- .3 Where fittings are provided without the appropriate Canadian registration number, the Contractor shall obtain a copy of the manufacturer's Statutory Declaration as provided to the authorities having jurisdiction.
- .4 All welding and fabrication shall be to the requirements of the ANSI/ASME B31.1 code for pressure piping and CSA standard B51 code for the Construction and Inspection of Boilers and Pressure Vessels.
- .5 All copper piping shall be certified to ASTM Standard B88 for Seamless Copper Water Tube.

## **2 Products**

### **2.1 Pipes and fittings**

- .1 Buried sanitary drains, 75mm (3") dia. and under shall be copper drainage tube (DWV), cast brass fittings and 50/50 solder joints. Drains 100mm (4") dia. and over shall be standard weight cast iron soil pipe and fittings with mechanical joints.
- .2 Unburied sanitary drains, 75mm (3") dia. and under shall be copper drainage tube (DWV), cast brass fittings and 50/50 solder joints. Drains 100mm (4") dia. and over shall be standard weight cast iron soil pipe and fittings with mechanical joints.
- .3 Vents 50mm (2") dia. and less shall be type DWV copper, 65mm (2-1/2") and over galvanized.

## **3 Execution**

### **3.1 General**

- .1 Ream all piping and keep plugged to prevent entry of dirt. Use pipes, which conform to CSA and ASTM standards.
- .2 Connect vent lines into the soil stack above highest fixture or extend separately through roof to a height of 600mm (24") above roofline and 3.6m (12 ft) away from any opening into building and flash properly.
- .3 Do not use double hubs, straight crosses, double T's or double TY's on any soil or waste pipe.
- .4 Install piping in a workmanlike manner and in accordance with the practices of the trade.
- .5 Consider the piping shown on the Drawings as diagrammatic, for clearness in indicating the general runs and connections and that the piping may, or may not, in all parts be shown in the true position. This does not relieve the responsibility for the proper erection of the systems of piping in every respect suitable for the work intended.

- .6 On screwed piping, make up joints, metal to metal with red or white lead and oil applied to the thread. No hemp wick or packing will be permitted in making up screwed joints.
- .7 Ensure that welding is performed, using either gas or electric welding equipment. Thoroughly clean pipe surfaces and level the ends of each pipe and fitting before welding. Securely align and space piping so that the width of circumferential welds is two and one-half times the pipe wall thickness. Ensure that the deposited metal forms a gradual increase in thickness from the outside surface to the centre of the weld.
- .8 Ensure that the pipe welding is done by a welder holding a certificate from the Department of Labour for the class of piping to be welded.
- .9 When welding or cutting with a torch, take every precaution to prevent fire. Ensure that welding or torch cutting operators have a fully charged 4.5kg (10 lb.) carbon dioxide fire extinguisher with them, when welding or cutting in building, or tunnels. Protect wooden structures with asbestos blanket.
- .10 Ensure that fabrication, welded or otherwise, meets the requirements of the ASA B31.1 Code for Pressure Piping, the CSA B51 Code for Boiler, Pressure Vessel, and Pressure Piping, and all requirements of the Boilers and Pressure Vessels Act of the Province of Ontario.
- .11 Use only fittings, or other materials to be incorporated in the work, which are approved by the Boiler Inspection Branch of the Department of Labour, for the class of work for which they are used.
- .12 Thoroughly clean the inside of fittings and outside of pipe with steel wool and coat with flux, before soldering any copper pipe work joint. Remove the working parts of valves before soldering commences, and replace after soldering is complete.
- .13 Use di-electric connections for cathodic protection wherever pipes of dissimilar material are connected together. When connecting grooved end steel to copper piping, use Victaulic dielectric waterway, Style 47-GG.
- .14 All traps and fittings shall be of same material or equal in quality and thickness to the pipe to which they are connected.

- .15 Provide unions or flanges at all connections to equipment or fixtures requiring servicing or replacement.
- .16 In copper pipes, provide wrought copper unions with soldered joints for pipe up to and including 50mm (2"), and 1,035 kPa (150 psi) cast brass flanges for pipes 65mm (2-1/2") or larger.
- .17 Install all grooved end components as per manufacturers latest recommendation. All grooved products shall be of one manufacturer.
- .18 Provide thrust restraints on mechanical pipe joints where required to accommodate axial thrust. Scope of bracing shall include but not be limited to all joints at the base of all vertical drains, including cleanouts, and all joints in horizontal piping at the lowest level which drains by gravity to the street services.

### **3.2 Testing**

- .1 After all pipes have been placed in position and all branches installed, but before fixtures have been set or connected, test the tightness of all joints and the soundness of all pipes.
- .2 Make all tests before piping is furred in.
- .3 Notify Consultant at least 48 hours before commencing with test, and give Consultant a written certificate confirming these tests.
- .4 Sanitary, Waste, and Vent Piping: Securely close all openings in pipe ends throughout the work by means of approved plugs and fill the entire piping system, including stacks, branches to fixtures and all horizontal runs with water, up to highest opening and let this water stand at this level for not less than two (2) hours. Perform another test after the fixtures are set, connected, and connections are made to all equipment. Test by running water into all pipes, fixtures, traps, and apparatus in order to detect any imperfect material or workmanship. Where it is impossible to test the whole system at one time, divide into parts. Perform a smoke or ball test or any other test required by authorities having jurisdiction.
- .5 Test all pumped drain lines hydrostatically at 1-1/2 times the working pressure but at not less than 1,380 kPa (200 psi), for a period of not less

that four (4) hours without any drop in pressure. Do testing before piping is buried or furred in and before pressure sensitive devices are installed in the pipework. Correct all defects disclosed by tests. Retest until all results are acceptable.

- .6 If any leaks are discovered by the above tests, remove and replace the faulty portions of the systems and repeat the test. Repeat this procedure until the system is accepted by the Consultant's representative on the site. Do not caulk threaded joints.
- .7 Check horizontal pipe with an accurate level for any alterations in pitch. Inspect laterals, cross arms, and eliminate pockets.

### **3.3 Flushing and cleaning**

- .1 General
  - .1 Inspect the systems, and remove any heavy debris and excessive oil and dirt.
  - .2 Flush all completed systems with clear water at the highest obtainable pressure and velocity.

### **3.4 Completion**

- .1 Provide a declaration, signed by a responsible officer of the Company indicating that the following procedures and tests have been performed in accordance with the drawings and specifications. Provide two (2) copies of the signed declaration to the Consultant.
  - .1 Pressure test performed and leak free.
  - .2 Plumbing inspections made and issue necessary certificates.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Submit shop drawings for the following equipment:
  - .1 Floor drains
  - .2 Trap primers

## **2 Products**

### **2.1 Floor drains**

- .1 Mechanical Rooms, Plenums and Unfinished Areas
  - .1 As specified on mechanical drawings, or approved equal.
- .2 Finished Areas
  - .1 As specified on mechanical drawings, or approved equal.

### **2.2 Funnel floor drains**

- .1 Unfinished Areas
  - .1 As specified on mechanical drawings, or approved equal.
- .2 Finished Areas
  - .1 As specified on mechanical drawings, or approved equal.

### **2.3 Trap primers**

- .1 All traps for floor drains shall be protected with trap primers.



- .2 Provide new trap seal priming device as specified on mechanical drawings, or approved equal.

### **3 Execution**

#### **3.1 Traps**

- .1 Provide every fixture and floor drain with traps in accordance with local regulations. Provide each trap with its own brass plug and ferrule cleanout.
- .2 For traps located in ceilings, provide access doors.
- .3 For drains in apparatus casings or air plenums, provide deep seal trap. For drains in outside air plenums, provide running trap located as far as possible from drains.
- .4 For traps on floor and hub drains, provide an automatic trap primer.
- .5 If required by authorities having jurisdiction, provide building traps complete with cleanout and fresh air inlet with special grilles to meet Consultant's approval.

#### **3.2 Drains**

- .1 In all areas with seamless flooring and plastic terrazzo finishes provide special flanges. These flanges shall be 100mm (4") larger in diameter than the drain top or sleeve diameter, and located approximately 5mm ( $\frac{3}{16}$ ") below the top flanges to be of the same material as the drain finish.
- .2 Provide special flanges for the following items as described above:
  - .1 Floor drains
  - .2 Hub drains
  - .3 Combination drains
  - .4 Area drains

### **3.3 Unions, flanges, di-electric couplings**

- .1 Provide unions or flanges at all connections to equipment of fixtures requiring servicing or replacing.
- .2 In copper pipes, provide wrought copper unions with soldered joints for pipes up to and including DN50 (2") sizes and 1,034 kPa (150 psi) cast brass flanges for pipes DN100 (4") or larger.
- .3 Install approved dielectric isolation in following specified systems:
  - .1 In all locations where specifically noted or shown
- .4 Install approved dielectric isolation at the transition between noble materials such as copper, brass bronze, high alloy castings, or stainless steel and low alloy ferrous materials such as black iron, galvanized iron, or cast iron. These dielectric isolators must be installed in such a way that they are not shorted out by accidental contacts to process equipment, building steel, instrumentation tubing, or electrical neutrals. Ensure that dielectric unions are constructed of materials that are compatible galvanically with the systems to which they are connected, e.g. a dielectric union for installation between copper and iron must be constructed with a body of iron and a tailpiece of copper or brass.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:

- .1 Electric domestic hot water heaters.

### **1.3 Submittals**

- .1 Submit shop drawings for:
  - .1 Electric domestic hot water heaters
- .2 As a minimum provide the following information:
  - .1 Data sheets for heaters.
  - .2 Power and control wiring diagrams.
  - .3 Physical outline dimensions showing clearances, and connection entries.

## **2 Products**

### **2.1 Electric domestic water heaters**

- .1 As specified on mechanical drawings, or approved equal.

### **3 Execution**

#### **3.1 General**

- .1 Provide pressure relief valves for each water heater. Pipe to nearest drain.
- .2 Line side power wiring shall be provided by Division 26 - Electrical. Provide certified wiring schematics to Division 26 - Electrical for associated equipment.
- .3 Field control wiring of local safeties and interlocks shall be provided by this Section.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 Gas-fired storage hot water heaters.

### **1.3 Submittals**

- .1 Submit shop drawings for:
  - .1 Gas-fired storage hot water heaters
- .2 As a minimum provide the following information:
  - .1 Data sheets for heaters,
  - .2 Power and control wiring diagrams.
  - .3 Physical outline dimensions showing clearances, and connection entries.

## **2 Products**

### **2.1 Gas-fired domestic hot water heaters**

- .1 As specified on mechanical drawings, or approved equal.

### **3 Execution**

#### **3.1 General**

- .1 Install gas-fired heaters in accordance with the Ontario Gas Utilization Code and local regulations.
- .2 Provide a temperature and pressure relief valve for each water heater. Pipe to nearest drain.
- .3 Line side power wiring shall be provided by Division 26 - Electrical. Provide certified wiring schematics to Division 26 - Electrical for associated equipment.
- .4 Field control wiring of local safeties and interlocks shall be provided by this Section.
- .5 Connect to natural gas supply piping. Provide isolation valves, pressure regulators, and piping specialties as required by local gas code and to suit gas pressure.
- .6 Refer to Section 15570 – Breeching, Chimneys, and Stacks for flue vents.

**End of section**

## **1 General**

### **1.1 Related Requirements**

- .1 Section 22 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Submit shop drawings for the following equipment:
  - .1 Plumbing fixtures and brass.
  - .2 Fixture carriers and other appurtenances.

## **2 Products**

- .1 Toilet – Floor Mount Flush Valve (Barrier Free Design)
  - .1 As specified on mechanical drawings or reviewed equivalent.
- .2 Sink – Kitchen/General Use
  - .1 As specified on mechanical drawings or reviewed equivalent.
- .3 Dental Sink – Operatory, Sterilization Room & Laboratory
  - .1 As specified on mechanical drawings or reviewed equivalent.
- .4 Eyewash Station Counter Mounted
  - .1 As specified on mechanical drawings or reviewed equivalent.
- .5 Janitor Sink – Floor Mounted
  - .1 As specified on mechanical drawings or reviewed equivalent.
- .6 Basin - Counter Mtd. (Barrier Free Design and General Use)
  - .1 As specified on mechanical drawings or reviewed equivalent.

### **3 Execution**

#### **3.1 Traps**

- .1 Provide every fixture with traps in accordance with local regulations. Provide each trap with its own brass plug and ferrule cleanout.
- .2 For traps located in ceilings, provide access doors.

#### **3.2 Unions, flanges**

- .1 Provide unions or flanges at all connections to fixtures requiring servicing or replacing.
- .2 In copper pipes, provide wrought copper unions with soldered joints for pipes up to and including DN50 (2") sizes and 1,034 kPa (150 psi) cast brass flanges for pipes DN100 (4") or larger.

#### **3.3 Fixtures**

- .1 Supply and install all hangers, supports, brackets, reinforcement, steel back-up plates, etc. for the proper installation of fixtures and supply fittings.
- .2 Install all components in strict accordance with manufacturer's recommendations.
- .3 Where plumbing fixtures contact wall, and/or floors, seal joints with Dow Corning #781, building sealant, make watertight and bead smooth in a neat workmanlike manner.
- .4 Exposed trim, supplies, traps, fittings, etc. shall be brass, heavily chrome plated unless noted otherwise.
- .5 Provide a trap for each fixture.
- .6 Vent fixtures in accordance with Section 22 13 16 – Sanitary Waste and Vent Piping.
- .7 Install chrome plated angle on straightaway type screwdriver compression stops, as required, on all hot and cold water service connections to all fixtures.



- .8 Install escutcheon plates where all service connections to fixtures pass through walls or floors. Plates shall be cast brass, heavy chrome plated. Same internal diameter as external diameter of pipe.

**End of Section**

## **1 General**

### **1.1 Contract Drawings**

- .1 The Drawings for the HVAC Work are diagrammatic performance drawings, intended to convey the scope of Work, and indicate general arrangement and approximate location of apparatus, fixtures, and pipe runs. The Drawings do not intend to show architectural and structural details.
- .2 Do not scale drawings, but obtain information involving accurate dimensions to structure from dimensions shown on architectural and structural drawings, or by site measurements. Consult general construction drawings as well as detail drawings to become familiar with all conditions affecting the Work and verify spaces in which the Work will be installed.
- .3 Make, at no additional cost to the Owner, any changes or additions to materials and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).
- .4 Alter at no additional cost to the Owner, the location of materials and/or equipment as directed, provided that the changes are made before installation and do not necessitate additional material.
- .5 Install all ceiling mounted components (diffusers, grilles) in accordance with reflected ceiling drawings reviewed by the Consultant.
- .6 Leave space clear and install all work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by another Division of Work or Contract. Verify spaces in which work is to be installed. Install all pipe runs, etc., to maintain headroom and clearances and to conserve space in shafts and ceiling spaces.
- .7 Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied under other Divisions of Work or Contracts.

**1.2 Installation requirements**

- .1 The Consultant's Drawings and instructions govern the general location of all items.
- .2 Install all equipment and apparatus to allow free access for maintenance, adjustment and replacement.
- .3 Install all Products and services in accordance with the manufacturer's requirements and/or recommendations.
- .4 Do not use explosive activated tools.
- .5 Install all services capped for future to allow easy access for future tie-in.
- .6 All equipment installed in parking structure floor slabs, ramps and driving areas shall meet all requirements of ULC – S413 – 94 with regard to corrosion protection:
  - .1 The use of dissimilar materials shall be avoided, or if unavoidable, electric contact shall be prevented.
  - .2 Embedded materials used for pipes and other hardware shall be:
    - .1 Non metallic, or;
    - .2 A low copper aluminum alloy or an equally corrosion resistant metal, coated on surfaces in contact with concrete to prevent galvanic corrosion with steel reinforcing, or;
    - .3 Protected against the corrosive effects of de-icing chemicals by an effective and durable coating.
- .7 Install equipment neatly to the satisfaction of the Consultant. Unless noted otherwise, install all products and services to follow building planes. Installation shall permit free use of space and maximum headroom
- .8 Cap off and seal all open ends of installed ductwork, piping and conduits to prevent entrance of foreign matter.

- .9 Do not install piping in a location or manner, which might result in freezing.

### **1.3 Temporary services**

- .1 Refer to Section 01500 regarding temporary services, Contractor's shop, storage and other facilities.
- .2 Do not use any of the permanent HVAC systems during construction, unless specific written permission is obtained from the Consultant or unless allowed elsewhere in the Contract Documents.
- .3 The use of permanent facilities for temporary construction service shall not affect in any way the commencement of the warranty period. The warranty period shall commence as specified in CCDC – 2, as amended by the supplementary conditions.

### **1.4 Cooperation**

- .1 Confer with all trades installing equipment that may effect the work of this Division, and arrange equipment in proper relation with equipment installed under all Divisions of the Contract.
- .2 Furnish all items to be built in, in time, complete with all pertinent information, commensurate with the progress of the work.
- .3 Store materials neatly and out of the way and clean up daily all refuse caused by the work.
- .4 Coordinate work with all Divisions. Relocate equipment and/or material installed, but not coordinated with the work of other Divisions, as directed by the Consultant, at no extra cost. Inform other Divisions of the locations of openings, chases, sleeves, supports, services, connections, etc. to be incorporated into the work.

### **1.5 Services to equipment supplied by others**

- .1 Provide all necessary connections required for equipment supplied by the Owner and other Divisions. Examine all Drawings and Specifications and identify all requirements.
- .2 Provide valves, unions, caps, and vibration isolation for all services.

- .3 The Contractor shall be responsible to verify, adjust and coordinate the type, size and location of HVAC services required for all equipment supplied by the Owner and other Divisions.

## 1.6 Cutting and patching

- .1 Inform all other Divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting and patching, including layout, x-rays, ferrosscanning at premium time. Obtain the permission of the Consultant before doing any cutting.
- .2 Do all necessary cutting and patching of existing work. X-ray all proposed floor-opening locations prior to core drilling. Refer to Section 23 00 55 – Work in Existing Buildings.
- .3 Obtain the Consultant's approval before doing any cutting and patching. Any structural modifications must not affect structural, fire barrier or vapor barrier integrity.

## 1.7 Abbreviations

- .1 Abbreviations with respect to government agencies, testing agencies, technical societies, and approval agencies are as listed below:
  - .1 **AMCA** Air Moving and Conditioning Association
  - .2 **ANSI** American National Standards Institute
  - .3 **ARI** Air Conditioning and Refrigeration Institute
  - .4 **ASHRAE** American Society of Heating, Refrigerating, and Air Conditioning Engineers
  - .5 **ASME** American Society of Mechanical Engineers
  - .6 **ASTM** American Society for Testing and Materials
  - .7 **AWWA** American Water Works Association
  - .8 **CGA** Canadian Gas Association

- .9 **CSA** Canadian Standards Association
- .10 **FM** Factory Mutual
- .11 **IAO** Insurers' Advisory Organization  
(CGI Information systems and Management Consultants  
Inc.)
- .12 **MICA** Midwest Insulation Contractors Association
- .13 **NBC** National Building Code
- .14 **NBFU** National Board of Fire Underwriters (currently  
American Insurance Association)
- .15 **NEMA** National Electrical Manufacturers Association
- .16 **NFPA** National Fire Protection Association
- .17 **OBC** Ontario Building Code
- .18 **BC** National or State (US) Building Codes
- .19 **SMACNA** Sheet Metal and Air Conditioning Contractors  
National Association
- .20 **TEMA** Tubular Exchanger Manufacturers Association
- .21 **ULC** Underwriters' Laboratories of Canada

## 1.8 Manufacturer's certification

- .1 Submit letters from the manufacturers of all equipment certifying that their technical representatives have inspected and tested their equipment, have approved the methods of installation and operation. Where existing systems are extended, provide letters covering both new and existing equipment and connections.

- .2 These letters shall state the names of persons present at the inspection and testing, methods used and a list of functions performed with location and room numbers where applicable.
- .3 Refer to the respective equipment sections for requirements for letters.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 – General Requirements shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Provide Shop Drawings for:
  - .1 Access doors and panels.

### **1.3 Materials and equipment**

- .1 Use only new materials and equipment of Manufacturer as specified or shown on the Drawings. Ensure that equipment and materials for similar applications are of the same Manufacturer.
- .2 If the Contractor wishes to substitute materials of Manufacturers other than those named, he shall state in his Tender the name and a complete description of the materials to be substituted, along with the amount of change in the Contract price.
- .3 Ensure that materials not specified to a specific Manufacturer are of high commercial standard and quality.

## **2 Products**

### **2.1 Access doors and panels**

- .1 In plaster, gypsum board, tiled or masonry walls for exposed flush installation, provide 203mm by 203mm (8" x 8") prime coated 16 ga. access door with 18 ga. mounting frame, continuous concealed hinge, and screwdriver operated stainless steel cam latch, similar to Acudor UF-5000.
- .2 In plaster or tiled walls for recessed installation, provide 305mm by 305mm (12" x 12") 16 ga. access door recessed by 25mm (1"). Door to be complete with 14 ga. mounting frame, concealed pivoting rod type



hinge, and flush-to-surface screwdriver operated stainless steel cam latch, similar to Acudor AT-5020.

- .3 In gypsum board surfaces or in acoustic tiles for recessed installation, provide 305mm by 305mm (12" x 12") 16 ga. access door recessed by 25mm (1"). Door to be complete with 14 ga. mounting frame with drywall taping bead on all sides, concealed pivoting rod type hinge, and flush-to-surface screwdriver operated stainless steel cam latch, similar to Acudor DW-5015.
- .4 In fire rated walls, provide 305mm by 305mm (12" x 12") 16 ga. rated access door, ULC listed "B" label for 1-1/2 or 2 hours. Door to be complete with 16 ga. mounting frame, concealed hinge, spring closer, and knurled knob operated universal self-latching bolt, similar to Acudor FB-5060.

### **3 Execution**

#### **3.1 Flashing**

- .1 Provide galvanized or aluminum sleeves for piping through roof.
- .2 Ensure that the flashing suits roof and extends minimum 450mm (18") on all sides. Leave flashing as directed by the Contractor, to be built into roofing, rendering a watertight connection.
- .3 Provide counter flashing on diesel and boiler exhaust stacks, ducts, and pipes passing through roofs to fit over flashing or curb. Coordinate with Roofing Contractor.
- .4 Sleeve pipes through waterproof floors.
- .5 Pay special attention to the waterproofing conditions of basement walls and floors. Co-operate at all times with the water proofing trade and do not cut or destroy any waterproofing seal without the consent of the waterproofing trade. Provide piping sleeves passing through waterproof walls with asphalt roofing felt wrapped around to leave 25mm by 50mm (1" x 2") recess on both sides of the wall. These recesses and the space between pipe and sleeve shall be caulked by this Division in accordance with the requirements of Division 07 – Thermal and Moisture Protection.

### 3.2 Inserts, sleeves, escutcheons and curbs

- .1 Use only factory made, threaded, or toggle type inserts as required for supports and anchors, properly sized for the load to be carried. Place inserts only in portions of the main structure and not in any finishing material.
- .2 Use factory made expansion shields where inserts cannot be placed, but only where permission is given by the Consultant.
- .3 Do not use powder-activated tools except with written permission from the Consultant.
- .4 Supply and locate inserts, holes, anchor bolts, and sleeves in time when walls, floors and roof are erected.
- .5 Sleeves shall be concentric with pipe and be minimum of 50mm (2") larger than pipe size.
- .6 Pass insulation unbroken where pipe or duct is insulated, except through fire rated walls and floors. Size sleeves to provide 13mm (½") clearance all around.
- .7 Use the following sleeving material for pipe sleeves:
  - .1 Through interior walls use Schedule 10 steel pipes, machine cut, flush with finished structure. Check room-finish schedules.
  - .2 Through exterior walls above grade use Schedule 10 steel pipes, machine cut, flush with finished structure inside and to suit flashing on outside.
  - .3 Through exterior walls below grade and other waterproof walls use extra heavy weight cast iron or PVC sleeves, machine cut. Check flashing details for further information.
  - .4 Through waterproof floors, through janitor's closets, mechanical rooms, compartment mechanical rooms, showers, kitchens, washrooms, and through roofs, use Schedule 40 sleeves, machine cut. As an alternative, copper DWV sleeves up to and including 150mm (6") sleeve size and rolled 32 ounce copper sleeves for

- larger than 150mm (6") sleeve size may be used. Extend sleeves 100mm (4") above finished floor upwards and cut flush with underside of floor. Refer to flashing details through waterproof floors.
- .5 Through other interior floors use Schedule 10 steel pipes, machine cut, flush with finished structure on both sides. Check room-finish schedules for further information.
  - .6 Ensure that watertight concrete curbs, 100mm (4") high by 100mm (4") wide with 19mm ( $\frac{3}{4}$ ") chamfered edges, are furnished around pipes passing through waterproof floors except where furred in. Read Division 03 – Concrete for further information.
  - .8 Pack spaces between the insulated pipe and the sleeve or where uninsulated, between the pipe and the sleeve, with ULC listed fire rated foam. Maintain vapour barrier on cold lines. Seal the annular space both sides as follows:
    - .1 For horizontal sleeves in exposed areas, use a seal equal to or better fire rated than the wall to be sealed. Use "Fire barrier" as distributed by Double A/D Distributors Ltd. (UL No. 4 U 18.7 approved).
    - .2 For horizontal concealed sleeves through firewalls and through walls separating areas of different air pressure, use a permanently resilient (silicone base or equal) sealing compound.
    - .3 For vertical sleeves through roofs, janitor's closets, equipment rooms, and where required to provide fire rated separation, use permanently resilient (silicone base or equal) sealing compound, non-flammable and waterproof. Ensure that the seal is compatible with floor and ceiling finishes. Check the room-finish schedules for further information.
    - .4 All fire stop materials and methods must be approved in accordance with CAN4-S115-M85, and be ULC listed.
    - .5 Seal is not required for other sleeves.

- .9 Cover exposed floor and wall pipe sleeves in finished areas with satin finish chrome or nickel plated solid brass or with satin finish stainless steel escutcheons with non-ferrous set screws. Split cast plates of the screw locking type may be used. Do not use stamped steel friction type split plates.
- .10 Use the following sleeving for ducts:
  - .1 Unless otherwise noted, use minimum 1.3mm (18 gauge) galvanized steel sleeves.
  - .2 For rectangular duct openings through walls and floors provide a removable wood box-out of the required size.
  - .3 Through firewalls, build fire dampers into wall.
  - .4 Through floors where ducts are not furred in or enclosed in a duct-shaft, ensure the 100mm (4") high by 100mm (4") wide watertight concrete curbs are provided, with 19mm ( $\frac{3}{4}$ ") chamfered edges all around. Extend sleeves where used, flush to top of curb. Read Division 03 – Concrete for further information.
  - .5 Through floors where ducts are enclosed in a duct shaft or furred in, provide the watertight concrete curbs at the extreme top and bottom ends of the shaft only.
  - .6 Through roofs, provide curbs and sleeves as shown on the detail drawings and to suit flashing requirements.
- .11 After ducts are installed, pack the opening and seal both sides as follows:
  - .1 Use fiberglass insulation for packing, except through curbed concrete floors use "Fire barrier" as distributed by Double A/D Distributors Ltd. (UL No. 4 U 18.7 Approved).
  - .2 Seal the packing in openings through floors with permanently resilient (Silicone base or equal) compound, non-flammable and waterproof. Press duct supports firmly into caulking before bolting down to curb.

- .3 Through all vertical walls seal the fibreglass packing using a permanently resilient (silicone base or equal) sealing compound.
- .4 All fire stop materials and methods must be approved in accordance with CAN4-S115-M85, and be ULC listed.
- .5 Seal is not required for other packings.
- .12 Brace duct sleeves and box-outs to retain their position and shape during the pouring of concrete and other work.
- .13 Provide bracing for each duct at every passing through structure to prevent sagging.
- .14 Cover exposed duct sleeves and openings in exposed areas only. Use 1.3mm (18 gauge) galvanized steel escutcheons in form of a duct collar. Over curbs extend the collar 25mm (1") down the side of the curb, similar to counter flashing. Fix collar in position with cadmium plated screws.

### **3.3 Access doors and panels**

- .1 Install all concealed mechanical equipment requiring adjustment or maintenance in locations easily accessible through access panels or doors. Install systems and components to result in a minimum number of access panels. Indicate access panels on "As Built" drawings.
- .2 Provide the respective Division of Work with panels, doors or the frames therefore; complete with all pertinent information for installation. Arrange with and deliver to the Division in whose work they occur to install them. Ensure that access doors are installed in a manner to match the building material grids where applicable.
- .3 Prepare detailed and coordinated drawings showing location and type of all access doors. Submit these drawings to Consultant to review.
- .4 Size all access doors to provide adequate access and commensurate with the type of structure and architectural finish, minimum size 150mm (6") by 150mm (6). Should it be necessary for persons to enter, provide a minimum 600mm (24") by 450mm (18") size doors.

.5 Ensure proper fire rating of access doors in fire separations, fire-rated walls and ceilings.

.6 Lay-in type tiles, properly marked, may serve as access panels.

### **3.4 Drip pans**

.1 Construct drip pans of min. 1.0mm (20 gauge) galvanized steel sheet with sealed connections. Provide drain lines from drip pans to nearest hub drain, funnel floor drain, janitor's sink or appropriate approved location.

.2 Provide drip pans at the following locations:

.1 Beneath all pipes passing through electrical, battery, UPS, elevator machine, diesel generator, and telephone rooms, over horizontal runs of bus ducts, and in locations as indicated on Drawings.

### **3.5 Workmanship**

.1 Install ducts and pipes parallel and perpendicular to the building planes and concealed in chases, behind furring or above ceiling, except in unfinished areas. Install all exposed systems neatly and group together, to present a neat appearance.

.2 Install all equipment and apparatus requiring maintenance, adjustment, or replacement with sufficient clearance for servicing.

**End of section**

## **1      General**

### **1.1    General**

- .1      Section 23 00 01 – General Requirements, shall apply to and govern this Section.

### **1.2    Co-ordination between new and existing installations**

- .1      Check and co-ordinate all systems in the new building addition which are extended to or from existing systems to ensure their proper operation.
- .2      Provide interfacing components between new and existing systems as necessary for proper performance and operation.

### **1.3    Penetrations in existing structure**

- .1      Do all cutting and core drilling for the Work of this Division. Obtain Consultant's approval before proceeding.
- .2      Provide sleeves and follow Consultant's instructions where necessary to completely penetrate existing floors, walls, ceiling, roof or structural members.
- .3      X-ray all proposed penetrations of concrete slabs to locate hidden services before penetrating existing structure. Advise Consultant of any interference.
- .4      Do all necessary patching and repairing. Maintain integrity of fire ratings.
- .5      Flash all parts passing through or built into a roof, outside wall or waterproof floor.
- .6      If any fire proofing material or insulation on building structure is damaged where mechanical equipment has been removed or added, Contractor to repair at this Division's expense.

#### **1.4 Use of existing material and equipment**

- .1 Test existing equipment, which is to remain in areas being renovated for proper operation. Identify required repairs in written report to Consultant.
- .2 Clean, test for proper operation and repair existing equipment to be relocated before being put back into service. Identify required repairs in written report to Consultant.
- .3 Repair or replace, without adjustment to the Contract price, all existing equipment, which is damaged in process of relocation.
- .4 Unless noted otherwise provide additional equipment of the same type and manufacturer where required to supplement existing equipment.
- .5 Review existing equipment on site to determine operating conditions prior to Tender.

#### **1.5 Salvage materials**

- .1 Remove from the site all materials in renovated areas of the existing building which are not to remain or be reused, unless noted otherwise on mechanical drawings.

#### **1.6 Existing services**

- .1 Disconnect and remove all existing products, which are abandoned.
- .2 Remove all piping, which is abandoned except inaccessible piping in furred-in space. Cut and cap piping below finished surfaces.
- .3 Allow for all work necessary to complete the alterations, rerouting and/or repositioning of existing services and equipment, and all interconnections of new and existing systems.
- .4 Verify the location and size of all existing services before proceeding with the work.
- .5 Maintain heating and cooling in the building as required to protect the building and equipment or to provide comfort conditions for the occupants.



- .6      Keep all sprinkler, standpipe and other fire and life safety protection systems in operation at all time.

### **1.7      Interruption of services**

- .1      Co-ordinate all work with the use of the building by the Owner.
- .2      Maintain all mechanical services to all parts of the building which are in use. Provide temporary services as necessary.
- .3      Obtain Owner's written approval before interrupting any service.
- .4      Request permission to interrupt services in writing not less than two (2) weeks in advance and state time(s) and duration(s) of interruptions.

### **1.8      Premium time**

- .1      Include cost of premium time in Tender Price for work during nights, weekends or other time outside normal working hours necessary to maintain all mechanical services in operation.

### **1.9      Fire protection**

- .1      Maintain fire protection at all times in accordance with governing authorities' rules and regulations.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Division 26 - Electrical will do all power wiring for equipment provided by Division 23 - HVAC.
- .2 Division 26 - Electrical will do all line side power wiring for equipment provided by Division 23 – HVAC, up to the respective starter, motor control center, control panel, disconnect or VFD, also provided by Division 23 - HVAC. Load side power wiring shall be by Division 23 - HVAC.
- .3 Division 23 – HVAC shall provide all disconnect switches for mechanical equipment as required by code. Provide weatherproof switches for all outdoor locations.
- .4 Field control wiring of local safeties and interlocks for packaged equipment shall be provided under the respective Sections unless otherwise specified.
- .5 Conduit and wiring materials and methods shall be in strict accordance with the requirements of Division 26 - Electrical.
- .6 Check all wiring diagrams and control diagrams submitted in shop drawing form. Before submitting these shop drawings to the Consultant, submit these drawings to Division 26 - Electrical Contractor for approval. Have these drawings stamped by Division 26 - Electrical Contractor as verification of their approval before forwarding to the Consultant. Co-operate in the commissioning of all electrically driven equipment with Division 26 - Electrical.

## **2 Products**

### **2.1 General**

- .1 Conduit and wiring materials and methods shall be in strict accordance with the requirements of Division 26 - Electrical.

## **3 Execution**

### **3.1 General**

- .1 Refer to Division 26 - Electrical.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Shop drawings**

- .1 Provide Shop Drawings for:
  - .1 Hangers and supports

## **2 Products**

### **2.1 Pipe attachments**

- .1 For pipe attachments, review Section 23 07 00 – HVAC Insulation, of these specifications. Otherwise, adhere to the following:
  - .1 For uninsulated fire servicing piping – ULC and FM approved -, use Taylor Fig. 41 swivel ring hanger, or approved equivalent.
  - .2 For uninsulated steel pipes, use Taylor Fig. 22Z, or approved equivalent, adjustable clevis up to and including 100mm (4") pipe size, and Taylor Fig. 24, or approved equivalent, adjustable clevis for sizes 125mm (5") and larger.
  - .3 For uninsulated copper pipes, use Taylor Fig. 56, or approved equivalent, autophoretic coated clevis hanger up to and including 100mm (4") pipe size.
  - .4 For uninsulated copper tubing, use Taylor Fig. 43, or approved equivalent, autophoretic coated swivel ring hanger up to and including 25mm (1") pipe size.
  - .5 For insulated pipes where the insulation is around the hanger and continuous vapour barrier is not required, use the same hangers as for uninsulated pipes.

- .6 For insulated pipes where hanger is around insulation, provide galvanized sheet metal insulation shield minimum 250mm (10") long, 1.3mm (18 gauge), between covering and Taylor Fig. 22Z or Fig. 24 clevis, or Taylor Fig. 24L extended clevis, or approved equivalent, sized to include insulation.

## 2.2 Upper attachments

- .1 Provide upper attachments as follows:
  - .1 Standard beam clamp for normal service, Taylor Fig. 425, or approved equivalent.
  - .2 Top beam clamp (NFPA approved), Taylor Fig. 408, or approved equivalent.
  - .3 C clamp with locknut, Taylor Fig. 301, or approved equivalent.
  - .4 Side beam bracket for light duty side mounting, Taylor Fig. 202, or approved equivalent.

## 2.3 Pipe support

- .1 For vertical adjustment of hanger rods, provide Taylor Fig. 68 forged steel turnbuckle, or approved equivalent.
- .2 Where trapeze hanger is used for a group of pipes, use Taylor Fig. 12 U bolts, or approved equivalent, except where roller type hanger is indicated on the drawings or in the specifications.
- .3 For roller type hangers on both hot and cold pipes, provide Taylor Fig. 70 to 75 protection saddles, or approved equivalent, to suit covering thickness. Use Taylor Fig. 93 adjustable roller hanger, or approved equivalent, for pipe sizes up to and including 150mm (6") over insulation. For pipes 200mm (8") and larger over insulation, use Taylor Fig. 95 adjustable 2-rod roller hanger, or approved equivalent. On trapeze hangers and where pipe is supported from below, use Taylor Fig. 280S adjustable pipe roller stand, or approved equivalent.

- .4 For vertical pipe support, provide Taylor Fig. 82Z, or approved equivalent, zinc plated steel riser clamp for steel pipe, and Taylor Fig. 86, or approved equivalent, autophoretic coated steel riser clamp for copper pipe.
- .5 For guides on vertical pipes, use manufactured pipe alignment guides (e.g. Flexonics). For horizontal pipes, use Taylor Fig. 255, or approved equivalent, pipe alignment guide. Field fabricated guides with rolled T-section welded to the pipe and guiding shoe, are also acceptable.

### **3 Execution**

#### **3.1 General**

- .1 Provide supports required for the erection and support of the mechanical work. Construct supports of steel, masonry or concrete, as noted or required. Ensure that steel supports in contact with water or high humidity are galvanized members bolted together using cadmium plated bolts, all others primed steel.
- .2 Ensure that housekeeping pads or concrete bases are provided for floor mounted equipment. Make the minimum size, 100mm (4") high for bases or pads, keyed to the floor slab, extending at least 100mm (4") all around the equipment, with 19mm ( $\frac{3}{4}$ ) chamfered edges. Where concrete is provided by Division 03 – Concrete, provide all anchor bolts and setting templates to Division 03 – Concrete.
- .3 Support suspended equipment from the bottom. Support tanks and other equipment with cast or welded steel saddles having proper curvature and inherent beam strength. Support plenums and sheetmetal type air-handling units from auxiliary frames or beams under equipment. Support fans from structural steel frames with steel base plate. Read Division 05 – Metals, for further information.
- .4 Provide supports and suspended bases having ample strength to safely carry the load under all operating conditions and during testing. Submit support and base details to the Consultant for review. Design supports except springs with a minimum factor of safety of five (5) based on ultimate tensile strength at operating temperature.

- .5 Ensure that the load onto structures does not exceed the maximum loading as shown on structural drawings or as directed by the Consultant.
- .6 Take special care in locating hangers and supports to avoid introduction of undue reaction forces onto the structure of the building, to flanges of pumps and equipment, to expansion joints and to the pipe.
- .7 Install all piping supported from hangers or supports in a manner to ensure that building construction is not weakened or over-stressed, that pipes are secure, vibration free, free to expand and contract and properly graded, and that vertical adjustment of horizontal piping is possible after erection.

### 3.2 Hangers

- .1 For structure attachments, adhere to the following:
  - .1 Support hangers directly from the structure only. Do not support pipes or equipment from other pipes, ducts, equipment, suspended ceiling, etc.
  - .2 Suspend hanger rods generally from certified inserts in concrete or by beam clamps. Before welding to steel structure members obtain prior permission of welding method from the Consultant and ensure that loads do not exceed the limit set by the Consultant. Ensure that hanging from floors and roofs made from pre-cast concrete members is from inserts originally cast into the members and provided by this contractor, or by rods passing between the members connected to a steel plate resting on the upper surface.
- .2 Sliding guides must have sliding surfaces cleaned of all dirt, paint or corrosion and, except for Teflon, have coating of graphite paste added during erection. Adjust guides to allow for free sliding at operating conditions. After assembly, provide these guides with temporary protective cover or wrapping added to keep them free of debris during extent of construction work. When piping is ready to be put into service, remove this protective covering, blow out guides clean of all debris and add paste where applicable. Care must be taken that ample clearance is provided so as not to obstruct free sliding of guide.

- .3 Install copper, brass, and stainless steel pipes with 3mm ( $1/8$ " ) thickness of di-electric packing between the pipe and the pipe attachment or use Taylor plastic coated pipe attachments.
- .4 Install guides on pipes with expansion movement next to expansion joints. Consult expansion joint manufacturer's recommendations and follow his instructions for number and spacing of guides. Use a minimum of two guides on each side of expansion joints.
- .5 Set hanger rods on steel and copper lines with expansion movement out of plumb in ambient temperature position, a distance equal to one-half pipe movement calculated from anchor point. Base movement on 25mm (1") expansion per 30m (100 ft) of pipe length and 37°C (67°F) temperature difference. Use toggle type insert of beam clamp for such locations.
- .6 Use roller type hanger only where shown on the drawings.
- .7 Install all hangers close to points where pipes change direction or where branch piping drops or rises from main.
- .8 Install vertical riser suitably anchored and guided with manufactured or fabricated guides to maintain accurate vertical position. Protect insulated pipes with 2.2mm (12 gauge) galvanized steel jacket at guides. Guide pipes with expansion movement and definite anchor points up to and including 100mm (4") sizes, at every floor or 3m (10 ft). Guide larger pipes and vertical cast iron pipes at every second floor or 7.5m (25 ft).
- .9 For horizontal cast iron, glass, or polypropylene pipes where packed or friction type mechanical joints are used, provide a support at every joint in straight runs with maximum 1.5m (5 ft) between supports. Where fittings are joined together (elbows, wyes, etc.) provide a separate support for a minimum of every second fitting.
- .10 For horizontal cast iron, pipes where screwed or bolted type joints are used, the spacing or supports may be increased not to exceed 2.4m (8 ft) between supports, but provide a support for every joint and every second fitting as described above.



- .11 Use lockwasher with single nut on all bolted connections for pipe supports, anchors, guides and support steel, or use double nuts.
- .12 During hydrostatic test on all air and vapour piping supported by springs or counterweights, install temporary rigid supports, blocking, etc., or lock the spring against movement to prevent excessive strain on piping or equipment.
- .13 Use spring hangers where vertical movement of the horizontal pipes may occur due to expansion or contraction. Refer to Sections 23 05 16 – Expansion Compensation and 23 05 48 – Vibration Isolation, for further information.
- .14 For rod hangers use round steel threaded rod supports on horizontal pipes, spaced at the following maximum intervals and having the minimum diameter as directed.

.1 For Steel Pipes:

Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN15 (½)	1,524 (5)	9 (¾)	9 (¾)
DN20 (¾)	1,829 (6)	9 (¾)	9 (¾)
DN25 (1)	2,134 (7)	9 (¾)	9 (¾)
DN32 (1- ¼)	2,438 (8)	9 (¾)	9 (¾)
DN40 (1- ½)	2,743 (9)	9 (¾)	9 (¾)
DN50 (2)	3,048 (10)	9 (¾)	9 (¾)
DN65 (2- ½)	3,048 (10)	13 (½)	9 (¾)
DN80 (3)	3,658 (12)	13 (½)	9 (¾)
DN100 (4)	4,268 (14)	16 (⅝)	13 (½)
DN125 (5)	4,877 (16)	16 (⅝)	13 (½)
DN150 (6)	5,182 (17)	19 (¾)	16 (⅝)
DN200 (8)	5,791 (19)	22 (⅞)	19 (¾)

Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN250 (10)	6,706 (22)	22 ( $7/8$ )	19 ( $3/4$ )
DN300 (12)	7,010 (23)	22 ( $7/8$ )	19 ( $3/4$ )
DN375 (15) and over	max. 7,620 (25)	to suit weight	to suit weight

.2 For Copper or Stainless Steel Tubing:

Pipe Diameter mm (in)	Horizontal Spacing of Supports mm (ft)	Single Rod Diameter mm (in)	Double Rod Diameter mm (in)
DN15 ( $1/2$ )	1,524 (5)	9 ( $3/8$ )	9 ( $3/8$ )
DN20 ( $3/4$ )	1,829 (6)	9 ( $3/8$ )	9 ( $3/8$ )
DN25 (1)	1,829 (6)	9 ( $3/8$ )	9 ( $3/8$ )
DN32 (1- $1/4$ )	2,134 (7)	9 ( $3/8$ )	9 ( $3/8$ )
DN40 (1- $1/2$ )	2,438 (8)	9 ( $3/8$ )	9 ( $3/8$ )
DN50 (2)	2,743 (9)	9 ( $3/8$ )	9 ( $3/8$ )
DN65 (2- $1/2$ )	3,048 (10)	13 ( $1/2$ )	9 ( $3/8$ )
DN80 (3)	3,048 (10)	13 ( $1/2$ )	9 ( $3/8$ )
DN100 (4)	3,658 (12)	16 ( $5/8$ )	13 ( $1/2$ )

.15 Do not use pipe hooks, chains, or perforated straps.

.16 Use angle or channel iron welded frames for trapeze hangers.

### 3.3 Anchors

.1 Design pipe anchors to restrain the movement of pipes in all directions.

- .2 Take special care in locating anchors to avoid introduction of undue reaction forces into the structure of the building, to flanges of pumps and equipment, to expansion joints and to the pipe.
- .3 Fabricate anchors and guides of structural steel channels, angles or plates secured to building structure. Size cylindrical type guides for full pipe insulation.
- .4 Submit for review by Consultant prior to installation, a detailed design prepared in conjunction with the expansion joint manufacturer for anchors, guides, and their proposed connection to the structure, including reaction forces and loads imposed on structure. All drawings must be signed by a Professional Engineer registered in the Province of Ontario. Do not proceed with installation until after receipt of reviewed drawings.

### **3.4 Duct support**

- .1 Provide all foundations and supports required for the proper erection of the ductwork. Use concrete, masonry, and steel as specified, shown or required. Provide lightweight concrete fill around buried ductwork.
- .2 Co-operate with Division 03 – Concrete and Division 05 – Metals, and coordinate the work under this Division with those Divisions to ensure that opening required in floors, walls and partitions for the ducts are provided in the exact location required.
- .3 Where possible, use beam clamps, pre-set sleeves, and inserts for attachment to or passage through work under other Divisions. Do not weld to or cut into work under other Divisions unless with the special permission of the Consultant.
- .4 Where vibration mountings are required, make necessary provisions in accordance with the recommendations of the equipment manufacturer. Refer to Section 23 05 48 – Vibration Isolation, for further information.
- .5 Install ducts securely supported from hangers or supports, in a manner to ensure that building construction is not weakened or over-stressed, that ducts are secure, free of vibration, free to expand and contract and properly graded.

- .6 Bolt steel frames to galvanized steel ducts. Rivet aluminum frames to aluminum ducts. Bolt steel frames to soldered lugs on copper ducts. Use di-electric gaskets. Bolt steel frames to welded lugs on stainless steel ducts.
- .7 Extend angles 50mm (2") to either side of ducts. For no-ferrous ducts, use di-electric gasket between duct and support. For additional stainless steel ducts use supports not directly attached to the duct. For watertight ducts, use supports not attached to the duct.
- .8 Support vertical ducts as follows:
  - .1 Support vertical ducts in duct shafts at the top and the bottom of the shafts and at every floor in between. Supply auxiliary steel structural steel, sized as required.
  - .2 Support other vertical ducts at the passage through every floor.
- .9 Support round and oval ducts using a 38mm by 3mm (1-1/2" x 1/8") split ring bolted at each end, extending minimum 75mm (3") on each side.
- .10 Support rectangular ducts using a bolted or tack welded frame on 38mm by 38mm by 3mm (1-1/2" x 1-1/2" x 1/8") angle steel.
- .11 In T-bar ceilings, attach diffusers connected to flexible duct directly to the ceiling suspension system main runners. Use this method for diffusers or mechanical items weighing less than 9 kg (20 lbs.). Support diffusers or equipment weighing more than 9 kg (20 lbs.) directly from the roof or floor.

### **3.5 Equipment support**

- .1 Place all suspended equipment on welded steel bases of up to 150mm (6") profile steel, stiffened with 3mm (1/8") checkered steel plate. Coordinate with Division 05 – Metals.
- .2 Place floor plates on 100mm (4") concrete housekeeping pads. Ensure that the load on the structure does not exceed 488 kg per square meter (100 lbs. per square feet) projected floor area within the perimeter of the supports.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 All necessary vibration isolation elements for piping and equipment, and vibration isolation bases for equipment to prevent noise levels from exceeding the room criteria listed in Table 34, Chapter 47 of the ASHRAE 2003 HVAC Applications Handbook.
  - .2 Manufacturer of vibration isolation equipment shall have the following responsibilities:
    - .1 Determine vibration isolation sizes and locations.
    - .2 Provide piping and equipment isolation systems as scheduled or specified.
    - .3 Guarantee specified isolation system deflection.
    - .4 Provide installation instructions, drawings, and field supervision to assure proper installation and performance.
  - .3 In addition to the Work covered under this Section, comply with description of individual systems and general requirements under other Sections of the Specifications.

### **1.3 Submittals**

- .1 The Contractor shall supply to the vibration control manufacturer approved drawings of all equipment to be isolated.

- .2 The vibration control manufacturer shall supply shop drawings of all vibration control components to be used on the project.
- .3 As a minimum provide the following information:
  - .1 Catalogue cuts and data sheets on specific vibration isolators to be utilized showing compliance with the specifications.
  - .2 An itemized list showing the items of equipment or piping to be isolated, the isolator type of model number selected, isolator loading and deflection, and reference to specific drawings showing base and construction where applicable.
  - .3 Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.
  - .4 Written approval of the base design to be used, obtained from the equipment manufacturer.
  - .5 Drawings showing equipment base constructions for each machine, including dimensions, structural member sizes and support point locations.
  - .6 Drawings showing methods of suspension, support guides for piping and ductwork.
  - .7 Drawings showing methods for isolation of pipes and ductwork piercing walls and slabs.
  - .8 Concrete and steel details for base including anchor bolt locations.
- .4 Submit letter from manufacturer certifying that vibration isolation and expansion compensation equipment have been installed in accordance with his recommendations and the Contract Documents, and that it operates to his satisfaction.

#### **1.4 Quality assurance**

- .1 It is the objective of this Specification to provide the necessary design for the control of excessive noise and vibration in the Building due to the

operation of machinery or equipment, and/or due to interconnected piping, ductwork, or conduit. The installation of all vibration isolation units, and associated hangers and bases, shall be under the direct supervision of the vibration isolation manufacturer's representative.

- .2 All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
- .3 All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.
- .4 The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than "10%.
- .5 All neoprene mountings shall have a Shore hardness of 30 to 60 "5, after minimum aging of 20 days or corresponding oven-aging.
- .6 All grooved joint couplings and specialties shall be the products of a single manufacturer.

## **2 Products**

### **2.1 General**

- .1 All vibration isolation devices shall be the product of a single manufacturer.

### **2.2 Type A Spring isolators**

- .1 Minimum diameter of 0.8 of the loaded operating height and horizontal spring stiffness 1.1 times rated vertical spring stiffness. Corrosion resistance where exposed to corrosive/outdoor environment shall be with:
  - .1 Springs neoprene coated.



- .2 Hardware cadmium plated.
- .3 All other metal parts hot-dip galvanized.
- .2 Reserve deflection, from loaded to solid height, of 50% of rated deflection with levelling device.
- .3 Minimum 6mm (1/4") thick neoprene acoustical base pad on underside, unless designated otherwise.
- .4 Designed and installed so that ends of springs remain parallel.
- .5 Non-resonant with equipment forcing frequencies or support structure natural frequencies.
- .6 Type A spring isolators to be Mason Type SLF or as approved.

### **2.3 Type B Spring isolators**

- .1 Isolators shall be same as Type A, except:
  - .1 Provide built-in resilient vertical limit stops.
  - .2 Provide tapped holes in top plate for bolting to equipment.
  - .3 Isolators shall be capable of supporting equipment at a fixed elevation during equipment erection.
- .2 Type B spring isolators to be Mason Type SLR or as approved.

### **2.4 Type H Combination spring/elastomer hanger rod isolators**

- .1 Isolators shall incorporate the following:
  - .1 Spring and neoprene isolator elements in a steel box retainer.
  - .2 Characteristics of spring and neoprene as described in Type C and Type D hanger isolators.
- .2 Type H isolator to be Mason Type 30N or as approved.

## 2.5 Mounting types and static deflection schedule

Equipment Types	Base Type	Isolator Type	Static Defl. mm (in.)
Piping (see specifications)			
Floor Supported	-	B	25mm (1")
Suspended	-	H	32mm (1-¼")
Curb Mounted Roof Equipment	(1)	(3)	per lowest fan speed

### .1 Notes:

- .1 Base as recommended and/or provided by manufacturer.
- .2 Same as connected pump.
- .3 Spring isolator complying with Type A.

## 3 Execution

### 3.1 General

- .1 Have all materials and systems for vibration isolation designed and supplied by one company, referred to in this Article as the 'manufacturer'. Install in accordance with manufacturer's written instructions. Vibration isolators must not cause any change or position of equipment or piping resulting in piping stresses or misalignment.
- .2 Provide through the manufacturer all vibration isolation equipment work and measures to prevent the transmission of objectionable vibration to the building structure and from one area to another area. Provide all necessary drawings indicating isolator locations and base dimensions. Have the installation directed and supervised by the manufacturer. Supply to the manufacturer the necessary copies of all drawings of equipment to be isolated.
- .3 Consider the areas classified as follows for selection of vibration control devices:

- .1 Mechanical rooms or equipment locations in basement or sub-basement areas only and not bordering areas regularly occupied are 'non-critical'.
- .2 Mechanical rooms or equipment locations bordering habitable suites, boardrooms, conference rooms, private offices are 'ultra-critical'. This shall include all mechanical penthouses and all mechanical compartment rooms.
- .4 All piping DN40 (1-½") and over located in mechanical equipment rooms, and for a minimum of 12.2m (40 ft) or 100 x pipe diameters, whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of noise and vibration isolation hangers, Type H with 32mm (1-¼") static deflection.
- .5 All piping and ductwork to be isolated shall freely pass through walls and floors without rigid connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain 20mm (¾") to 32mm (1-¼") clearance around the outside surfaces. This clearance space shall be tightly packed with fiberglass, and caulked airtight after installation of piping or ductwork.
- .6 No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified.
- .7 Electrical conduit connections to isolated equipment shall be flexible to allow free motion of isolated equipment.
- .8 Do not install any equipment, piping, or conduit, which makes rigid contact with the building unless permitted in this Specification. Building includes, but is not limited to, slabs, beams, columns, studs, and walls.
- .9 Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.
- .10 Bring to the Consultant's attention prior to installation any conflicts with other trades, which will result in unavoidable rigid contact with equipment

or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

- .11 Obtain inspection and approval of any installation to be covered or enclosed, prior to such closure.
- .12 Thrust restraints shall consist of Mason Type WB or approved equal with the same deflection as specified for the spring mountings. The spring element shall be designed so it can be preset for thrust and adjusted to allow for a maximum of 6mm (¼") movement at start, stop, and normal operation.
- .13 Diagonal restraints shall be attached at the centerline of thrust, and shall be Mason Type WB, or as approved.
- .14 Vertical piping loads, including water strainers, valves between pump base elbow supports and the suction and discharge header piping, shall be supported by the pump base spring isolators without stress or strain to the pump housing.
- .15 Correct, at no additional cost, all installations, which are deemed defective in workmanship or materials.

### **3.2 Equipment Isolators**

- .1 Mount floor mounted equipment on 100mm (4") concrete housekeeping pads over complete floor area of equipment. Mount vibration isolating devices and related inertia blocks on concrete pad.
- .2 Each fan and motor assembly shall be supported on a single structural steel frame. Provide all ductwork connected to vibration-isolated equipment at both inlet and outlet with flexible connectors having sufficient length and flexibility to eliminate vibration transmission and to not short circuit the effectiveness of the vibration isolation. Make flexible connections of glass fibreglass cloth sleeves, sealed to prevent air leakage. Install a minimum length of flexible connection on both sides equal to static pressure of the fan in inches but not less than 150mm (6").

- .3 The machine to be isolated shall be supported by a structural steel frame or concrete inertia base.
- .4 Brackets shall be provided to accommodate the isolator. The vertical position and size of the bracket shall be specified by the isolation manufacturer.
- .5 The minimum operating clearance between the equipment frame or rigid steel base frame and the housekeeping pad or floor shall be 25mm (1"). Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 50mm (2").
- .6 The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
- .7 The isolators shall be installed without raising the machine and frame assembly.
- .8 After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
- .9 Isolation mounting deflection shall be the minimum as specified or scheduled on Drawings.
- .10 Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 6mm (¼").
- .11 Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base or isolators.

### **3.3 Piping isolators**

- .1 All piping isolators are included under this Section.
- .2 Isolate piping outside the shafts as follows:

- .1 All water piping in machine rooms, including strainers, filters, valves and associated equipment with water systems.
- .2 Piping and associated equipment where exposed on roof.
- .3 Water piping within 12.2m (40 ft) or 100 x pipe diameters, whichever is greater, from connected rotating equipment.
- .3 The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, the main structural elements of the building.
- .4 The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.
- .5 Hanger rods shall be aligned to clear the hanger box.
- .6 Horizontal suspended pipe DN50 (2") and smaller and all steam piping shall be suspended by Type E isolator with a minimum 6mm (¼") deflection. Water pipe larger than DN50 (2") shall be supported by Type H isolator with a minimum 32mm (1-½") static deflection.
- .7 Horizontal pipe floor supported at slab shall be supported via Type A or B, with a minimum static deflection of 25mm (1") or same deflection as isolated equipment to which pipe connects whichever is the greater.
- .8 Vertical riser pipe supports shall utilize Type H hanger or similar spring and neoprene detail.
- .9 Pipe guides, where required, shall utilize resilient pipe guides, Mason Type ADA or equivalent, to avoid direct contact of piping with building.
- .10 Pipe sway braces, where required, shall utilize two (2) neoprene elements (type D to accommodate tension and compression forces).
- .11 Pipe extension and alignment connectors: Provide connector at riser takeoffs, cooling and heating coils, and elsewhere as required to accommodate thermal expansion and misalignment.

### **3.4 Isolator position**

- .1 Close to building structure.

- .2 Between building structure and supplementary steel if required.
- .3 Suspend isolators from rigid and massive support points.
- .4 Supplementary steel to be sized for a maximum deflection of 1.6mm ( $1/16$ "") at center span.
- .5 Support piping in shafts and floor supports entering shaft with Type B isolators or Type H hangers depending on piping loads and support point space conditions within shafts.
- .6 Guide piping in shafts as required with approved mounting designs incorporating Mason Type ADA mountings to building. Prevent direct contact of piping with building structure.

### **3.5 Manufacturers review**

- .1 On completion of installation of all vibration isolation devices herein specified, the noise control manufacturer shall inspect the completed system, check the vibration levels in the areas as requested by the Consultant, and report in writing any installation error, improperly selected isolation devices, or other faults in the system that could affect the performance of the system. A written report shall be submitted outlining corrective work necessary to comply with the above specifications. Corrective work shall be the responsibility of the Division 23 – HVAC Contractor.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

## **2 Products**

- .1 Not Used

## **3 Execution**

### **3.1 Pipe systems**

- .1 After finished painting is complete, identify each pipe with stencils and stencil paint. Alternatively, use SMS Coil-Mark or adhesive style building service pipe markers.
- .2 Use capital letters minimum 51mm (2") high for DN80 (3") diameter piping or larger, including insulation, and 19mm ( $\frac{3}{4}$ ") size capital letters on smaller diameters.
- .3 Use flow arrows to indicate direction of flow. Use double arrow where flow is reversible. Arrow shall be solid black or white; minimum 152mm (6") long by 51mm (2") wide for DN80 (3") diameter piping or larger, including insulation, and 102mm (4") long by 19mm ( $\frac{3}{4}$ ") wide on smaller diameters.
- .4 Locate identification and flow arrows as follows:
  - .1 Behind each access door.
  - .2 At each change of direction and take-off.
  - .3 Not more than 12.2m (40 ft) apart on all pipes exposed and/or located behind accessible ceiling.
  - .4 On both sides of sleeves.



- .5 Adjacent to valves.
- .6 Above each floor or platform for vertical exposed pipes approximately 1,524mm (5 ft.) above floor.
- .5 Stenciling to be performed in a neat, quality manner. Upon completion of project, provide one complete set of stencils used for Owner.
- .6 Use wording shown on Legend on Drawings or as instructed by the Consultant. Special system designations and abbreviations shall be submitted to Consultant for approval prior to use.
- .7 Colour coding to be as per the following schedule. For all other services, provide colour coding in conformance with CAN/CGSB-24.3 and ANSI A131.

<b>Marker Legend</b>	<b>Classification</b>	
	<b>Primary</b>	<b>Secondary</b>
<b>Description and Service</b>		
Condensate	Yellow	Black
Low Pressure Steam (103 kPa / 15 psi Or Less)	Yellow	Black
High Pressure Steam (Above 103 kPa / 15 psi)	Yellow	Black
Natural Gas	Yellow	Orange

- .8 Use primary colours for full length of piping or in minimum 914mm (36") long sections; use minimum 457mm (18") long sections on each side of valves. Use secondary colours in min. 51mm (2") wide bands.
- .9 Install pipe identification in accordance with the manufacturer's recommendations.

### 3.2 Valves

- .1 Supply and attach to each valve a lamacoid tag 32mm (1-1/4") in diameter or 38mm (1-1/2") square, similar to SMS RP/SP-1500 series. The system code to be 5mm (3/16") high characters on the top line, valve numbers to

be 9mm ( $3/8$ " ) high on the bottom line. Tags to be colour coded in conformance with piping system colours as per CAN/CGSB-24.3.

- .2 Attach tag to valve with a brass chain.
- .3 Schedule the valve numbers using a sequential numbering system.
- .4 Prepare and submit valve directories and charts giving number, size, location, purpose, and normal position (opened or closed) for each valve.
- .5 Provide two (2) framed copies of the valve charts and locate where directed by the Consultant.
- .6 All control, drain, and test connection valves shall be provided with signs indicating their purpose.

### 3.3 Equipment

- .1 Identify all fans, pumps, controls, starters, switches, pushbuttons, and all other equipment as to service by a white lamacoid engraved nameplate on black background. Submit sample plates and lettering to the Consultant. Attach plates only after all painting work is completed. Use mechanical fastening devices acceptable to the Consultant.
- .2 Manufacturer's nameplates shall be affixed to all equipment, serial number and all information usually provided, including voltage, cycle, phase, motor power, etc., name of the manufacturer and his address. All stamped etched or engraved lettering on plates shall be perfectly legible. Do not paint over nameplates and, where apparatus is to be concealed, attach the nameplates in an approved location on the equipment support or frame.
- .3 Identify all equipment with the corresponding remote controls.
- .4 Equipment plates shall have 9mm ( $3/8$ " ) capital letters; starter plates shall have 3mm ( $1/8$ " ) capital letters. All plates shall be sized to accommodate required description. Locate plates conspicuously and secure with self-tapping sheet metal screws where possible, or with double sided adhesive tape. Recognizable abbreviations will be acceptable, other proposed abbreviations to be approved by Consultant.

### **3.4 Ductwork**

- .1 Identify all ductwork with 51mm (2") high stencils using black or white ink to contrast surface being identified.
- .2 Identification location shall conform to guidelines for pipe systems, and shall indicate flow medium, function, and direction.
- .3 Stenciling to be performed in a neat, quality manner. Upon completion of project, provide one complete set of stencils used for Owner.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 General requirements**

- .1 Test, balance and adjust all systems to the Drawings and Specifications, in accordance with the intent and requirements of the ASHRAE Guide - Testing, Adjusting and Balancing (Chapter 37, 2003 ASHRAE Application Handbook).

### **1.3 Qualification**

- .1 The Testing, Balancing and Adjusting (TAB) Contractor must be a member in good standing with the National Environmental Balancing Bureau (NEBB) or the Associated Air Balance Council.

### **1.4 Scope of work**

- .1 The TAB Contractor shall:
  - .1 Within fourteen (14) days after award of contract, submit proof of certification for AABC or NEBB.
  - .2 Within thirty (30) days after award of contract, submit a report to the consultant summarizing the TAB Contractor's comments and recommendations regarding their review of the contract documents. Meet with the Contractor, Owner and Consultant as necessary to discuss.
  - .3 Within thirty (30) days after contract award, submit an outline of proposed TAB procedures, or alternatively, provide a copy of the latest edition of AABC or NEBB Procedural Standards.
  - .4 Conduct ongoing reviews of all related construction documentation, including co-ordination drawings and shop drawings.

- .5 Visit the site a minimum of once per month during construction, commencing when the pipe and/or duct installation starts. Submit a written report to the Consultant, including date of visit, areas observed, and any anticipated problems, which could adversely affect the TAB work.
- .6 Prior to commencing the TAB work, the TAB Contractor shall submit the list of instruments he will use on the project, together with a record of calibration dates and procedures.
- .7 Perform all prebalancing work as specified in respective procedures.
- .8 Furnish all TAB labour, instruments and services necessary to complete the TAB work for air systems and water systems to achieve the required air and water flow rates. For fans with fixed drives, provide preliminary balance for first set of sheaves, advise Division 23 – HVAC Contractor of results, install new sheaves, and rebalance system following installation of second set of sheaves. Adjust adjustable drives for required rpm and airflow. Adjust VAV box minimum and maximum airflows. Adjust and set all volume control devices to achieve proper air distribution, pressures and patterns in all parts of supply return and exhaust air systems. Adjust and set all pumps, balancing valves and other flow devices to achieve optimum water distribution in all parts of the circulating water systems.
- .9 Document any deficiencies that prevent the system from being properly balanced and advise Division 23 – HVAC Contractor. Rebalance all affected systems following correction by the Division 23 – HVAC Contractor at no additional cost to the Owner.
- .10 Record the existing capacities of all existing fans, pumps, main duct branches, and partial systems remaining as part of the renovated work, before demolition occurs. Provide a separate report to the Consultant summarizing all measurements.

- .11 Balance all existing air and water systems altered under this project in accordance with values on the drawings and/or predemolition measurements made by the TAB Contractor.
- .12 Report on any noise and vibration problems that are discovered during the course of balancing.
- .13 Submit a Balancing Report to the Consultant.
- .14 Repeat the balancing procedures for up to 10% of the system at the request of the Consultant. Should the retest data differ by more than  $\pm 5\%$  from the originally reported values, the TAB Contractor shall be obligated to repeat the balancing of the entire system or systems at no additional cost to the Owner, if so requested by the Consultant.
- .15 Include for premium time where schedule requires that TAB work be undertaken after hours.

## 1.5 Co-ordination

- .1 The Division 23 – HVAC Contractor shall be responsible to ensure that all systems are complete and ready for testing, balancing and adjusting by the TAB Contractor. The Division 23 – HVAC Contractor shall:
  - .1 Confirm the complete operational readiness of the building, including sealed walls, doors, and ceilings to allow the balancing to be performed and required pressures to be set and maintained.
  - .2 Allow access to all components requiring testing, balancing, and servicing. This includes permanently installed ladders and catwalks.
  - .3 Maintain a construction schedule that allows the test and balance (TAB) firm to complete contract work prior to occupancy.
  - .4 Verify the installation conformity to the design drawings and specifications.
  - .5 Promptly correct deficiencies of materials and work that may delay completion of the TAB work.

- .6 Provide operation and maintenance manuals. Manuals must include the following:
  - .1 The manufacturers' method for adjusting and setting components for correct operation under actual load conditions.
  - .2 The manufacturers' recommended tolerance for maximum and minimum operating conditions.
  - .3 The recommended correction or  $A_k$  factors, to allow adjustment of flow, rpm, etc.
  - .4 A list of spare parts, identification numbers, and diagrams of their proper locations.
  - .5 Pressure drops for air and hydronic flows through the component or unit at design flow rate.
- .7 Start up all HVAC systems, according to the following conditions:
  - .1 Proper lubrication of rotating or sliding parts is verified.
  - .2 Motors, fans, and all HVAC equipment have the correct rotation.
  - .3 Installation of the correct drive (package) is checked.
  - .4 Belt tension is appropriate for the type of drive.
  - .5 Vibration isolators and bases are properly installed and are the correct type.
  - .6 Smoke and fire damper operation (left in full open position) is correct.
  - .7 Volume and control dampers (left in a neutral or wide-open position) function properly.
  - .8 Verification that duct-leakage test has been performed and ducts are sealed to the minimum tolerance specified.

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- .9 Verification that all registers, grilles, and diffusers are of the correct type, are properly installed, and are in the open position.
  - .10 Verification that all terminal boxes are the correct type and are properly installed according to the manufacturer's recommendations.
  - .11 Verification that motors, starters, and variable speed controllers with overload safety devices are the correct size and are operating properly.
  - .12 Verification that automatic controls are installed correctly and include all components specified, including interlocks, freeze stats, damper controllers, minimum positioning switches, control valves, actuators, and sensors.
  - .13 Verification that hydronic pumps and related components are properly installed and operate correctly.
  - .14 Verification that strainers are clean and that the system is vented and free of air.
  - .15 Verification that expansion tanks are properly installed and working.
  - .16 Verification that coils are piped correctly and are clean.
  - .17 The motor, amps, volts, and rpm, are compared with nameplate data and are adjusted within a motor-rated hp or amperes.
  - .18 Verification that fan and pump power and speed are within design range.
  - .19 Verification that the controls are complete and operational.
  - .20 Verification of the correct type, quantity, and cleanliness of installed filters.
- .2 During testing and balancing; the Division 23 – HVAC Contractor shall:



- .1 Operate and maintain all systems requiring balancing during the balancing period.
  - .2 Ensure that the control system responds to the testing and balancing requirements. Provide all necessary personnel, equipment and software to make adjustments to controls as required to achieve design condition.
  - .3 Furnish and install drives and motors as required to accomplish design requirements.
  - .4 Provide all equipment, labour, instruments and incidentals and pay for all power and fuel to carry out the tests.
- .3 Start-Up Report:
- .1 The Contractor shall provide a copy of a detailed start-up report, including initial tabulated data required for the start-up of systems, to the test and balance agency for reference in the balancing work.
- .4 Joint effort of Contractors:
- .1 Upon completion of balancing, the TAB Agency shall provide flows, pressures, and temperatures to the control contractor for final calibration of the automatic control system. The Control Contractor shall provide access to computerized data and equipment and/or provide operating personnel.
  - .2 After balancing, the TAB Agency shall provide water flow rates, etc. to the chiller, cooling tower, and boiler suppliers for final setup and performance verification.

## 2 Products

- .1 Not Used

### **3 Execution**

#### **3.1 General**

- .1 TAB work shall be undertaken in accordance with the following descriptions. Procedures not specifically described herein or requiring amplification shall be in accordance with AABC or NEBB standards, as applicable.

#### **3.2 Air system balancing**

- .1 Air quantities in main ducts shall be measured by Pitot tube traverses of the entire cross section area of the duct. Openings in ducts for Pitot tube insertion shall be sealed with approved plugs. Outlet and inlet air quantities shall be determined in accordance with AABC/NEBB procedures.
- .2 Total air quantities shall be obtained by adjustment of fan speeds. Branch duct air quantities shall be adjusted by volume dampers. Damper positions shall be permanently marked after TAB work is complete.
- .3 For systems handling outdoor air, the system shall be balanced at the normal minimum outdoor air condition. Where the system is designed to deliver 100% return air or a variable amount of outdoor air, the total airflow tests shall be repeated for 100% maximum outdoor air and shall agree with conditions measured under minimum outdoor air operation before the system is considered to be in balance.
- .4 Adjusting of individual outlets shall be performed as per AABC/NEBB procedures or as otherwise approved by the Consultant. Outlets shall be set for the air pattern required and all main supply air dampers shall be adjusted and set for the design indicated. All required changes in air patterns or setting necessary to achieve correct air balance and to minimize drafts shall be performed by the TAB Contractor.
- .5 All measured air quantities shall be within  $\pm 5\%$  of design air quantities where achievable.
- .6 Each Variable Air Volume (VAV) supply and return air terminal unit shall be adjusted to deliver the maximum and minimum air quantities specified

in all specified modes of operation. (Use the prescribed procedures for each type terminal device). The individual supply outlets for each zone shall be adjusted after the respective control unit is manually set (Pneumatic and/or Direct Digital Control (DDC)) to design airflow settings (Minimum and Maximum). Factory calibration of all types of VAV and High Velocity Fan Powered/Reheat Units shall be verified and reset as required by the TAB Contractor.

- .7 The TAB Contractor shall perform the test and compile the data required. In addition to the tabulation forms, the TAB Contractor shall provide schematic diagrams showing all system components cross-referenced to form tabulations. The lists provided hereinafter shall be considered minimum requirements. All information required to prove system balance shall be provided by the TAB Contractor.

- .8 Air Handling Equipment Tests and Data

- .1 Tabulate design conditions from documents and installed conditions from shop drawings:
  - .1 Fan, unit or system number.
  - .2 Location.
  - .3 Area served.
  - .4 Manufacturer, model and serial number of air unit, motor(s), pulley and belts.
  - .5 Motor nameplate power (kilowatts), amperage, voltage, phase, hertz, frame type, and service factor.
  - .6 Sheave Manufacturer, model number, grooves, and pitch diameter, adjustable or fixed. Include pitch diameter settings on adjustable sheaves.
  - .7 Fan and motor rpm.
  - .8 Fan or unit static pressure profile. Measure and record pressure differentials across coils, filters, dampers, etc.

- .9 Total airflow, Outdoor Air, Return Air, Exhaust Air, Relief Air, and Outlet Air (Maximum and Minimum).
  - .10 Terminal Manufacturer and type.
  - .11 Outlet or inlet size, effective area and  $A_k$  Factor, except when using a direct reading flow hood.
  - .12 Design temperature differences.
  - .13 Design brake horsepower (kilowatts).
  - .14 Check that stratification has been eliminated before taking measurements. Make temperature traverse readings after each mixing compartment. Advise Division 23 – HVAC Contractor if any stratification is present.
- .2 Tabulate from equipment field tests.
- .1 Fan and motor rpm.
  - .2 Motor amperage for each phase.
  - .3 Voltage for each phase.
- .3 Tabulate from air data from field test (for each required condition).
- .1 Total air quantity for each outlet or inlet and for Supply air, Return Air, Exhaust Air, Relief Air and Outdoor Air for each system.
  - .2 Pressure reading at most distant point of system (Pa / mm w.g. for VAV systems only).
  - .3 Pressure drops across filters, boxes, coils and air-to-air heat exchangers.
  - .4 Supply, Return and Exhaust fan pressure differentials.
  - .5 Temperature differences across coils and air-to-air heat exchangers.

- .6 Traverse locations and grid with actual velocities. Record duct static pressure at each traverse location. Provide traverses at all points necessary for balancing.

### 3.3 Demonstration

- .1 At the request of the Consultant, the Balancing Contractor shall repeat the balancing procedure for any system or portion of a system. The Balancing Contractor shall repeat the balancing procedure on 10% (as selected by the Consultant) of systems. If the data is within  $\pm 5\%$  of the reported data, the system shall be considered acceptable and the report accepted. If the data is not within  $\pm 5\%$  of the reported data, the Consultant can request that the entire system or systems be rebalanced.

### 3.4 Reports

- .1 Submit written reports, during the course of construction, of potential developing problems relating to the work being provided under other sections of the specifications where such problems may adversely effect the proper balancing of the equipment or systems.
- .2 Submit written reports for review upon completion of each major phase of the balancing work.
- .3 The TAB Contractor shall prepare and submit three (3) copies of the Balancing Report to the Consultant for review and evaluation prior to final acceptance of the project. The Balancing Report shall include the data outlined above, but may be expanded or modified to be compatible with the requirements of the installed equipment and systems.
  - .1 The cover of the TAB Report must show the "AABC" or "NEBB" Logo, Name and Address of the project, Architect, Mechanical Engineer, Installing Contractor, Date the report is issued, Address and Phone Number of the TAB Contractor. The AABC/NEBB Seal and Signature of the TAB Supervisor who is in charge of the reported project must be submitted on the "Certification" Report Form (TAB 2-98)/
  - .2 Identification of all types of instruments used and their last dates of calibration shall be submitted with the Final Report.

- .3 Once Consultant's comments have been incorporated in the report, submit four (4) copies of the Final Report to the Consultant.

### **3.5 Quality assurance**

- .1 The AABC/NEBB Tab Contractor shall guarantee that all work will be performed in accordance with the applicable AABC/NEBB Standards and Procedures. The TAB Contractor Certification Number must be provided to the Consultant.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 – General Requirements, shall apply to and govern this Section.
- .2 All insulation shall comply with minimum R-value requirements listed in ASHRAE Energy Standard 90.1, latest edition.
- .3 All insulation materials and installation must meet the requirements of applicable codes and standards, and be appropriately labeled.

### **1.2 Submittals**

- .1 Submit Shop Drawings for:
  - .1 Insulation products.
  - .2 Recovery jackets.
- .2 Submit samples of all insulation materials to Consultant mounted on a board, and labeled for intended services, including 'K' factors. Obtain Consultant's comments prior to ordering insulation and proceeding with the installation.

### **1.3 Scope of work**

- .1 Piping insulation.
- .2 Equipment insulation, including tanks.
- .3 Breeching insulation.
- .4 Thermal duct insulation.
- .5 Adhesives, tie wires, tapes.
- .6 Recovery jackets.

## **2 Products**

### **2.1 Material and installation**

- .1 Unless otherwise noted, insulating materials are based on Knauf Fiber Glass GmbH.
- .2 All insulation materials, adhesive sealants and coatings, shall be ULC listed, non-hygroscopic, and mould-proof.
- .3 Insulation materials shall not flame, smolder, glow or smoke at their service temperatures.
- .4 Use insulation material rated as follows:
  - .1 For fluids up to 121°C (250°F) and steam up to 103 kPa (15psi): rated at 121°C (250°F).
  - .2 For fluids over 121°C (250°F) and steam up to 1380 kPa (200psi): rated at 232°C (500°F).
  - .3 For boiler breeching, diesel generator muffler and exhaust piping up to 650°C (1200°F).
  - .4 For cold fluids: rated for -40°C (-40°F) and 121°C (250°F).
- .5 Cover expansion joints first with a 0.7mm (24 gauge) galvanized metal sleeve and then insulate to provide equivalent thickness to that on adjoining pipe.
- .6 Apply all insulation in a manner to facilitate replacing and/or servicing of equipment.
- .7 All insulation system materials inside the building must meet the requirements of NFPA 90A, with a flame spread rating of less than 25, and smoke developed rating of less than 50, when tested in accordance with CAN/ULC-S102.
- .8 Make good and refinish cracks, undulation or any other deficiencies occurring in the insulation or vapour barrier. Priming or painting of insulation will be done under Division 09 – Finishes.



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- .9 Canvas jackets shall comprise 1.83kg/m<sup>2</sup> (6oz./sq.ft) plain weave cotton fabric sealed with dilute fire retardant, waterproof, ULC listed lagging adhesive.
  - .10 PVC recovery jackets shall be 0.51mm (0.020") thick with longitudinal slip joints and 0.51mm (0.020") thick one piece premolded PVC fittings, off-white in colour.
  - .11 Aluminum recovery jackets shall be 0.4mm (26ga.) thick smooth aluminum jackets with longitudinal slip joints with 0.5mm (24ga.) thick preformed fittings with factory attached protection liner on interior surface.
  - .12 The following areas are designated as "exposed" where the term is applied to covering:
    - .1 Mechanical and electrical equipment rooms, penthouses, parking garage, loading dock, shipping/receiving areas.
    - .2 Mechanical plenum spaces.
    - .3 Below suspended ceiling level in occupied areas or below slab where no ceiling occurs.
    - .4 Duct shafts and/or pipe shafts serviced via "walk-in" type access doors.
    - .5 Crawl spaces, tunnels.
  - .13 Cover duct and pipes exposed to weather or dampness with 75mm (3") thick insulation and a final application of Denso waterproof self-adhesive fiberglass tape adequately overlapped to render it water tight. The following areas are designated as "exposed to weather or dampness" and are applicable for this treatment:
    - .1 Air intake, relief, and exhaust plenums directly connected to the outside of the building.
    - .2 Underground service trenches.
    - .3 Buried below ground level.

- .4 Areas subject to high humidity.
- .5 Ductwork and piping exposed on the roof.

## 2.2 Cold piping

- .1 Cover 'cold' piping with rigid type fiberglass dual temperature 72kg/m<sup>3</sup> (4.5lbs/ft<sup>3</sup>) nominal density insulation with factory applied fire resistive fibreglass reinforced vapour barrier jacket and aluminum foil vapour barrier with self-sealed lap. Butt joints sealed with butt strips or aluminum tape. Recover pipe in exposed areas with canvas or PVC jacket.
- .2 Insulation thickness shall be as specified on mechanical drawings.
- .3 Wrap valves and inline components with 19 kg/m<sup>3</sup> (1.15lbs/ft<sup>3</sup>) density flex duct insulation, under compression at 2 to 1 ratio. Recover in exposed areas with canvas or PVC jackets.
- .4 Insulate over flanges and mechanical couplings with specified insulation and thickness, sized to suit flange diameters. Fill spaces between insulation and adjoining pipe insulation with similar material. Recover in exposed areas with canvas or PVC jackets.
- .5 Cover the first 150mm (6") of hanger rods directly connected to the piping, with block or sectional insulation. Finish to match jacket on piping. Recover in exposed areas with canvas jacket.
- .6 Cover all insulated electrically traced piping and equipment exposed to the outside, with weatherproof aluminum jacket.

## 2.3 Hot piping

- .1 Cover 'hot' piping with rigid type fiberglass 72kg/m<sup>3</sup> (4.5lbs/ft<sup>3</sup>) nominal density insulation with factory applied fire resistive fibreglass reinforced white kraft paper jacket bonded to aluminum foil vapour barrier with self-sealed lap. Hold insulation in place with flare type staples. Recover pipe in exposed areas with canvas or PVC jacket.
- .2 Insulation thickness shall be as specified on mechanical drawings.

- .3 Wrap valves and inline components with 19 kg/m<sup>3</sup> (1.15lbs/ft<sup>3</sup>) density flex duct insulation, under compression at 2 to 1 ratio. Recover in exposed areas with canvas or PVC jackets.
- .4 Insulate over flanges and mechanical couplings with specified insulation and thickness, sized to suit flange diameters. Fill spaces between insulation and adjoining pipe insulation with similar material. Recover in exposed areas with canvas or PVC jackets.

## 2.4 Ducts

- .1 Insulate round supply ducts up to 750mm (30") diameter and rectangular supply ducts up to 750mm (30") width with 25mm (1") thick fiberglass reinforced foil faced 19kg/m<sup>3</sup> (1.15lbs/ft<sup>3</sup>) density flame resistant flexible duct insulation. Adhere insulation to duct surface with adhesive applied in strips 150mm (6") wide on 300mm (12") centres. Use fiberglass tying cord or 16 gauge annealed wire until the adhesive sets. Butt edges of insulation tightly together, and seal all breaks and joints with self-adhering aluminum tape.
- .2 Insulate round supply ducts over 750mm (30") diameter and rectangular supply ducts over 750mm (30") width with 25mm (1") thick fiberglass reinforced foil faced 48kg/m<sup>3</sup> (3.0lbs/ft<sup>3</sup>) density flame resistant rigid duct insulation board. Fasten the insulation with welded pins and speed washers on maximum 300mm (12") centres. Use a minimum of two (2) rows of fasteners per side. Butt edges of insulation tightly together, and seal all breaks and joints with self-adhering aluminum tape.
- .3 Where angles or standing seams extend beyond the insulation and before the final finish, apply a compressed layer of 25mm (1") fiberglass faced flexible duct insulation 19kg/m<sup>3</sup> (1.15lbs/ft<sup>3</sup>) density over the angles and standing seams. Extend the insulation 75mm (3") on each side of the angle and place tightly around the projecting leg of the angle. Apply the insulation overlapping the edge so that the vertical part of the insulated angle will project throughout the work.
- .4 Where interior acoustic insulation is required, decrease the exterior insulation by equal thickness. Overlap the exterior insulation by at least 300mm (12"), upstream and downstream.

- 
- .5 Finish ductwork in exposed areas with canvas jacket.
  - .6 Apply vapour barrier over insulation on cold and dual temperature ducts.
  - .7 Insulate all ductwork exposed to the outside with 75mm (3") insulation and weatherproof aluminum jacket.
  - .8 Insulate the following duct:
    - .1 Air conditioning supply ducts from apparatus casings to air terminal control units, reheat coils, or duct termination.
    - .2 Tempered air supply ducts in unheated space.
    - .3 All rigid supply ducts downstream from air terminal control units, reheat coils and fan coils.
  - .9 Air intakes and exhaust:
    - .1 Insulate with fiberglass reinforced foil faced 48kg/m<sup>3</sup> (3.0lbs/ft<sup>3</sup>) density flame resistant rigid vapour seal insulation board.
    - .2 Impale the insulation in place with suitable speed washers or clips. Where angles or standing seams extend beyond the insulation, apply a compressed layer of 25mm (1") 19kg/m<sup>3</sup> (1.15lbs/ft<sup>3</sup>) density flexible duct wrap over the angles and standing seams. The wrap shall extend 75mm (3") on each side of the angle and placed tightly around the projecting leg of the angle. Apply the insulation overlapping the edge of the wrap on the angle so that the vertical part of the insulated angle will project throughout the work.
    - .3 Seal all breaks and joints by adhering a 75mm (3") aluminum foil vapour barrier tape with fire retardant adhesive. Cover with canvas adhered with resin base lagging adhesive. Finish with one coat of the same lagging adhesive.
    - .4 Insulate the following intakes and exhaust:
      - .1 All outdoor air intake ductwork from outside louvres to mixing plenum of air handling unit or to motorized damper in other systems in 50mm (2") thickness.

- .2 All exhaust and relief ductwork from outside louvres back 1.5m (5 ft) upstream of motorized dampers or where there are no motorized dampers, from louvre to fan discharge in 50mm (2") thickness.
  - .3 Mixed air plenums in 50mm (2") thickness.
  - .4 Behind unused portion of louvers in 50mm (2") thickness.
- .10 Ensure that access doors of casings and plenums are supplied pre-insulated. Do not apply additional insulation.

### **3 Execution**

#### **3.1 Application**

- .1 Do not apply insulation before piping ductwork and equipment has been tested and accepted.
- .2 All insulation shall be supplied and installed by a qualified insulation applicator in accordance with the latest MICA Commercial and Industrial Insulation Standard.
- .3 All insulation shall be applied in full accordance with the insulation manufacturer's recommendations, and shall present a neat workmanlike appearance upon completion.
- .4 Use insulation, wrapping, vapour barriers and adhesive materials having flame spread, fuel contributed and smoke developed ratings in accordance with rulings and regulations of authorities. Follow all rules, regulations, and instructions of the Fire Marshall's office and all authorities having jurisdiction.
- .5 Do not apply any insulation or finishing when the ambient temperature in the space is less than 10°C (50°F).
- .6 Apply insulation only on clean and dry surfaces.
- .7 Apply all covering in a neat and workmanlike manner to present a clean appearance upon completion of job. Use insulation materials on cold

pipng, ducts, and equipment that are non-hygroscopic and are complete with a continuous vapour barrier. Wheatpaste must not be used.

Acceptable insulation adhesive, coating, and sealant manufacturers are Benjamin Foster, Minnesota Mining, and Bakelite Thermosets Company.

- .8 Insulate all silencer casings where no internal media contacts wall.
- .9 All aluminum and PVC recovery jackets shall be removable and reusable.
- .10 Dampers, supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapour sealed to prevent condensation.
- .11 Ensure insulation is continuous through non-fire rated walls and floors. Terminate insulation neatly on either side of a fire rated barrier. Fill space between pipe and construction with fire retardant sealant. Insulation or recovery jacket shall not penetrate fire-rated construction.
- .12 Insulate electrically traced piping and equipment only after pipe tracing has been installed and tested.
- .13 Apply all insulation in a manner to facilitate replacing and/or servicing of equipment. All insulation for equipment shall be removable and reusable.
- .14 Repair/replace all insulation damaged during construction with the thickness, quality, and finish of original insulation.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 – General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide an air flow control system to achieve the control sequences outlined on the mechanical drawings.

### **1.3 Electrical equipment and work**

- .1 Read together with Division 26 – Electrical and adhere to its requirements. Supply and install all electrical apparatus, which is required and is not covered by Division 26 – Electrical.

### **1.4 Shop drawings**

- .1 Submit shop drawings for the following products:
  - .1 Airflow control system

## **2 Products**

### **2.1 General**

- .1 The plans and specification for the room airflow control system are based on systems and equipment manufactured by Antec Controls
- .2 The room airflow system provider shall be an entity that designs, develop, manufactures and sells products and services to control the environment and airflow of critical space using a Quality Management System registered to ISO 9001
- .3 In strict accordance with this specification, alternative room airflow control system and equipment shall only be considered for approval provided that the equipment is equal in every respect to the operation characteristic, capacities and intent of control sequences specified herein. Approval to

- bid does not relieve the room airflow control system supplier from complying with the minimum requirements or intent of this specification.
- .4 Other acceptable manufacturers can be submitted provided they meet the specifications.
  - .5 The engineer and owner shall be the sole judges of quality and equivalence of equipment, materials, methods and life cycle cost.
  - .6 The airflow control system supplier shall provide a detailed proposal describing all elements of the room control system. A schematic layout shall be provided, showing relations of these elements and a description of how they interact.
  - .7 Technical specification data sheets shall be provided for all proposed system components and devices.
  - .8 All proposed airflow control devices shall include discharge, exhaust and radiated sound power level performance obtained from testing in accordance with ASHRAE 130.
  - .9 Any alternate airflow control system supplier shall provide a separate compliance schedule, which shall include the section, paragraph and subparagraph of these specifications, and a direct statement to indicate compliance or noncompliance with the requirements. For all areas of noncompliance, the supplier shall describe what specific and alternative approach has been taken and document the impact this will have on the sizing of the air delivery systems, the required cooling and heating capacities, energy costs and maintenance of the building.

## **2.2 Performance requirements**

- .1 The airflow control system shall be pressure independent, and be furnished and installed to control the room environment.
- .2 The airflow control system shall hold constant the volume of supply air into the room to operate the room at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates, and maintain room pressurization in relation to adjacent areas.



- .3 The airflow control system shall be direct digital control (DDC) type.
- .4 Each room where shown on drawings shall have a dedicated room airflow control system. The airflow control system shall be independent and standalone.
- .5 The airflow control system shall be capable of operating as a standalone system.
- .6 The system shall not use or rely on information from controllers in other rooms or from outside spaces to control functions within its designated room.
- .7 The calibration laboratory shall measure volumetric flow rate with the following calibration accuracy, in accordance with the scope of accreditation to ISO/IEC 17025:
  - .1 30 standard cubic feet per minute to 100 standard cubic feet per minute shall have 4.0 percent expanded uncertainty.
  - .2 100 standard cubic feet per minute to 250 standard cubic feet per minute shall have 2.5 percent expanded uncertainty
  - .3 250 standard cubic feet per minute to 4200 standard cubic feet per minute shall have 4.0 percent expanded uncertainty

### **2.3 Airflow control device**

- .1 Refer to Section 23 35 00 – Air Control Valve
- .2 Refer to Section 23 36 00 – Air Terminal Units

### **2.4 Control Sequences**

- .1 For venturi flow valve:
  - .1 Room ventilation, pressurization, supply and general exhaust control: (Volumetric Offset):
    - .1 The airflow control system shall use volumetric offset control to maintain room pressurization. The system shall maintain

- proper room pressurization polarity (negative or positive) regardless of any change in room/system conditions. Systems achieving room pressure control using differential pressure measurement will be not be considered.
- .2 The airflow control system shall continuously calculate the difference between the total return airflow and the total supply in the room. The return valve shall modulate to maintain the room volumetric offset setpoint.
  - .3 Refer to mechanical drawings.
- .2 Room temperature control:
- .1 The room airflow control system shall maintain room temperature at setpoint by varying the supply air temperature and maintaining supply air volume. Supply air temperature shall be varied by modulating a reheat coil.
  - .2 Refer to mechanical drawings.
- .3 Occupancy control:
- .1 Where shown on the mechanical drawings. The room airflow control system shall have the ability to change the minimum ventilation set points, based on the occupied state, in order to reduce energy consumption when the space is not occupied.
  - .2 The occupancy state shall be set through a local occupancy sensor.
  - .3 Refer to mechanical drawings.
- .4 Room pressure monitoring:
- .1 The airflow control system shall be provided with a room pressure sensor.
  - .2 The room pressure shall be monitored at all times with reference to the adjacent space.

- .3 Refer to mechanical drawings.
- .2 For variable volume terminal applications:
  - .1 Room ventilation, pressurization, supply and general exhaust control: (Volumetric Offset):
    - .1 The airflow control system shall use volumetric offset control to maintain room pressurization. The system shall maintain proper room pressurization polarity (negative, neutral or positive) regardless of any change in room/system conditions. Systems achieving room pressure control using differential pressure measurement will not be considered.
    - .2 The airflow control system shall continuously calculate the difference between the total return airflow and the total supply in the room. The return vav terminal unit shall modulate to maintain the room volumetric offset setpoint.
    - .3 Refer to mechanical drawings for detailed control sequences.
  - .2 Room temperature control:
    - .1 The airflow control system shall maintain the room temperature at set point by varying the supply airflow and supply air temperature. Supply air temperature shall be varied by a modulating reheat coil.
    - .2 Refer to mechanical drawings.

### **3 Execution**

#### **3.1 Installation**

- .1 Verify that conditions are suitable for installation.
- .2 Verify that field measurements are as shown on the drawings.

- .3 All temperature control wiring required for a complete and operating system, as herein specified, shall be furnished and installed by the temperature control contractor unless specifically shown on the electrical drawings.
- .4 The term 'wiring; shall be construed to include the use of conduit, wire, miscellaneous materials and labor, as required for installation and connection of the electrical control devices furnished as part of the control system or furnished by equipment suppliers.
- .5 This wiring shall include all electrical connections required as specified in the sequence of operation. All devices and wiring required for interlocking HVAC equipment as specified in the sequence of operation shall be furnished by the temperature control contractor.
- .6 All line and low voltage wiring materials and installation covered by this Section shall be in accordance with the latest revision of the National electric Code and applicable local codes and shall carry the UL label where applicable.
- .7 The ATC contractor shall install appropriately sized and fused 24 VAC transformers suitable for NEC Class II wiring.
- .8 All cables shall be furnished and installed by the ATC contractor. The ATC contractor shall terminate and connect all cables as required. The ATC contractor shall utilize cables specifically recommended by the laboratory airflow controls supplier.
- .9 The mechanical contractor shall install all airflow control devices in the ductwork.
- .10 The mechanical contractor shall provide and install all reheat coils and transitions that are not integral to the venturi valve.
- .11 The mechanical contractor shall provide and install insulation as required.
- .12 Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.

### **3.2 System start-up and training**

- .1 System start-up shall be provided by a factory trained and authorized representative of the airflow control system manufacturer. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, general exhaust or return) and system programming.
- .2 The balancing contractor shall be responsible for final verification and reporting of all airflows. The factory trained and authorized representative of the airflow control system manufacturer shall be on hand to assist the balancing contractor in adjusting any airflow or velocity readings as required.
- .3 The airflow control system supplier shall furnish a minimum of four hours of owner training by factory trained and certified personnel. The training shall provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves/terminals and general troubleshooting procedures.
- .4 Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each trainee.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.
- .2 The complete installation shall conform to TSSA Standard B-149.1 Natural Gas and Propane Installation Code.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 Natural gas system.

### **1.3 Regulatory Requirements**

- .1 In addition to specific requirements for pipe fittings as further specified in this document and where applicable, the equipment shall comply with the Boiler and Pressure Vessels Act and CSA Standard B51.
- .2 In compliance with the Act and relevant Codes, all fittings shall be registered by the manufacturer, and shall be identified by the appropriate Canadian registration number.
- .3 Where fittings are provided without the appropriate Canadian registration number, the Contractor shall obtain a copy of the manufacturer's Statutory Declaration as provided to the authorities having jurisdiction.
- .4 All welding and fabrication shall be to the requirements of the ANSI/ASME B31.1 code for pressure piping and CSA standard B51 code for the Construction and Inspection of Boilers and Pressure Vessels.

### **1.4 Shop drawings**

- .1 Submit Shop Drawings for:

- .1 Gas valves.

## **2 Products**

### **2.1 Pipes and fittings**

- .1 Gas piping shall be Schedule 40 ASTM-A53 with screwed fittings up to 65mm (2-1/2") dia. and Schedule 40 standard steel butt-welding fittings for 75mm (3") dia. pipe and above.
- .2 Gas vent piping shall be type 'L' hard copper with wrought copper or cast brass fittings and 95/5 solder joints.

### **2.2 Gas valves**

- .1 Valves shall be CSA approved (CGA 3.16) lubricated all iron plug valves or ball valves.
  - .1 Threaded
    - .1 Newman Hattersley Fig. 170M
    - .2 Toyo 5044A
    - .3 Kitz 58
    - .4 MAS B-3
  - .2 Flanged
    - .1 Newman Hattersley Fig. 171M
    - .2 Kitz 150 SCTAM
    - .3 Or Approved Equal

### **3 Execution**

#### **3.1 General**

- .1 Install and test gas piping in compliance with the latest issue of the Local Gas Utility Regulations, TSSA B149.1, and to the approval of the local Gas Utility and local authorities.
- .2 Ream all piping and keep plugged to prevent entry of dirt. Use pipes, which conform to CSA and ASTM standards.
- .3 Install piping in a workmanlike manner and in accordance with the practices of the trade.
- .4 Consider the piping shown on the Drawings as diagrammatic, for clearness in indicating the general runs and connections and that the piping may, or may not, in all parts be shown in the true position. This does not relieve the responsibility for the proper erection of the systems of piping in every respect suitable for the work intended.
- .5 On screwed piping, make up joints, metal to metal with red or white lead and oil applied to the thread. No hemp wick or packing will be permitted in making up screwed joints.
- .6 Ensure that welding is performed, using either gas or electric welding equipment. Thoroughly clean pipe surfaces and level the ends of each pipe and fitting before welding. Securely align and space piping so that the width of circumferential welds is two and one-half times the pipe wall thickness. Ensure that the deposited metal forms a gradual increase in thickness from the outside surface to the centre of the weld.
- .7 Ensure that the pipe welding is done by a welder holding a certificate from the Department of Labour for the class of piping to be welded.
- .8 When welding or cutting with a torch, take every precaution to prevent fire. Ensure that welding or torch cutting operators have a fully charged 4.5kg (10 lb.) carbon dioxide fire extinguisher with them, when welding or cutting in building, or tunnels. Protect wooden structures with asbestos blanket.
- .9 Ensure that fabrication, welded or otherwise, meets the requirements of the ASA B31.1 Code for Pressure Piping, the CSA B51 Code for Boiler,



Pressure Vessel, and Pressure Piping, and all requirements of the Boilers and Pressure Vessels Act of the Province of Ontario.

- .10 Use only fittings, or other materials to be incorporated in the work, which are approved by the Boiler Inspection Branch of the Department of Labour, for the class of work for which they are used.
- .11 Thoroughly clean the inside of fittings and outside of pipe with steel wool and coat with flux, before soldering any copper pipe work joint. Remove the working parts of valves before soldering commences, and replace after soldering is complete.
- .12 Use di-electric connections for cathodic protection wherever pipes of dissimilar material are connected together.
- .13 In copper pipes, provide wrought copper unions with soldered joints for pipe up to and including 50mm (2"), and 1,035 kPa (150 psi) cast brass flanges for pipes 65mm (2-1/2") or larger.
- .14 Slope piping down in direction of flow to low points.
- .15 Use eccentric reducers at pipe size changes installed FOT to provide positive drainage.

### **3.2 Valves**

- .1 Valves shall be the same size as the line in which installed.
- .2 Valves shall be located in such a manner that the top works, operators, and bonnets may be easily removed.
- .3 Stems of valves shall be positioned for maximum ease in use, but in no event in a manner causing a hazard, nor with stem down unless specifically shown as such.
- .4 Valves shall be located to permit isolation of branch piping and each equipment item from the balance of the system and to allow safe and convenient access without moving equipment and with a minimum of piping and equipment disassembly.

- .5 Provide valves where shown on the Drawings, or on schematic diagrams, or in details, or as specified.
- .6 Install valves in the following locations:
  - .1 Where indicated on Drawings and in the Specification.
  - .2 At each single item of equipment.
- .7 Install emergency gas shutoff valves at the following locations:
  - .1 Main gas service before entering building.
  - .2 Branch gas piping serving each item of equipment or appliance.
  - .3 Outside mechanical rooms containing gas fired equipment.
  - .4 All branch gas lines from gas risers.
  - .5 Kitchens

### **3.3 Testing**

- .1 Make all tests before piping is furred in.
- .2 Notify Consultant at least 48 hours before commencing with test, and give Consultant a written certificate confirming these tests.
- .3 Check horizontal pipe with an accurate level for any alterations in pitch. Inspect laterals, cross arms, and eliminate pockets.
- .4 Subject gas piping to an air pressure test of 1,035 kPa (150 psi) for two (2) hours without leakage and test joints with a soap solution while the piping is under pressure. Purge after pressure test in accordance with TSSA B149.1.
- .5 The tagging of tested gas piping systems is described in the regulation covered by Paragraph 3.1.1 above. Affix tags to the piping at point of entry into the building.
- .6 If any leaks are discovered by the above tests, remove and replace the faulty portions of the systems and repeat the test. Repeat this procedure

until the system is accepted by the Consultant's representative on the site.  
Do not caulk threaded joints.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 All rigid supply, return and exhaust air ductwork and plenums.
  - .2 All flexible ductwork.
  - .3 Balancing dampers.
  - .4 Fire dampers.
  - .5 Flexible connections.
  - .6 Acoustic lining.
  - .7 Backdraft dampers.

### **1.3 Shop drawings**

- .1 Submit shop drawings for all products supplied in this section.

### **1.4 Definitions**

- .1 References to SMACNA shall mean "HVAC Duct Construction Standards, Metal and Flexible", current edition.

## 2 Products

### 2.1 Ductwork

- .1 Fabricate the following ductwork from galvanized steel, in accordance with requirements of SMACNA 1000 Pa (4" w.g.) pressure class:
  - .1 All supply air ductwork from air handling units to air terminal control units.
  - .2 All ventilation air supply ductwork.
  - .3 All ductwork used for smoke exhaust, including relief air ductwork.
- .2 Fabricate the following ductwork from aluminum in accordance with requirements of SMACNA 500 Pa (2" w.g.) pressure class:
- .3 Fabricate the following ductwork from galvanized steel, in accordance with requirements of SMACNA 500 Pa (2" w.g.) pressure class:
  - .1 All remaining rigid rectangular ductwork and plenums.
- .4 Galvanized steel shall have 380 g/m<sup>2</sup> (1.26 oz./sq.ft) total both sides galvanizing coat to ASTM 690 standards.
- .5 Aluminum shall be utility grade with not more than 0.40% copper minimum tensile strength of 110.3 MPa (16,000 psi) and suitable for Pittsburg lock seam construction. Refer to SMACNA manual for conversion of galvanized duct thickness to acceptable aluminum duct thickness.
- .6 Construct round ductwork to meet the requirements of SMACNA 1500 Pa (6" w.g.) pressure class and as follows:
  - .1 Provide welded slip joint construction round duct fittings. Wipe pipe and fittings with Durodyne S-2 duct sealer before assembly. Secure joints with self-tapping screws, and then brush again with thick coat of duct sealer.
  - .2 Provide die-formed round elbows through to 200mm (8") diameter constructed by 1.0mm (20-gauge) galvanized steel. Provide five-section construction for larger elbows.

- .3 Provide conical round tees.
- .7 Construct flat oval ductwork using galvanized steel construction as follows:
  - .1 Factory fabricated by United Sheet Metal, spiral uniseal through 500mm (20") minor axis, 0.7mm (24-gauge) for up to 600mm (24") major axis.
  - .2 Fittings shall be continuous weld, 1.0mm (20-gauge) up to 900mm (36") major axis.
  - .3 Elbows shall be easy bend.
  - .4 Transitions shall have OTR-10 reinforcement.

## 2.2 Balancing dampers

- .1 Construct all dampers of the same type of material used for the ductwork.
- .2 For dampers in rectangular ductwork:
  - .1 Construct volume dampers not greater than 225mm (9") in height of minimum 1.6mm (16-gauge) steel, centrally hinged. Use a Durodyne type KS-385 linkage.
  - .2 Construct volume dampers with a height greater than 225mm (9") of not less than 1.6mm (16-gauge) steel with reinforced leaves, centrally hinged, bronze or nylon bushings, mounted on a 13mm (½") square rod in 2.7mm (12-gauge), 38mm (1-½") channel frame, securely held by a Durodyne KP-22 locking quadrant with indicating device. The dampers shall be of multi-blade, opposed type construction with a maximum blade length not exceeding 1.2m (4 ft) and a maximum blade height of 150mm (6").
  - .3 Allowable leakage when closed against 1kPa (4" w.g.) at 7.62 m/s (1,500 fpm) face velocity 10%. Provide threaded rod and nut (metric thread) lever adjustment with washer and locknut.
  - .4 Place quadrants on insulated cuts on a bracket so that the quadrant lock is outside the insulation at all times. Place quadrants such that

the limiting two (2) positions of the damper correspond to the limiting positions of the quadrant.

- .3 For dampers in round ductwork, use double thickness, aero-dynamically shaped, butterfly dampers with rounded edges, tack welded to steel shafts set in nylon bushings complete with glands and asbestos rope packing. Use quadrants as described for low-pressure ductwork louver dampers. Use dampers constructed to function at the indicated pressures, smoothly without undue noise or vibration. Allowable leakage 5% against 1.5kPa (6" w.g.) and at 10.2 m/s (2,000 fpm) face velocity.
- .4 Splitter dampers to be constructed of galvanized sheet metal, two (2) gauges heavier than the duct, maximum 1.3mm (18-gauge). Splitter dampers up to 600mm (24") will be securely attached to a single steel pivot rod, which will be set in metal sockets attached to duct. End of the splitter to be turned over to form a teardrop and on this end the rod will be connected. On splitter dampers 625mm (25") and larger, provide two (2) rods. These rods will be provided with setscrew locking devices to hold position. Splitter dampers to be made rigid by reinforcing them. Duct panels surrounding splitter damper will not be cross-broken, but will be reinforced to prevent sagging or drumming. Length of splitter shall be at least 300mm (12") long or 1-1/2 times the width of the smaller branch whichever is longer.
- .5 Quadrants on insulated ducts to be placed on a bracket so that quadrant lock is on surface of insulation. Quadrants will be placed so that the limiting two (2) positions of the damper correspond to the limiting positions of the quadrant.

### **2.3 Fire dampers**

- .1 Provide, where shown and required by ordinance or codes, fire dampers made to NFPA Standard 90A and ULC listed and to the approval of all authorities having jurisdiction, complete with angle steel frame, fusible link, pivot rods, and spring catches. Construct fire dampers of 6mm black steel, as required by authorities. Make hinges and pulleys of stainless steel. Dampers shall be Type 'B' (with pocket) unless space limitations do not permit.

## 2.4 Flexible connections

- .1 Connect fan units to ductwork by means of 150mm (6") wide heavy 'Ventglas' fabric securely fastened to equipment and ductwork by a galvanized steel band, provided with tightening screws. Ensure that all connections are leakproof. Provide 1.3mm (18-gauge) protective collar over flexible connections.

## 2.5 Flexible ductwork

- .1 Where shown on mechanical drawings connections to diffusers will be by means of Flexmaster T/L triple-lock aluminum flexible ducting made of dead soft aluminum, and manufactured in a manner to produce a triple-lock mechanical seam forming a continuous and secure air tight joint.
- .2 Flexible ductwork shall not be permitted for use in clinic zone. Refer to mechanical drawings.

## 2.6 Acoustic duct lining

- .1 Where indicated on drawings, line ductwork inside with fibreglass acoustic duct insulation. Insulation to comply with ULC S110-M.
- .2 Facing for low velocity duct liner (max. 12.2 m/s - 2,400 fpm) shall be a tightly bonded mat, stencilled as per NFPA 90.
- .3 Facing for circular ducts and medium/high velocity ductwork (over 12.2 m/s - 2,400 fpm), or where indicated on drawings shall be with perforated, minimum 28 percent open area, minimum 0.85mm (22-gauge) thick galvanized steel finish.
- .4 Provide lining with minimum thickness and density as follows:
  - .1 In ductwork 25 mm (1") at 24 kg/m<sup>3</sup> (1-½ lb/ft<sup>3</sup>), unless otherwise noted on drawings.
  - .2 In plenums 50 mm (2") at 32 kg/m<sup>3</sup> (2 lb/ft<sup>3</sup>).
  - .3 In linear slot diffuser plenums 13 mm (½") at 24 kg/m<sup>3</sup> (1-½ lb/ft<sup>3</sup>).
- .5 Lining media shall have a flamespread classification of not greater than 25, when tested in accordance with ASTM E84, NFPA Standard 255, CAN



4-S102, or UL No. 723. Furthermore, fuel contribution and smoke development rating shall not be greater than 50, when tested in accordance with ASTM E84, NFPA Standard 255, CAN 4-S102, or UL No. 723

- .6 Lining shall be suitable for duct velocity of 30.5 m/s (6,000 fpm), without erosion damage.
- .7 Media shall have the following physical properties:
  - .1 Maximum thermal conductivity of 1.42 W/m<sup>2</sup> °C (0.24 BTU/ft<sup>2</sup> hr °F), at 25mm (1") thickness and 24 kg/m<sup>3</sup> (1-½ lb/ft<sup>3</sup>) density.
  - .2 Sound absorption coefficient (NRC) of minimum 0.7, at 25mm (1") thickness and 24 kg/m<sup>3</sup> (1-½ lb/ft<sup>3</sup>) density (ASTM C423).

## 2.7 Backdraft dampers

- .1 Backdraft dampers shall have galvanized steel channel frames, full blade-length shafts, brass, ball or nylon bearings, neoprene blade strips secured to pivot side of blades, counter balance weights and suitable for vertical or horizontal mounting.
- .2 Maximum blade length shall be 750mm (30"). Use multiple units for larger sizes.
- .3 Maximum resistance to air flow shall be 50 Pa (0.2" w.g.) at design airflow. Increase damper size to meet pressure drop requirement.

## 3 Executions

### 3.1 Ductwork

- .1 All ductwork construction and installation to be in accordance with recommendations of the current SMACNA standards unless otherwise noted herein.
- .2 Sheet metal, which is not to be insulated, will be cross-broken on the four sides of each panel section. All vertical and horizontal sheet metal barriers, duct offsets; elbows, as well as the panels of straight sections of

ducts will be cross-broken. Cross-breaking to be applied to the sheet metal between the standing seams or reinforcing angles. The centre of the cross-break will be of the required height to assure surfaces being rigid. Insulated sheet metal and ducts will not be cross-broken.

- .3 Where it is necessary that ducts be divided, due to pipes, hangers, or other obstructions, which must pass through the ducts, provide teardrop shaped deflectors around these obstructions so that they will not interfere with the movement of air. Ductwork around these deflectors to be increased in size to maintain equivalent free area around deflectors. Holes in ductwork to be caulked and cover-plated to close any space left between edge of hole and obstruction passing through ducts. The passing of pipes or other obstructions through ducts will only be done when authorized at the site, by the Consultant.
- .4 In square elbows and in elbows where radius is less than  $1\frac{1}{2}$  x width of duct, sheet metal deflector vanes will be installed the full height of duct, being securely riveted in place. All vanes to be double thickness vanes of same gauge as duct in which they are installed. Vanes to be tack welded. For vane lengths over 1.2m (4 ft) tack weld vanes to 9mm ( $\frac{3}{8}$ " ) tie-rod at mid-span.
- .5 All necessary allowances and provisions will be made in the installation of the ducts for structural framing of the building and when changes or offsets are necessary, the required areas shall be maintained. All of these changes however, must be approved, and installed as directed at the time.
- .6 During installation, the open ends of ducts must be protected with blank, flanged sheet metal baffles, securely attached to prevent debris and dirt form entering.
- .7 Where ducts are shown connecting to masonry openings and/or along the edges of all plenums at floors, walls, etc., provide a continuous 38mm x 38mm x 4.7mm ( $1\frac{1}{2}$ " x  $1\frac{1}{2}$ " x  $\frac{3}{16}$ " ) galvanized angle steel, which will be bolted to the structure and made airtight to same by applying caulking compound on the angles before they are drawn down tight. The sheet metal at these locations will be bolted to the angle steel framing.

- .8 All air ducts, casings, plenums, etc., to be constructed of lock forming quality prime galvanized steel sheets, which are free from blisters, slivers, imperfectly coated spots, etc., no second quality sheet metal allowed.
- .9 Ducts to be constructed using double or Pittsburgh lock corner seams. All seams to be hammered down and made airtight. For transverse joint refer to current ASHRAE Guide for low-pressure ductwork.
- .10 Gauges and reinforcing of sheet metal ductwork will be as indicated in the current SMACNA manual, except 0.55mm (26-gauge) ductwork will not be allowed.
- .11 All sheet metal connections for apparatus plenum chambers, etc., to be constructed on 1.3mm (18-gauge) metal reinforced with 38mm x 38mm x 4.7mm (1-1/2" x 1-1/2" x 3/16") galvanized angles up to 2.4m (8 ft) in height. When height exceeds 2.4m (8 ft) angles shall not be less than 50mm x 50mm x 6mm (2" x 2" x 1/4"). In all case provide connections structurally designed for maximum fan pressures.
- .12 Angles on all apparatus and plenum chambers to be installed on not more than 1.2m (4 ft) centres and at all vertical and longitudinal seams on the plenum construction.
- .13 Ensure that all openings required through floors, walls, partitions, etc., for the duct system are provided in the exact location.
- .14 The bottom joint and 150mm (6") of vertical joint on outside air intake ducts and mixing chamber ducts will be soldered and made watertight. Provide drain connection and run copper drainpipe to nearest floor drain.
- .15 Provide 50mm (2") insulated sheet metal blank off panels behind unused portions of exterior louvers.
- .16 Connect flexible ductwork using stainless steel worm drive clamps, adjustable clamps, or duct straps applied over two wraps of duct tape.
- .17 Maximum length of flexible ducts shall be 3.6m (12 ft). Utilize rigid ductwork as required to meet this requirement.

- .18 Install flexible ductwork clear of ceiling assemblies, light fixtures, etc. Support by 25mm (1"), 0.85mm (22-gauge) galvanized steel straps at 1.5m (5 ft) centres.
- .19 Frame and install motorized dampers. Attach each motorized damper module to channel framing.
- .20 Seal all ductwork in accordance with the appropriate SMACNA "Standard Duct Sealing Requirements". All sealants shall be ULC listed in accordance with standard S-102 where insulation is applied internally to ductwork, metal duct shall act as vapour barrier and all joints to be completely sealed.
- .21 Ductwork modification:
  - .1 Make all necessary allowances and provisions for the structural framing of the building. Do not execute any such changes without permission of the Consultant.
  - .2 Transform or divide low-pressure ducts (up to 500 Pa / 2" w.g. static pressure) as may be required. Maintain the indicated cross sectional areas. Do not exceed an aspect ratio of 4 to 1. Install air stream deflectors when pipes and other small obstructions must pass through ducts, but maintain the free passage area.
  - .3 Transform rectangular ducts for pressures higher than 500 Pa (2" w.g.). Do not exceed the initial pressure drop. Do not exceed an aspect ratio of 4 to 1. Do not pass any obstructions through any of these ducts.
  - .4 Round or oval ducts for pressures higher than 500 Pa (2" w.g.). Do not change dimensions without obtaining approval. Do not pass any obstructions through any of these ducts.

### **3.2 Balancing dampers**

- .1 Provide balancing dampers in all locations necessary for balancing the air system including but not necessarily limited to the following locations:

- .1 Where ducts enter or leave duct shafts, (including ducts to last floor where shafts may not exist).
- .2 In all supply branches without reheat coil stations (e.g. corridors, electrical rooms, etc.).
- .3 In all other locations shown on the drawings.
- .2 Note: For clarity of drawings, balancing dampers mentioned under paragraphs 3.2.1.1. and 3.2.1.2. are not shown or indicated on the drawings, but must be supplied and installed.
- .3 In each branch connection, install splitter dampers in supply ducts and louver dampers in return ducts.
- .4 Install duct mounted louver type dampers between angle steel duct framing, using neoprene gasket. In stainless steel ducts, cover the neoprene gaskets with Teflon tape.
- .5 Bolt all dampers in plenum wall to a counter frame using a neoprene gasket between damper and wall.
- .6 Install access doors and panels at all dampers, to provide access to the entire damper assembly.

### **3.3 Fire dampers**

- .1 Enlarge duct sections around fire dampers, to allow unrestricted duct area while damper is in open position. Provide approved type access doors with airtight gaskets, for inspection and servicing of fire dampers. Provide dampers in supply and return take-offs at each floor of the multiple louver type.
- .2 Provide fire dampers in all ducts over 0.013m<sup>2</sup> (0.14 sq.ft) in area in the location shown on drawings, whether or not specifically requested by ordinances and codes.
- .3 For stainless steel exhaust ducts provide butterfly fire dampers constructed of stainless steel.

- .4 Before proceeding with any work, submit erection drawings approved by all authorities having jurisdiction showing location and construction details of all fire dampers.

### **3.4 Control dampers**

- .1 Install automatic control dampers in all relief ducts to the outside, in all return ducts to the main air handling units from all main return-relief fans, and elsewhere where shown. Install all damper sections between angle steel frames attached to the ductwork.

### **3.5 Cleaning of air systems**

- .1 Wipe clean all ductwork internally before erection.
- .2 After completing the systems, vacuum clean all ductwork and all apparatus internally through cleanouts.
- .3 Run air systems for at least twelve (12) operational hours using throwaway filters in place of permanent filters. Include for additional throwaway filter as well as for filters for all air handling units provided under this Contract.
- .4 Have all ductwork inspected for internal cleanliness. The Architect will then permit installation of all permanent filters in order to facilitate balancing.

### **3.6 Duct access panel and test holes**

- .1 Access Panels
  - .1 Provide all access doors of the same material as used for the ducts in which they are to be installed. Ensure through gasketing and suitable fastening materials that the entire systems are completely free from corrosion, water leakage (washable ducts), and air leakage (all ducts).
  - .2 Ensure that all duct access doors are easily accessible through the structure.

- .3 All access doors will be in accordance with NFPA Standard 90-A. Construct all duct or apparatus access panels from double thickness frame, 25mm (1") apart, with necessary reinforcing for rigidity. Provide access panels on insulated ducts apparatus with 25mm (1") space filled with fibreglass insulation. Make panels airtight with a continuous rubber gasket. Provide openings in ductwork or casings with continuous galvanized reinforcing bars, extended on insulated ductwork or casings, to the face of the insulation.
- .4 Provide 450mm x 450mm (18" x 18") and smaller panels with at least two (2) brass window sash fasteners, larger panels with at least two (2) brass pin hinges and two (2) fasteners. Make fasteners on wall-through panels operational from inside and outside. Provide all panels with brass drawer type handles (two (2) minimum, each).
- .5 Provide access panels where shown, and in the following locations whether shown or not:
  - .1 In ductwork to facilitate full cleaning of all ducts.
  - .2 Bottom of all duct risers.
  - .3 Next to outside air intakes and outlets.
  - .4 At fire dampers.
  - .5 Into plenums and apparatus casings to facilitate maintenance and cleaning of all components.
  - .6 Immediately upstream and downstream of each reheat coil.
- .6 In ducts vulnerable to settlement of liquids or solids, provide reach-through type access doors size 250mm x 200mm (10" x 8") of rigid construction complete with frame and counter frame, bolted and gasketed. Provide insulated doors in ducts that are to be used for access.

- .7 In all other ducts provide access doors of adequate size to allow for inspection, cleaning and for general maintenance, of dampers, filters, louvers, birdscreens, coils, thermostats, thermometers, firestats, fire linkages and all other duct mounted appurtenances. Provide reach-through type access doors of rigid construction with frame and counter-frame, hinged and sash locked with gasket. Insulate doors for ducts that are to be insulated.
- .2 Test Holes:
  - .1 At each main branch in ductwork and at each fan discharge and suction, provide sufficient number of Pitot tube test holes for balancing systems. Also, provide test holes for traverse at fan discharge.
  - .2 Test holes to be located within easy reach of catwalks or ladders.
  - .3 Each test hole will have 19mm ( $\frac{3}{4}$ " ) clear opening, provided with a metal ring plate with a threaded hole, and a matching screwed head plug. Where these plugs are installed in insulated ductwork, provide an extension collar against which the insulation can be finished.
  - .4 Reinforced holes to be provided where thermometers, manometers, thermostats, gauges, damper rods, etc., occur in ductwork. Extended collars will be provided for the reinforced holes where these occur on insulated ductwork.
  - .5 Where copper tubing passes through ductwork, or casing, provide a rubber grommet to prevent damage to copper tubing.

### 3.7 Acoustic duct lining

- .1 Secure to ductwork with approved fire retardant adhesive suitable for fibreglass insulation using 100% coverage and 2.7mm (12-gauge) anchors, or minimum 1.9mm (14-gauge) weld pins on 400mm (16") centres. Cut-off excess fastener length after mechanical fasteners (speed clips) have been applied. Transverse joints shall be firmly butted with no gaps and longitudinal corner joints shall be overlapped and compressed. Coat all joints, raw edges, rips, and protrusions with approved mastic.



- Provide continuous sheet metal edge protectors at entering and leaving edges of lined duct sections, and all joints.
- .2 Duct dimensions shown are clear inside dimensions. Increase duct dimensions to suit thickness of duct lining.
  - .3 Unless noted otherwise acoustic insulation shall be installed in accordance with SMACNA Standard for Metal and Flexible Duct.
  - .4 Extent of ductwork acoustic lining:
    - .1 Downstream of air terminal control units (CAV, VAV and fan powered), except units supplied with integral attenuator, for min. 1,524mm (5 ft) length.
    - .2 Downstream of heat pump units, for min. 2,438mm (8 ft) overall length, or min. 914mm (3 ft) length beyond the first 90 degree elbow.
    - .3 All toilet exhaust branch ducts which serve different toilet rooms from same riser on the same level unless at least 5m (16 ft) of ductwork, including at least three (3) of 90 degree elbow separate grilles in separate rooms.
    - .4 Air transfer ducts for full length.
    - .5 Return air stub ducts at shaft intake openings for full length.
    - .6 All ductwork serving spaces with noise criteria of NC-30 or lower.
    - .7 Where indicated on Drawings.
  - .5 Where ductwork velocities exceed 12.2 m/s (2,000 fpm), use of internal lining shall be reviewed with the Consultant in fulfilling the above requirements. If internal lining is deemed unsatisfactory for the particular application, provide perforated metal facing over internal lining, or sound traps as directed.

### **3.8 Insulated plenums and casings**

- .1 Provide insulated metal sandwich panels for all exterior intake and exhaust air plenums consisting of prefabricated 1.3mm (18-gauge) galvanized sheet metal panels and 50mm (2") rigid fibreglass insulation with interlocking joints securely fastened.
- .2 Provide steel supports, joiner sections, floor channels, opening frames and sealing materials. Provide 1.3mm (18-gauge) minimum channel stiffeners at not greater than 800mm (32") centres.
- .3 Connect corners and butt joints with 1.6mm (16-gauge) galvanized sections. Seal all joints with rubber mastic. Use angle joints to attach panel edges to walls.
- .4 Construct entire plenum to resist deflection and seal sufficiently to avoid air leakage when subjected to a pressure differential between inside and outside of up to 2,490 Pa (10" w.g.)
- .5 Provide access doors suitable for personnel pass through.
- .6 Insulate plenum floors with 25mm (1") rigid fibreglass insulation and cover with 1.6mm (16-gauge) galvanized sheet metal panels.
- .7 Seal penetrations through plenum walls with gland seals.
- .8 Construct drain pans from 1.6mm (16-gauge) type 304 stainless steel. Weld all joints. Install DN32 (1-¼") DWV drain connection to nearest drain complete with deep seal trap (minimum 100mm / 4"). Install to completely drain the pan.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 All fans not part of equipment assemblies.

### **1.3 Submittals**

- .1 Provide shop drawings for all fans. Shop drawings shall include sound power levels for inlet and outlet at rated capacity, and fan curves.
- .2 As a minimum, provide the following information:
  - .1 Product data sheets indicating rated capacities, sound power levels for inlet and outlet at rated capacity, and fan curves for 75%, 100% and 125% of rated RPM.
  - .2 Physical outline dimension drawing showing required clearances, weights, and location and size of connection entries.
- .3 Provide manufacturer's certification letter. Refer to Section 23 00 00 – General Requirements.

## **2 Products**

### **2.1 General**

- .1 Provide all fans indicated on the drawings or approved equal.
- .2 Provide all fan ratings based upon tests performed in accordance with code adopted jointly by the ASHRAE and AMCA. Provide each fan with

the AMCA seal. Provide fans with a high efficiency and a pressure characteristic that is constantly rising from free delivery to shut-off. Fans to have non-overloading horsepower characteristics.

- .3 The fan manufacturer will provide certified performance curves of capacity vs. static pressure; BHP vs. capacity and noise sound power; values at rated RPM and at 75% and 125% of rated RPM. When installed, the fan not performing to the curve will be tested by the fan manufacturer and be 'made good' at no cost to the Owner.
- .4 Provide all fan wheels statically and dynamically balanced in the manufacturer's plant in accordance with AMCA Standard 204, Balance Quality and Vibration Levels for Fans. Fans to operate quietly and without pulsations.
- .5 The fan manufacturer will check that the motor horsepower specified is sufficient to accelerate the fan to operating speed without motor overload within normal time limits. If it is found insufficient, the Consultant will be notified, prior to tendering, and a larger motor and starter will be provided to prevent overloading. If, when installed, motor overload and stopping occur due to fan inertia, the fan manufacturer will pay all costs incurred for changing motors, starters, wiring, etc.
- .6 Fans used for smoke exhaust shall be suitable for continuous operation at 205°C (400°F).
- .7 Fan belts shall be oil and heat resistant, non-static type. Drives shall be precision-machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower.
- .8 For belt driven fans with variable pitch motor drive, the drive must be factory set to the specified fan RPM.
- .9 For belt driven fans with fixed drives, allow for one (1) drive change for air balancing purposes (parts only, labour by Air Balancing Contractor).

## **2.2 Duct/Ceiling Inline Fans GN/GC Series**

- .1 As specified on mechanical drawings, or approved equal.

- .2 Fan shall be inline (GN) or ceiling (GC) mounted, direct driven, centrifugal exhaust fan.
- .3 The fan wheel housing and integral outlet duct shall be injection molded from a specially engineered resin exceeding UL requirements for smoke and heat generation. The outlet duct shall have provision for an aluminum backdraft damper with continuous aluminum hinge rod. The inlet box shall be minimum 0.85mm (22-gauge) galvanized steel. Motor shall be isolation mounted to a one piece galvanized stamped steel integral motor mount/inlet. A field wiring compartment with disconnect receptacle shall be standard. Unit shall be shipped in ISTA Certified Transit Tested Packaging.
- .4 (GN) Inline - To accommodate different mounting positions, an adjustable prepunched mounting bracket shall be provided.
- .5 (GC) Ceiling - To accommodate different ceiling thickness, an adjustable prepunched mounting bracket shall be provided. A white, high impact styrene injection molded grill shall be provided as standard. Unit shall be designed with provision for field conversion from ceiling to in-line.
- .6 Wheel shall be centrifugal forward curved type, injection molded of polypropylene resin.
- .7 Motor shall be open drip proof type with permanently lubricated bearings and include impedance or thermal overload protection and disconnect plug. Motor shall be furnished at the specified voltage.
- .8 The following accessories shall be provided by the manufacturer:
  - .1 Fan mount speed controller
  - .2 Wiring between motor and speed controller.
  - .3 Reinforced aluminum backdraft damper with continuous hinge rod.

### **2.3 Rooftop exhaust fans**

- .1 As specified on mechanical drawings, or approved equal.

- .2 Fan shall be a spun aluminum, roof mounted, belt driven, upblast centrifugal exhaust ventilator.
- .3 The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 1.3mm (16-gauge) marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a one-piece inlet spinning and continuously welded curb cap corners for maximum leak protection. The windband shall have a rolled bead for added strength. A two-piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. An integral conduit chase shall be provided into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 1.9mm (14-gauge) steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Lifting lugs shall be provided to help prevent damage from improper lifting. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design airflow, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit-tested packaging.
- .4 Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision-machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.
- .5 Motor shall be heavy-duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase, and enclosure.
- .6 Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy-duty regreasable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum catalogued operating speed.
- .7 Supply the following accessories unless described otherwise in the plans and schedules:
  - .1 UL safety disconnect switch

- .2 Wiring between motor and disconnect switch
- .3 Insulated prefabricated curb
- .4 Gravity backdraft damper unless fan is equipped with automatic damper

### **3 Execution**

#### **3.1 Installation**

- .1 Install fans as shown, with resilient mountings and fan restraining snubbers as specified with vibration isolation and flexible electrical leads.
- .2 Install fans with flexible connections on inlet ductwork and on discharge ductwork in accordance with Section 23 30 13 – Ductwork and Accessories.
- .3 Align shafts, belt drive, and motor, adjust belt tension, and check motor rotation before start-up.
- .4 Protect motors and fans during construction and rotate fans, by hand, every month between delivery and acceptance of building
- .5 Provide torque restrains consisting of spring hangers mounted at 45° angle, for axial fans with 3.73 kW (5 HP) or larger motor and/or 623 Pa (2.5") ESP, installed with flexible connectors.
- .6 Adjust variable pitch fan/motor sheaves during balancing to achieve specified air quantities.
- .7 Provide sheaves and belts for final air balance where specified.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 All air control valves
  - .2 Power wiring shall be connected by Division 26 – Electrical.

### **1.3 Shop drawings**

- .1 Provide shop drawings for:
  - .1 Air control valve indicating configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
  - .2 Additional submittals:
    - .1 Product data sheet indicating configuration, general assembly, and materials used in fabrication, including catalog performance ratings that indicate air flow, static pressure, NC designation, electrical characteristics, and connection requirements.
    - .2 Certificate shall be issued to certify that the air coil capacities, pressure drops, and selection procedures meet or exceed specified requirements or coils are tested and rated in accordance with AHRI 410.



## **2 Products**

### **2.1 General**

- .1 The plans and specifications for the air control valve is based on equipment manufactured by Antec Controls.
- .2 The air control valve provide shall be an entity that designs, develops, manufactures and sells products and services to control the environment and airflow of critical space using a Quality Management System registered to ISO 9001.
- .3 In strict accordance with this specification, alternative air control valves and equipment shall only be considered for approval provided that the equipment is equal in every respect to the operational characteristics, capacities and intent of control sequences specified herein.
- .4 Other acceptable manufacturers can be submitted provided they meet the specifications.
- .5 The engineer and owner shall be the sole judges of quality and equivalence of equipment, materials, methods and life cycle cost.
- .6 The air control valve supplier shall provide a detailed proposal describing all elements of the air control system. A schematic layout shall be provided, showing relations of these elements and a description of how they interact.
- .7 All proposed air control valves shall include discharge, exhaust and radiated sound power level performance obtained from testing in accordance with ASHRAE 130.
- .8 Any alternate air control valve supplier shall provide a separate compliance schedule, which shall include the section, paragraph and subparagraph of these specifications, and a direct statement to indicate compliance or noncompliance, the supplier shall describe what specific and alternative approach has been taken and document the impact this will have on the sizing of the air delivery systems, the required cooling and heating capacities, energy costs and maintenance of the building.

## 2.2 Venturi valves

- .1 Provide venturi valves of the sizes and capacities shown on the drawings.
- .2 The airflow control device shall be a venturi shaped anemometer using differential pressure to measure airflow equal to the Antec controls model VFX venturi valve.
- .3 The pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controls on a manifold system.
- .4 The airflow control device shall maintain a controlled accuracy within plus or minus five percent of signal over an airflow turndown range of no less than ten to one.
- .5 No minimum duct diameter entrance shall be required to ensure accuracy.
- .6 The airflow control device shall be constructed of using 14 gauge aluminum with continuously welded seams.
- .7 The damper shall be constructed with 16 gauge galvanized steel and mounted on a zinc plated steel shaft with composite Teflon bearings.
- .8 Supply valves shall be insulated with  $\frac{3}{4}$  inch flexible closed-cell polyethylene insulation with a flame-spread index not exceeding 25 and smoke developed index not exceeding 50 when tested according to ASTM E 84.
- .9 The valve shall ship all required components including silencers, hot water or electric duct heaters, matched for performance as required.
- .10 Valves using invasive airflow sensing technology including cross flow sensors and vortex shedding sensors, shall not be acceptable.
- .11 For electrically actuated VAV operation for tracking pairs, two-position or constant volume, a low speed electric actuator shall be used to modulate the airflow over the range of the specific valve size. The maximum time to modulate from minimum to maximum flow shall be less than 90 seconds. A UL or CSA listed electronic actuator shall be factory mounted to the

valve. The actuator shall have sufficient torque to modulate the airflow against the maximum duct static pressure (within product specifications). Loss of main power shall cause the valve to position itself in an appropriate failsafe state (select all that apply).

- .1 Supply Valve – Fail to last airflow position
- .2 Return Valve – Fail to last airflow position
- .12 This position shall be maintained constantly without external influence, regardless of the external conditions on the valve, within product specifications, until power is restored.
- .13 Each airflow control device shall be factory calibrated to the job specific airflows as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of no more than plus or minus one percent of signal over the entire range of measurement. Air flow control devices shall be further calibrated and their accuracy verified to plus or minus five percent of signal at a minimum of 48 different airflows across the full operating range of the device.
- .14 The calibration laboratory shall measure volumetric flow rate with the following calibration accuracy, in accordance with the scope of accreditation to ISO/IEC 17025:
  - .1 30 standard cubic feet per minute to 100 standard cubic feet per minute shall have 4.0 percent expanded uncertainty.
  - .2 100 standard cubic feet per minute to 250 standard cubic feet per minute shall have 2.5 percent expanded uncertainty
  - .3 250 standard cubic feet per minute to 4200 standard cubic feet per minute shall have 4.0 percent expanded uncertainty
- .15 Each air control valve shall be marked with device-specific factory calibration data. At a minimum, it should include the tag number, serial number, model number, characterization information (for electronic devices), and quality control inspection numbers. All information be stored by the manufacturer for use with as-built documentation.

## **2.3 Controls**

- .1 Refer to Section 23 09 00 Instrumentation and Controls for HVAC.
- .2 Refer to mechanical drawings.

## **3 Execution**

### **3.1 Installation**

- .1 Verify that conditions are suitable for installation.
- .2 Verify that field measurements are as shown on the drawings.
- .3 All temperature control wiring required for a complete and operating system, as herein specified, shall be furnished and installed by the temperature control contractor unless specifically shown on the electrical drawings.
- .4 The term 'wiring; shall be construed to include the use of conduit, wire, miscellaneous materials and labor, as required for installation and connection of the electrical control devices furnished as part of the control system or furnished by equipment suppliers.
- .5 This wiring shall include all electrical connections required as specified in the sequence of operation. All devices and wiring required for interlocking HVAC equipment as specified in the sequence of operation shall be furnished by the temperature control contractor.
- .6 All line and low voltage wiring materials and installation covered by this Section shall be in accordance with the latest revision of the National electric Code and applicable local codes and shall carry the UL label where applicable.
- .7 The ATC contractor shall install appropriately sized and fused 24 VAC transformers suitable for NEC Class II wiring.
- .8 All cables shall be furnished and installed by the ATC contractor. The ATC contractor shall terminate and connect all cables as required. The ATC

contractor shall utilize cables specifically recommended by the laboratory airflow controls supplier.

- .9 The mechanical contractor shall install all airflow control devices in the ductwork.
- .10 The mechanical contractor shall provide and install all reheat coils and transitions that are not integral to the venturi valve.
- .11 The mechanical contractor shall provide and install insulation as required.
- .12 Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.

### **3.2 System start-up and training**

- .1 System start-up shall be provided by a factory trained and authorized representative of the air control valve manufacturer. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, general exhaust or return) and system programming.
- .2 The balancing contractor shall be responsible for final verification and reporting of all airflows. The factory trained and authorized representative of the air control valve manufacturer shall be on hand to assist the balancing contractor in adjusting any airflow or velocity readings as required.
- .3 The air control valve supplier shall furnish a minimum of four hours of owner training by factory trained and certified personnel. The training shall provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves/terminals and general troubleshooting procedures.
- .4 Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each trainee.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 All variable volume terminal units.
  - .2 All bypass terminal units.
- .2 Power wiring shall be connected by Division 26 – Electrical.

### **1.3 Shop drawings**

- .1 Provide shop drawings for:
  - .1 Variable volume terminal units.
  - .2 Bypass terminal units.
- .2 In addition to general submittal requirements, shop drawings shall include sound power data in accordance with the following:
  - .1 All sound power data shall be based on tests conducted in accordance with ARI/ADC Industry Standard 880-83 in an ADC or independent approved laboratory.
  - .2 Sound data shall include both valve and fan simultaneous operation, and fan only operation (for fan powered boxes).
  - .3 Sound power level in dB (re. 10\*\* - 12w) shall be submitted for octave bands 2 through 7 for both discharge and radiated sound power. The data shall be tabulated for design minimum inlet static pressure, and minimum inlet pressure plus 25mm w.g. (1" w.g.),

with fan operating at an external static pressure of 13mm w.g. ( $\frac{1}{2}$ "  
(for fan powered box).

## **2 Products**

### **2.1 General**

- .1 Tender documents are based on EH Price equipment. If an alternate supplier is used, the noise and vibration levels of the alternate product shall be equal to or less than the specified products. Any additional noise attenuation features required to meet the noise and vibration performance of the specified terminal units shall be provided by this Division at no additional cost to the Owner.
- .2 All components shall be factory installed, wired, calibrated, and tested by the air flow control device manufacturer to ensure a fully functional unit.
- .3 Provide a single 120V power wire for connection to adjacent junction box.

### **2.2 Variable volume terminals**

- .1 Provide single duct, variable air volume terminals of the sizes and capacities shown in the drawings.
- .2 Terminals shall be certified under the AHRI Standard 880 Certification Program and carry the ARI Seal.
- .3 The terminal casing shall be minimum 0.8mm (22-gauge) galvanized steel, internally lined with non-porous sealed liner which complies with UL 181, ASTM C1338, ASHRAE 62.1, ASTM C1071 and NFPA 90A. Insulation shall be 24 kg/m<sup>3</sup> (1- $\frac{1}{2}$  lb/ft<sup>3</sup>) density. All cut edges must be sealed to prevent erosion, while all discharge edges of the liner must be secured with metal brackets. The discharge connection shall be slip and drive construction for attachment to metal ductwork.
- .4 The damper shall be heavy gauge steel with shaft rotating in Delrin or bronze oilite self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper

shall incorporate a mechanical stop to prevent overstroking and a synthetic seal to limit close-off leakage.

- .5 Maximum casing air leakage shall be two (2) percent at 747 Pa (3" w.g.)
- .6 Actuators shall be mounted externally for service access. Terminals with internal actuator mounting or linkage connection must include gasketed access panel, removable without disturbing ductwork.
- .7 At an inlet velocity of 10.2 m/s (2,000 fpm), the differential static pressure required to operate any terminal size shall not exceed 6mm w.g. (1/4" w.g.) for the basic terminal.
- .8 Sound ratings for the terminal shall not exceed 35 NC at 75mm w.g. (3" w.g.) static pressure. Sound performance shall be ARI certified.

### **2.3 Bypass terminals**

- .1 Provide single duct bypass terminals of the sizes and capacities shown on the mechanical drawings.
- .2 Terminals shall be certified under the AHRI Standard 880 Certification Program and carry the ARI Seal.
- .3 The terminal casing shall be minimum 0.8mm (22-gauge) galvanized steel, acoustically and thermally lined with minimum 12.7mm, dual density insulation meeting the requirement of NFPA 90A, UL 181, ASTM C1338, and ASTM C1071.
- .4 The terminal shall incorporate a gate valve with polyethylene bearings which slide in a metal track. Single blade pivoting dampers will not be accepted.
- .5 The terminal unit shall include integral inlet and bypass balancing dampers for field adjustment.
- .6 Static pressure taps shall be provide to facilitate balancing.
- .7 Actuators shall be mounted externally for service access. Terminals with internal actuator mounting or linkage connection must include gasketed access panel, removable without disturbing ductwork.



- .8 Sound ratings for the terminal shall not exceed 35 NC at 75mm w.g. (3" w.g.) static pressure. Sound performance shall be ARI certified.

## **2.4 Controls**

- .1 Refer to Section 23 09 00 – Instrumentation and Control for HVAC for thermostat and actuators for controls requirements.
- .2 The terminal supplier shall provide all accessories required (air flow sensors, controller, control transformer, etc.) to achieve the control sequences outlined on the mechanical drawings and specifications.
- .3 Actuators, flow transducers shall be supplied by Division 25 – Integrated Automation to the terminal manufacturer for installation, testing, and calibration by the terminal unit manufacturer at the expense of the terminal unit manufacturer.
- .4 Airflow sensor shall be designed to provide a differential pressure signal, which is amplified over the full capacity range of the terminal. Pressure measuring taps shall be provided external to the unit.
- .5 Provide all necessary internal control tubing, wiring, and mounting brackets for a complete operating unit.
- .6 All control components shall be mounted inside a protective metal shroud provided by the terminal unit manufacturer.
- .7 Primary air delivery shall be pressure independent. Room temperature control shall operate satisfactorily at primary supply duct static pressures ranging from 249 to 1245 Pa (1" to 5" w.g.) Maximum and minimum box volumes shall be factory set and calibrated. Settings shall be field adjustable.

## **3 Execution**

### **3.1 Installation**

- .1 Install terminal units in accordance with manufacturer's recommendations.

- .2 Each terminal unit shall be clearly marked with an identification label listing the terminal unit number, and minimum and maximum air settings. Coordinate terminal unit number with Division 25 – Integrated Automation.
- .3 Suspend terminal units from slab using threaded rod hangers and angle iron trapeze hangers.
- .4 Refer to Section 23 30 13 – Ductwork and Accessories for acoustic lining requirements of downstream ductwork.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
  - .1 All supply, return, and exhaust air grilles and diffusers, including all specified ancillaries.

### **1.3 Submittals**

- .1 Provide shop drawings for all registers, grilles, and diffusers.
- .2 Review requirements of outlets as to size, finish, and type of mounting with the Consultant prior to submitting shop drawings and schedules of outlets.

## **2 Products**

### **2.1 General**

- .1 Air outlet application to be based on required maximum space noise levels.
- .2 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.
- .3 Provide plaster frame for diffusers located in plaster and gypsum board surfaces.
- .4 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

## **2.2 Registers, grilles and diffusers**

- .1 Refer to Schedule on Drawings.

## **3 Execution**

### **3.1 Air outlets (diffusers, grilles and registers)**

- .1 Paint the inside of all duct openings with black flat paint before installing diffusers or registers to it.
- .2 Provide sponge rubber gasket around all register frames to ensure an airtight seal against finished wall or ceiling.
- .3 Registers and diffusers will be installed in such a manner as to facilitate repeated removals without damaging ceiling or wall construction and finish.
- .4 Positions indicated are approximate only. Check location of outlets with the Consultant and make necessary adjustments in position to conform to architectural features, sprinklers, symmetry and lighting arrangement.
- .5 Provide diffusers, grilles, and registers as shown on schedule.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:

- .1 Duct mounted filters.

### **1.3 Submittals**

- .1 Provide shop drawings for:

- .1 Duct mounted filters.

- .2 As a minimum provide the following information:

- .1 Product data sheets indicating media type, average filter efficiency, pressure drop at clean and dirty condition.

- .2 Physical outline dimension drawing showing frame dimensions, required clearances, and weights.

### **1.4 Regulations**

- .1 Air filters shall conform to requirements of Class 1 filters in accordance with CAN4-S111.

## **2 Products**

### **2.1 Duct mounted filters**

- .1 Provide filters as shown on the mechanical drawings.

- .2 Filter housing shall be constructed of 16 GA, galvanized steel.
- .3 Unit shall be pop riveted, bolted, and sealed airtight with RTV caulking.
- .4 The recommended stat pressure for standard housing is -4" to +3" W.G.
- .5 Access doors with neoprene gasket shall be provided on both sides of unit.
- .6 A minimum of 27 in. clearance is required for filter change out.
- .7 Unit shall be equipped with lifting lug.

### **3 Execution**

- .1 Not used.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 - General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools equipment, training commissioning and certification required to complete the work as shown on the drawings and specified herein, including:
- .2 Flue stacks for gas fired equipment, including space heating boilers and domestic hot water boilers.

### **1.3 Shop Drawings**

- .1 Provide shop drawings for:
  - .1 Breeching
  - .2 Flue stacks
  - .3 Support details

## **2 Products**

### **2.1 Type 'A' gas vents**

- .1 Positive pressure gas flues and breeching shall be as manufactured Industrial Chimney Company Model VIP (Environ), or approved equivalent.
- .2 The factory built chimney and breeching, including all system components, shall be ULC listed. The system shall be listed for use with building heating equipment burning gas or liquid fuels generating continuous temperature not exceeding 760°C (1400°F) and not exceeding 927°C(1700°F) on an intermittent base,

- .3 The chimney shall have a minimum of 25 mm (1") of high temperature insulation between the inner flue and the outer casing.
- .4 The inner flue of the chimney shall be fabricated from type 304 stainless steel or gas and #2 fuel oil, and type 36 stainless steel for #4, #5, #6 oil and coal. The outer wall shall be fabricated from aluminized or stainless steel. All exterior parts that are not stainless steel shall be coated by the installed with one base coat and one finish coat of heat resistant rust paint.

## **2.2 Type 'B' gas vents**

- .1 Natural draft gas flues and breeching shall be as manufactured by Don Park Inc. (Environ), or approved equivalent.
- .2 The factory built chimney and breeching, including all system components, shall be ULC listed.
- .3 The gas vent system shall be engineered and built as to develop a positive flow adequate to exhaust all flue gases to the outside atmosphere, without condensation within the vent or spillage at any appliance draft hood.
- .4 All flue gas carrying parts of the vent system shall be Type B double-wall gas piping with galvanized outer casing and aluminum inner pipe. The piping shall be continuous from the outlets of the appliances to the top.
- .5 B-vents and insulated B-vents may be mixed within the same vent to maintain flue gas temperature.

## **2.3 Type 'L' vents**

- .1 Vent system for oil-fired appliances shall be as manufactured by Energy Vent Ltd. (Environ).
- .2 The system shall be listed for venting oil-fired appliances approved with L-vent, producing flue gas temperatures not in excess of 298.8°C (570°F).
- .3 The vent system shall be ULC listed.



- .4 Vent casing shall be galvalume AZ150, with 304 stainless steel liner and 304 stainless steel collars.

### **3 Execution**

#### **3.1 General**

- .1 Provide lateral and vertical support as recommended by the manufacturer. The application of guy-wires is not permitted.
- .2 Provide suitable support from structure.
- .3 Supply collar providing 50mm (2") clearance around stack and counter flashing for collar. Supply collar for installation under roofing section.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 – General Requirements, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide all labour, materials, tools, equipment, training, commissioning and certification required to complete the work as shown on the drawings and specified herein, including:

- .1 Steam humidification system.

### **1.3 Shop drawings**

- .1 Submit shop drawings for the steam humidification system
- .2 As a minimum provide the following details:
  - .1 Submit manufacturer's installation instructions.
  - .2 Submit operation and maintenance data.
  - .3 Submit coordination drawings. Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections details of components, and dispersion tubes. Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, and required clearances.
  - .4 Submit minimum water quality requirements and water pressure requirements.

## **2 Products**

### **2.1 General**

- .1 Tender documents are based on equipment supplied by Nortec (Condair). Other acceptable manufacturers can be submitted provided they meet the intent of the specifications.
- .2 The engineer and owner shall be the sole judges of quality and equivalence of quality and equivalence of equipment, materials, methods and life cycle cost.

### **2.2 Gas Humidifiers**

- .1 Provide high efficiency condensing packaged gas-fired steam generating system produces clean, sterile, and efficient atmospheric pressure steam through combustion of natural gas or propane.
- .2 Unit to be complete with:
  - .1 Enclosed cabinet, powder painted steel construction and air gap between cabinet and insulated humidifier tank ensures safe surface temperature.
  - .2 All internal components compatible with de-ionized, reverse osmosis, potable and softened water.
  - .3 All tank surfaces shall be insulated with minimum 0.5" (12mm) thick insulation and enclosed within unit cabinetry to ensure safe surface temperature, high overall efficiency, and fast unit response time. Units with exposed insulation shall not be acceptable.
  - .4 Standard internal rain water cooler to ensure drain water temperature to 140°F (60°C).
  - .5 Blow-down plumbing trap, factory installed, enclosed in cabinet, prevents steam leakage to drain. Field installation not acceptable.
  - .6 Overflow protection internal to unit cabinet which includes integrated steam trap.

- .7 Drain line to include a vacuum breaker to prevent siphon drainage of the tank.
- .8 Stainless steel combustion chamber/heat exchanger shall be tubular in design.
- .9 Stainless steel combustion/heat exchanger shall be heat treated to protect against possible stress corrosion cracking. Combustion chamber/heat exchanger that are not heat treated 36 stainless steel are not acceptable.
- .10 Maximum net overall efficiency of 93%.
- .11 Unit must be rated as a condensing, high-efficiency gas appliance with a secondary heat exchanger and condensate removal.
- .12 Gas system with gas valve(s), explosion proof, premix combustion air blower(s), microprocessor controlled ignition, flame sensing and fault indicator light(s), 100% premix flat burner(s), spark igniters(s) and heat transfer efficiency maintained over all operating ranges.
- .13 A secondary combustion air safety, in addition to blower speed monitoring, utilizing a mechanical pressure differential switch, to ensure combustion air is entering the pre-mix blower properly.
- .14 Removable cover at front of unit facilitates easy cleaning (when applicable) with complete access to tank and heat exchanger surfaces. When removed, access must extend to the bottom of the tank with no lip.
- .15 Automatic water level control within a separate float chamber, isolated from the boiling action, to prevent false water level indication.
- .16 Dual magnetic electronic float system, located outside of the boiling water to ensure accurate water level control and reduced maintenance. Cool fill water is to be supplied into the assembly to keep the device cool. Systems using conductivity probes or floats located within boiling reservoir water are not acceptable.

- .17 Humidifier shall have a dual fill valve to feed water to the fill assembly, to reduce scaling and mineral build up on the magnetic floats.
- .18 Float chamber to include LED indication of five possible water level indications.
- .19 Pre-cleaning flushing feature shall be provided to reduce maintenance time.
- .20 End of season blow-down feature to evacuate contained water and minerals after 72 hours with no demand for humidification.
- .21 Standard Modbus, BACnet IP, and BACnet MSTP protocol communication capability with adaptability for LonWorks. BTL Certified options available.
- .22 Keep warm function allows the water temperature in the tank to be maintained at a high temperature for quick response of the unit to a call for humidity.
- .23 Integrated Controller with LCD touchscreen and backlit display  
Electronic Humidifier
- .24 Provide electrode humidifier generating mineral-free, sterile steam from a potable water supply packaged unit, wall mounted, and atmospheric steam generation using an electrode steam cylinder. Resistive element technology and boiler steam (pressure steam) technology not acceptable.
- .25 Refer to mechanical drawings for manufacturer's model, capacities, arrangement and all accessories required for type of unit.

### **2.3 Drain water cooler**

- .1 Provide a self-actuated automatic drain water cooler to ensure that drainage from the humidifier is cooled to a temperature acceptable to the municipality. Drain water cooler shall be self-actuated requiring no power input.

- .2 The cooler components shall include a stainless-steel reservoir with 25mm (1") hot water inlet, 50mm (2") drain outlet, 12mm (1/2") cold water inlet, self-activated hydraulic valve with thermostatic sensor in the cylinder, 19mm (3/4") manual drain valve.
- .3 The cooler shall be capable of cooling 0.28 L/s (4.5 USgpm) of water from 100°C-60°C (212°F – 140°F) with 0.47 L/s (7.5 USgpm) of cold water entering at 21°C (70°F).

## **2.4 Steam distribution piping**

- .1 Provide steam and condensate supply piping from humidifier to steam distributor. Steam piping shall be type K copper with (95-5) solder joints. Condensate lines shall be type L copper pipe and fittings with (95-5) solder joints.

## **3 Execution**

### **3.1 Humidifier**

- .1 Provide all control wiring for humidifier cabinets and all control wiring from humidistats to humidifiers.
- .2 Mount and wire air proving and high humidity switches supplied by unit manufacturer.

### **3.2 Start-up**

- .1 The supplier shall include for all start up supervision and adjustment of all humidifiers.
- .2 Instruct building operators in the operation, maintenance and service of the humidifiers prior to turnover.

### **3.3 Installation**

- .1 Meet manufacturer's installation requirements including clearances for service and maintenance.

- .2 Mount cabinets. Provide floor or wall mounting frames, as applicable, for the proper support of the humidifier. Ensure that cabinets are level.
- .3 Make drain, water steam distribution and condensate piping connections. Install all necessary controls.
- .4 Steam and condensate shall be sloped back to the steam boiler cabinet with uniform grade.
- .5 Provide all wiring between the humidifiers and the remote-control devices (humidistats, high limit humidistats, air flow proving switches).
- .6 Install humidifiers and steam dispersion panels per manufacturers' instructions.
- .7 Seal humidifier dispersion-tube duct penetrations with flange.
- .8 Install with required clearance for service and maintenance.
- .9 Gas system shall be rated as class 4 appliance certified for use with exhaust vent type BH or with CPVC venting.

**End of section**

## **1 General**

### **1.1 General**

- .1 Section 23 00 01 – General Conditions, shall apply to and govern this Section.

### **1.2 Scope of work**

- .1 Provide electric heaters as indicated on the drawings and specified herein.
- .2 All electric heaters to be supplied and installed by Division 26 – Electrical.

### **1.3 Electrical equipment and work**

- .1 Read together with Division 26 – Electrical and adhere to its requirements. Supply and install all electrical apparatus, which is required and is not covered by Division 26 – Electrical.

### **1.4 Shop drawings**

- .1 Submit shop drawings for the following product:
  - .1 Electric Heating Coils
  - .2 Electric Baseboard Heaters.

## **2 Products**

### **2.1 Electric heating coils**

- .1 The electric heating coil shall be ETL listed to UL 1995 and CSA 22.2, and provided by the venturi valve manufacturer.
- .2 The electric coil casing shall be constructed from a minimum 20 gauge, 0.038 inch galvanized steel.
- .3 The heating elements shall be open wire nickel chrome construction, supported by ceramic insulators.



- .4 The integral control panel shall be a NEMA 25, Type 1 enclosure with hinged access door for access to all controls and safety devices.
- .5 The electric coils shall be provided with a primary automatic reset thermal cutout, a secondary manual reset thermal cutout, and a differential pressure airflow switch for proof of airflow.
- .6 The electric coil shall be provided with a silicon controlled rectifier (SCR) controller with analog control 0-10 VDC.

## **2.2 Electric baseboard heaters**

- .1 As specified on mechanical drawings, or approved equal.

## **3 Execution**

### **3.1 General**

- .1 Install heaters in accordance with manufacturer's recommendations.

**End of section**

## **1 General**

### **1.1 Project Description:**

- .1 The project encompasses the 200 John Street, Whitby facility. In general, the work shall include, without being limited to the following:
  - .1 Provide new 120/208 Volt utility power service.
  - .2 Provide communications conduit systems, grounding systems, lighting, lighting control, fire alarm system, etc., as shown on the drawings.
  - .3 Provide 600A, 100% rated breaker and retrofit into base building switchboard 'SWBD'.
- .2 The electrical contractor shall provide a comprehensive Methods of Procedures (MOP's) two weeks prior to each and every power shutdown. MOP's must include a detailed sequence of operations to be completed during the respective shutdown as well as a back out plan. MOP's must be approved by the client, landlord and the electrical engineer prior to any work taking place.
- .3 Drawings shall be read in conjunction with the architectural drawings for dimensions, mounting heights, construction details, location of light fixtures, finishes and colours.
- .4 As part of this scope of work and prior to construction, electrical contractor shall coordinate and pay for the services of the fire alarm manufacturer, fire inspector and building inspector to thoroughly review the proposed installation locations for each and every control panel, remote annunciator panel, ancillary device, field device, etc to ensure that the proposed installation is fully compliant with CAN/ULC S524-14-AMD1 and Ontario Building Code. Compliance shall include interference and proximity to new and existing devices and obstructions (including but not limited to light fixtures, supply air ducts, exposed duct work, beams, raceways, etc), spacing between field devices provided as part of this scope of work in proposed installation locations, etc.

- .5 As part of this scope of work and prior to construction, electrical contractor shall coordinate and pay for the services of the building inspector to review the proposed exit sign orientations, locations, faces (read or pictogram) and chevrons.
- .6 Contractor shall provide a fire watch throughout the duration of the project.
- .7 Fire alarm system testing and verifications must take place between 11pm and 5am during the week.
- 2. Removal and reinstallation of ceiling tiles to accommodate all scopes of work shall be provided by the electrical contractor.
- 3. All panel schedule directories must be updated with typewritten panel schedules. Kroy tape must be used for all labeling at all outlets and lamacoids for enclosures.
- 4. The contractor must ensure that firestopping and sealants are installed at new floor openings in accordance with the current fire code requirements and to prevent water leakage to the floors below. Areas prone to water leakage are to be waterproofed prior to installation of the tenant floor coverings. The landlord will approve the proposed waterproofing method prior to the tenant proceeding with construction.

## **1.2 Substantial Performance of Contract**

- .1 All the equipment and wire must be cleaned and tested, before acceptance by the consultant.
- .2 Replace, at no cost, all incandescent lamps burned out during a 30 (thirty) day period, all burned-out fluorescent and HID lamps for a period of 90 (ninety) days and all burned out LEDs based on a 70% lumen maintenance within a 5 year warranty period after date of issuance of certificate of Substantial Performance for the contract of this building.

## **1.3 Terms and Conditions**

- .1 Definitions
  - .1 Wherever the words “equal”, “equivalent”, “approved”, or “approved equal” are used, it shall be understood to mean, “equal”, “equivalent”, “approved”, or “approved equal” in the opinion of the Consultant only.

- .2 Wherever the words “install”, “provide”, or “supply and install”, are used it shall be understood to mean “provide and install, inclusive of all labour, materials, installation, testing, and connections” for the item to which referred.
- .3 “Concealed” is defined as “out of sight” in “normal” viewing conditions, and includes buried in concrete, above acoustic tile or gypsum board ceilings, within masonry or gypsum board constructed walls, within cable trays of below raised access floors.
- .2 The Contractor shall co-operate fully with the Owner, Consultant, landlord and landlord’s agent and all contractors, sub-contractors and other persons working on the site.
- .3 The Contractor shall do the complete installation in accordance with the latest editions of the National Building Code, Ontario Building Code, Canadian Electrical Safety Code, CSA, or other Codes or governing authorities of competent jurisdiction. In case of discrepancies with this or the manufacturer’s specifications, the Contractor shall notify the Consultant immediately.
- .4 Obtain and pay for permits and ESA plans approvals (note: Building Permit obtained by owner) and inspections required for work performed. Provide Certificate (s) of Acceptance from the Authorities Inspection Department, upon completion of work.
- .5 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details and drawings which these authorities may require.
- .6 In order to meet the requirements of substantial completion the electrical contractor must complete the following:
  - .1 Installation and successful testing of all electrical system devices as per mutually agreed to test and commissioning plan.

- .2 Submission of all coordination and permit documentation for the Consultant's review.
- .3 Submission of all record and As-built documentation.
- .4 Correction of any deficiencies in the electrical system.
- .7 Work associated with power shutdowns and with testing and commissioning of electrical systems must be carried out on Sunday mornings from 1am to 4 am. All shutdowns must be approved by Owner and by Landlord.
- .8 Contractor must provide a dedicated on-site electrician for 8 hours on the Monday following each cutover.

#### **1.4 Contract Drawings**

- .1 The Drawings for the electrical system work are diagrammatic performance Drawings, intended to convey the scope of work and indicate the approximate sizes and locations of equipment and outlets. The Drawings do not intend to show Designer's Architectural, Mechanical or Structural details.
- .2 Do not scale or measure Drawings, but obtain information regarding accurate dimensions, from the dimensions shown or by site measurements. Follow the Drawings for laying out the work.
- .3 Make, at no additional cost, any changes or additions to materials and equipment necessary to accommodate Structural conditions (offsets around beams, columns, etc.).
- .4 Alter at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation, and do not necessitate additional materials.
- .5 Change location of termination panels and devices at no extra cost providing cable length increase resulting from relocation does not exceed 3m (10 ft.) and information is given before installation.
- .6 Confirm at the site, the exact location of equipment.

- .7 Any miscellaneous materials, hardware, devices, wiring, etc., not specifically described, but required for the installation and operation of the electrical system, shall be provided and included as part of the Bid.

## **1.5 Materials And Equipment**

- .1 All materials and equipment shall be completely new and unused products of only the most recent manufacturer model or version number, CSA certified, and manufactured to the Standards specified.
- .2 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the local Inspection Department.
- .3 No damaged, chipped or marked equipment or materials will be accepted and must not be installed.

## **1.6 Substitutes**

- .1 Manufacturer's Basis of Design product part numbers and / or product photos have been included as part of this specifications package as the basis for the specification and tenders. and to clearly describe the quality of the product that is required for the work. A specific Manufacturer's name and model number also represents specific physical dimensions and operational requirements required on this project.
- .2 Substitutes will only be considered when submitted in sufficient time to review the proposal before tender closing. Proposals must be submitted at least two weeks prior to the deadline for Addenda Issues and for light fixtures must include detailed photometric plots for proposed light fixture substitutions. The photometric plots must be of the entire floor plan and must include all partitions and workstations (based on 5' high furniture panels). After reviewing the proposals, the Engineer will preliminarily accept or reject the proposed substitute(s). Addenda will be issued to confirm the preliminary acceptance of proposed substitutions. Preliminary acceptance of substitutes does not constitute approval for the use of those substitutes in the work.
- .3 It is the Contractor's responsibility to demonstrate in his proposal that the proposed substitutions are compatible with all related work and that the

characteristics are equal to, or superior to the original specified items, including, but not limited to:

- .1 performance;
  - .2 physical characteristics (i.e. dimensions, weights);
  - .3 electrical characteristics (i.e. voltage, number of phases, rated load amperage);
  - .4 availability;
  - .5 noise characteristic (i.e. generated sound power, attenuation).
  - .6 average max to min and average light levels (light fixtures).
  - .7 lighting power density.
  - .8 illuminated surface area.
  - .9 lumen maintenance.
- .4 This Contractor shall be responsible for any additional costs necessary to accommodate substitutes.
  - .5 All shop drawings submitted for approved substituted equipment shall be marked as such by the Contractor.

## **1.7 Shop Drawings**

- .1 Submitted Shop Drawings must indicate details of construction, dimensions, capacities, weights and electrical performance and flame spread characteristics of equipment or materials, as well as specification reference Section number and project name.
- .2 Shop Drawings shall be provided with sufficient space on the front for all Consultant's and Contractor's "review" stamps.

## **1.8 Field Supervision**

- .1 Throughout the duration of the Project, a properly qualified Electrical Field Supervisor must be available at all times. The Supervisor who starts the work must not be changed unless requested by the project manager, or written permission from the project manager is obtained.
- .2 In addition, provide proper office supervision of the work. The person responsible for office supervision must visit the site as often as necessary, to ensure work is properly performed, and attend weekly site meetings when so requested.

## **1.9 Other**

- .1 It is the responsibility of the Contractor to perform all cutting, patching and repair related to the electrical system work.
- .2 Work by the electrical contractor shall be protected during erection against disfigurement, contamination or damage by mechanical abuse or harmful materials. Protective covers shall be installed where exposure to potential damage is likely. The contractor shall ensure that no eating, drinking or smoking is carried out in the finished areas. Damages resulting from a breach of these requirements shall be repaired at the cost of the electrical contractor.
- .3 Existing and adjacent finishes, work and structures shall be protected from damage resulting from work of this project.

## **1.10 Record and As-Built Drawings**

- .1 The Contractor shall maintain two sets of drawings on site. Clearly mark on these drawings all changes and deviations from the contract drawings and in particular mark the actual location of all feeder conduit locations.
- .2 All deviations from the contract drawings shall be recorded on the "as-built" drawings, including those changes due to Addenda, Site Instructions or Change Orders.



### **1.11 Demolition**

- .1 Disconnect and remove existing conduit and wiring in partitions to be demolished and existing 'BX' cables, conduit and wire in ceiling where existing outlets, lighting fixtures, devices and mechanical equipment are to be removed.
- .2 Remove all branch circuit wiring and raceways originating from the existing receptacle panels. Wiring and raceways shall be removed back to the source panel. Circuits utilized to feed existing to remain mechanical equipment and other 120/208 volt sources to remain must be maintained.
- .3 Remove all existing electrical outlets and light switches as well as the associated wiring and raceways not being reused and/or not required for new layout (note: existing outlets and switches to be removed are not shown on the drawings). Provide blank coverplates at all locations where electrical and/or communications devices were removed in which partitions are not being demolished.

### **1.12 Digital Photos**

- .1 Provide digital photos of all progress to date on a weekly basis. Each photo submission must be reviewed and approved by the consultant prior to continuing with the installation.

**End of section**

## **1 General**

### **1.1 Reference:**

- .1 This section forms part of every section of Division 26.

### **1.2 Cleaning:**

- .1 Clean devices and other surfaces that have been exposed to construction dust and dirt. Clean the insides and outsides of panels and other electrical equipment and completely remove all debris and tools from the project.

### **1.3 Codes and Standards:**

- .1 Complete the installation of the work in accordance with latest editions of the National Building Code, Canadian Electrical Safety Code, CSA, U.L.C., N.F.P.A, O.S.H.A. or other codes, as required.
- .2 Comply with CEC Electrical Bulletins in force at time of Bid submission. While not identified and specified by number in this Division, they are to be considered as forming part of related Standards.
- .3 Abbreviations for electrical terms are as per CSA Z85.

### **1.4 Finishes:**

- .1 All shop finished metal equipment and enclosure surfaces, must be prepared by removal of rust and scale from the raw metal, degreasing, cleaning, application of rust resistance primer inside and outside, and at least two coats of finish enamel paint. Use factory standard colours unless otherwise specified. Colour reference numbers are Sico.
- .2 Paint exterior surfaces of indoor electrical equipment to manufacturer's standard.
- .3 Clean and touch-up (to Consultant's acceptance) surfaces of shop-finished equipment that is scratched or marred during shipment or installation, so as to match original paint.

- .4 Leave with the Owner, 0.22 gal. of paint of each colour used, in the form of liquid or spray, to allow for future touch-up of damaged areas.

### **1.5 Inserts, Hangers and Sleeves:**

- .1 Provide hangers, inserts, sleeves and supports as required.
- .2 Inserts are to be of lead shield type.
- .3 Hangers must not be welded to structural steel members and burning of holes in structural steel is prohibited.
- .4 Sleeves are to be of a type suitable for the application and be sealed and made watertight. Sleeves through concrete shall be sized for free passage of conduit, and installed flush with underside of concrete slab and extend 100mm (4") above finished floor unless otherwise shown.

### **1.6 Intent:**

- .1 It is the intent of these drawings and specifications that the Contractor provide complete and operational systems as required.
- .2 Where differences occur, the maximum condition shall govern.
- .3 Any miscellaneous items, hardware, devices, wiring, etc., not specifically described, but required for the operation of the system, must be provided.

### **1.7 Mounting Heights:**

- .1 Mounting height of equipment is from finished floor to center line of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated, verify with Consultant before proceeding with installation.

### **1.8 Owners Instruction and Trial Usage:**

- .1 Instruct the Owner's operating personnel in the startup, operation, care and maintenance of all the equipment. All equipment to be tested, operational and commissioned before instruction. Provide sheets for

signatures of Owner's representative and operating personnel present at each instruction period.

- .2 Arrange and pay for the service of the manufacturer's factory service Engineer/Technician to supervise the start-up of his equipment installation, and to check, adjust, balance and calibrate components.
- .3 Provide these services for such period and for as many visits as necessary to ensure that the Owner's operating personnel are conversant with all aspects of its care and operation.
  - .1 Prior to any instruction sessions, commissioning coordinator shall submit check lists of each system or equipment indicating their operation status for acceptance by the Owner.
  - .2 Coordinate all instruction sessions to suit Owner's operation personnel schedule. Submit proposed instruction session schedule c/w training agenda three weeks prior to session start date to Owner for review.
- .4 The Owner's operating personnel must be permitted to operate the systems under the contractor's supervision for a reasonable period of time prior to Substantial Completion of Contract. This use shall not be misconstrued as acceptance of the equipment.

### **1.9 Plywood Backboard:**

- .1 Supply and install all plywood backboards required for the work of this Division. Plywood to be highest quality fire retardant fir. 1200 mm wide x 2400 mm high (4'-0" wide x 8'-0" high), 19mm (3/4") thick unless otherwise specified. Prime and paint backboards on both sides with fire retardant paint, equal to CGSB spec. #1-GP-151M, of a colour to match the equipment and services mounted thereon as defined in "Finishes" above. Do not paint over fire rated stamps.
- .2 Plywood backboards are to be provided for mounting the following surface wall mounted equipment:
  - .1 Cabinets.

- .2 Contactors.
  - .3 Control Panels
  - .4 Disconnect Switches.
  - .5 Junction Boxes 600mm (2 ft) square and larger.
  - .6 Pull Boxes.
  - .7 Panel Boards.
  - .8 Splitters
  - .9 Transient Voltage Surge Suppression Units.
  - .10 External Breakers
- .3 Where practical, group devices on a common backboard.

**1.10 Protection:**

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 600 VOLTS", or with appropriate voltage in English.

**1.11 Sealing:**

- .1 Where cables or conduits pass through non fire-rated floors, walls or roof, provide internal and external sealing thereto.
- .2 Retain the service of a specialty sealant contractor for the work required.
- .3 Comply with manufacturer's installation instructions for all sealant applications.
- .4 For non-fire rated locations, Sealant shall be silicone, that meets requirements of CGSB 19-GP-23, for the size of the joint required, and the types of materials being bonded.

- .5 For fire rated locations, the fire stop shall meet the requirements of ULC with regards to the type of assembly and the fire separation.
- .6 Provide architecturally approved air barrier seals and vapor barrier seals to electrical items passing through or terminating within walls, roofs and decks, humidity controlled areas and pressurized areas.
- .7 Engage the services of a third party architect to provide a sealed report for all fire stopping assemblies provided as part of this scope of work. Sealed report must detail compliance with the Ontario Building Code.

#### **1.12 Sprinkler Proofing:**

- .1 All areas of this building are protected by a wet sprinkler system. All electrical equipment to be configured for installation in such an environment.

#### **1.13 Warning Signs:**

- .1 Provide warning signs, as specified to meet requirements of Ministry of Labour Safety Inspection, Inspection Department, Authorities having jurisdiction and Consultant.
- .2 Use decal signs, in English minimum as required by Authorities.

#### **1.14 Wire Pulling Lubricant:**

- .1 Lubricant to be non-corrosive and CSA approved for the type of cable used.
- .2 Lubricants to be soap or wax based, depending upon application. Use soap based for short runs and for semi-conducting insulated wires, and wax based for long runs.

**End of section**

## **1 General**

### **1.1 Work Included:**

- .1 Provide all wire and box connectors required for a complete electrical system installation.

## **2 Products**

### **2.1 Materials:**

- .1 Pressure type wire connectors are to be manufactured to CSA C22.2 No.65. Clamps and connectors are to be manufactured to CSA C22.2 No. 18.
- .2 Building Wire Connectors shall be:
  - .1 For wire sizes up to #6 AWG - Ideal "Wing Nut" or Gardner - Bender "Wing Gard".
  - .2 For Wire Sizes #4 AWG and larger:
    - .1 End to end splices - Burndy YS.
    - .2 Parallel splices - Burndy UC.
    - .3 At studs and bus bars - Burndy QQA (CU / AL).
    - .4 Two or three conductors in parallel - Burndy Q2A or Q3Q (CU / AL).
- .3 Cable connectors shall be:
  - .1 For armored TECK cables, watertight type, with open compounded head - T&B series "Spin-on 2" with corrosion resistant boot.
  - .2 For armored cables steel type with nylon insulated throat - T&B "TITE-Bite".

- .3 Clamps or connectors for armored cable, flexible conduit, non-metallic sheathed cable shall be as required.

### **3 Execution**

#### **3.1 Installation:**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install connectors and tighten as recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
  1. Install bushing stud connectors in accordance with Electrical and Electronic Manufacturers' Association of Canada (EEMAC), EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters.

**End of section**



## 1 General

### 1.1 Work Included:

- .1 Provide building wire as detailed below and as required for a complete electrical installation.

## 2 Products

### 2.1 Materials

- .1 Wire in Conduit:
  - .1 Conductor material to be annealed commercial grade, copper, 98% conductivity, up to #10 AWG solid, with RW90 insulation, #8 and larger, stranded, with RW90 insulation, unless noted otherwise, 300V rating for fire alarm, security and other low voltage circuits, 600V rating for 120 / 208V circuits, 1000V rating for 240 / 416V circuits, 1000V rating for 277 / 480V circuits, 1000V rating for 347 / 600V circuits.
  - .2 Colour Coding:
    - .1 120 / 208V, circuits:
      - .1 Two conductor, 1 phase: 1 black, 1 white
      - .2 Three conductor, 1 phase: 1 red, 1 black, 1 white
      - .3 Three conductor, 3 phase: 1 red, 1 black, 1 blue
      - .4 Four conductor, 3 phase: 1 red, 1 black, 1 blue, 1 white
    - .2 347 / 600V, circuits:
      - .1 Two conductor, 1 phase: 1 orange, 1 white

- .2 Three conductor, 1 phase: 1 orange, 1 brown, 1 white
- .3 Three conductor, 3 phase: 1 orange, 1 brown, 1 yellow
- .4 Four conductor, 3 phase: 1 orange, 1 brown, 1 yellow, 1 white
- .3 Ground wires: green.
- .2 Low voltage Armored Cables Type AC-90:
  - .1 Type to be AC-90, Multi-conductor, with solid, annealed commercial grade 98 percent conductivity tinned copper conductors and cross-linked polyethylene with R90 insulation, 600 volt rating, on #10 and #12 size only.
  - .2 Colour Coding:
  - .3 Two conductor, 1 phase: 1 black, 1 white
  - .4 Three conductor, 1 phase: 1 black, 1 red, 1 white
  - .5 Grounding to be uninsulated, solid copper, with impregnated paper separator.
- .3 Low voltage Armored Cables - TECK:
  - .1 Type to be TECK, single conductor with annealed. Class B, stranded copper conductors and cross linked polyethylene, RW90 insulation, 1000 volt rating for #8 AWG and larger.
  - .2 Grounding to be uninsulated tinned stranded copper, with non-hygroscopic filter material to maintain circular cross-section.
  - .3 The inner and outer jackets to be PVC "Flamenol" suitable for – 40°C, with mylar tape separator and aluminum strip, armour helically wound and interlocked.

### **3 Execution**

#### **3.1 Installation:**

##### **.1 General:**

- .1 Wire shall be installed in conduit and sized for the connected load (s) and protection as required, unless otherwise specified.
- .2 All single neutrals ran with Phase 'A,' B,' C' conductors to be minimum #10 AWG. #12 AWG neutrals may be used when run from final junction box to wiring devices.
- .3 Minimum power conductor wire size shall be #12 AWG. Use solid conductors for #10 and smaller and stranded conductors for #8 and larger. All wiring shall be copper conductors, RW90 (90degC ampacity).
- .4 Home runs in excess of 25 m (75 ft.) for circuits protected by a 15A over current device, shall be #10 AWG. Refer to drawings for additional requirements.
- .5 The current carrying capacity of the feeders, subfeeders and branch circuit conductors shall be sized to equal or better than shown on the drawings. If wire or cable sizes with equivalent current carrying capacity other than that specified is used, ensure that the voltage drop shall not be more than 2%.
- .6 The number of wires indicated for various systems is intended to show the general scheme only. The required number and type of wires shall be installed in accordance with the manufacturer's diagrams and with the requirements of the installation.

##### **.2 Wire in Conduit:**

- .1 Provide pigtails at all outlets for wiring devices. All neutrals and branch circuits shall be connected in each outlet box to avoid a break in the neutral or the circuit wire when fixture or wiring device is disconnected.

- .2 At each junction, pull and outlet box make a 360 deg. loop of the stripped uncut ground conductor under the ground screws.
- .3 Low Voltage Armored Cables - (Feeders):
  - .1 Do not directly bury in or below concrete slabs or walls.
  - .2 Do not encircle single conductor cable with ferrous metal.
  - .3 No splices will be permitted.
  - .4 Single conductors of the three or four wire circuit shall be run with uniform spacing of not less than one cable diameter throughout the feeder length.
  - .5 Use wood throated cable clamps to ensure proper and uniform cable spacing.
  - .6 Where cables are installed on walls, provide mechanical protection over them up to 2.4m (8 ft.) above finished floor, using a 12 gauge U section aluminum cover.
  - .7 Cable connections to all enclosures, boxes and panels shall be by means of a watertight malleable aluminum connector.

**End of section**

## **1 General**

### **1.1 Work Included:**

- .1 Provide all grounding to conform with the Canadian Electrical Code and the latest instructions of the Inspection Authority, with any further requirements as noted herein.

## **2 Products**

### **2.1 Materials:**

- .1 All grounding conductors stranded copper, bare or insulated as indicated on Drawings or in Specifications.
- .2 All ground wires are to be FT-4 rated factory green. Green tape, spray paint or any other means to alter the colour of the conductor is not permitted.
- .3 Use Cadweld or Burndy Thermoweld process for all weld connections. AMP of Canada Ltd. Wrench-Lok grounding connectors are an acceptable equivalent to welded connections.
- .4 All ground connectors to be designed and approved for grounding purposes.

## **3 Execution**

### **3.1 Installation:**

- .1 Ground all conduit, and all non-current carrying metal parts, equipment cases, frames, bases, brackets, etc.
- .2 Grounding of all trays, AFRCR's, racks, cabinets, etc. provided by the electrical contractor.
- .3 Ground each piece of fixed equipment back to the panel feeding that equipment, by one of the following methods:

- .1 Conduit shall **not** be utilized for the ground return conductor.
- .2 Where the conduit is flexible, install a separate bare soft drawn copper ground inside the conduit. At the switchboard or distribution panel, provide a grounding bushing, loop the ground conductor through the bushing, and connect to the switchboard ground bus. At the fixed equipment, connect to an internal ground bus, or connect to the inside of the metal enclosure utilizing approved screws and connectors (remove all paint). Run a separate (dedicated) insulated ground wire in all conduits to all devices and fixtures.
- .3 Where equipment is fed by a multi-conductor power cable, provide a ground conductor in the cable. At the switchboard or panel, connect to the ground bus. Use a grounding connector on the cable for positive grounding of the metallic sheath. Loop the ground wire to the grounding connector.
- .4 Run a separate ground wire in all flexible conduits. Connect each end to ground bus or lug or connector.
- .5 Where mechanical protection is required for insulated grounding conductors install in rigid conduit.
- .6 Provide weld connection or wrench type grounding connectors for:
  - .7 All connections between grounding conductors.
  - .8 All connections to building steel.
  - .9 All connections between grounding conductors and cable lugs.
- .10 Arrange grounding to provide the minimum impedance paths for ground fault currents. Provide any additional grounding required for approval by the inspecting authorities.

### **3.2 Equipment Grounding**

- .1 Install grounding connections to typical equipment including non-current carrying metal parts of transformers, generators, motors, circuit breakers,

cable sheaths, raceways, pipe work, screen guards, switchboards, meter and relay cases, any exposed building metal and building structural steel.

**End of section**

## **1 General**

### **1.1 Work Included:**

- .1 Provide fastenings and supports as required for a complete electrical system installation.

## **2 Products**

### **2.1 Support Channels:**

- .1 U shape pre-galvanized steel, size 41 mm x 41 mm x 22 mm (1-5/8" x 1-5/8" x 7/8"), for surface mounting, suspending, or inserting into poured concrete walls and ceilings as required.
- .2 All channel fittings to suit channel type.
- .3 All other fittings to suit equipment weight, location and surface as required.

## **3 Execution**

### **3.1 Installation:**

- .1 Secure plywood backboards, channels, luminaires, equipment and fittings to wood with wood screws, to solid masonry, tile and plaster surfaces with lead anchors, to poured concrete with self-drilling expandable inserts, and to hollow masonry walls with toggle bolts.
- .2 All ceiling mounted equipment shall be independently supported from the structure. Do not support equipment from ceiling support system.
- .3 Support equipment, conduit or cable using clips, spring loaded bolts, or cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building using:
  - .1 Two-hole steel straps to secure surface conduits and cables 50 mm (2") and smaller.



- .2 Two-hole steel straps for conduits and cables larger than 50 mm (2").
- .3 Beam clamps to secure conduit to exposed steel work.
- .5 For suspended support system:
  - .1 Support individual cable or conduit runs with 6 mm (1/4") diameter threaded rods and spring clips.
  - .2 Support two or more cables or conduits on channels support by 6 mm (1/4") diameter threaded rod hangers where direct fastening to building construction is impractical.
  - .3 Support suspended luminaire using two or more lengths of Weldless "Single Jack", bright zinc plated steel chain, Canadian Standard #10 gauge, 13 links per foot.
- .6 Provide metal brackets, frames, hangers, clamps and related type of support structure where indicated or as required to support conduit and cable runs.
- .7 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .8 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .9 Do not use supports or equipment installed for other trades for conduit or cable support.
- .10 Install fastenings and supports as required for each type of equipment, cable and conduits, and in accordance with manufacturer's installation recommendations.
- .11 Hangers shall be spaced such that there is a hanger within 610mm (24") of every bend and that the maximum spacing does not exceed the limits indicated in OESC code.

- .12 All conduit or cable shall be supported at equipment mounted on spring isolators, with spring hangers for at least 4572mm (15').

**End of section**

## **1 General**

### **1.1 Work Included:**

- .1 Provide splitters, junction boxes, pull boxes and cabinets as shown on the drawings and as required for a complete electrical installation.

## **2 Products**

### **2.1 Splitter Troughs:**

- .1 Splitter trough construction is to be based on CSA C22.2 No. 76.
- .2 They shall have sheet steel enclosure, with welded corners and formed hinged cover suitable for locking in closed position.
- .3 Connection bars are to match required size and number of incoming and outgoing conductors as indicated.
- .4 Provide at least three spare terminals on each set of lugs in splitter troughs less than 400A and feed through lugs where required.
- .5 Provide double lugs for neutrals where required.
- .6 Enclosures shall be CSA/EEMAC Type 1 modified to sprinkler proof enclosure.

### **2.2 Junction and Pull boxes.**

- .1 Junction and pull box construction is to be based on CSA C22.2 No. 40.
- .2 They shall be suitable for surface mounting and be of welded steel construction with screw-on flat covers.
- .3 For flush-mounted pull and junction boxes, provide covers with 25 mm (1") minimum extension all around.

### **2.3 General Cabinets:**

- .1 Type D or E to be sheet steel, for surface mounting, complete with screw on cover (D) or hinged door (E), and return flange overlapping sides, handle and catch.

## **3 Execution**

### **3.1 Splitter Installation:**

- .1 Install splitter troughs where required. Mount plumb, true and square to the building lines.
- .2 Extend splitters for full length of equipment arrangement except where indicated otherwise.
- .3 Provide watertight connections for all services entering the top of the splitter trough.

### **3.2 Junction, Pull Boxes and Cabinet installation:**

- .1 Install junction, pull boxes and cabinets in inconspicuous but accessible locations.
- .2 Only certain junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m (100 ft) of conduit run between boxes, and after every 2 (two) 90° bends.

### **3.3 Identification:**

- .1 Install nameplates.

**End of section**

## **1 General**

### **1.1 Work Included:**

- .1 Provide outlet and conduit boxes and fittings as required for a complete electrical system installation.

## **2 Products**

### **2.1 Outlet and Conduit boxes - General**

- .1 The construction of outlet boxes, conduit boxes and fittings is to be based on CSA C22.2 No.18.
- .2 Boxes shall be suitable for the utilization voltage.
- .3 Combination boxes shall have barriers where outlets for more than one system are grouped.
- .4 Recessed 100 mm (4") square or larger outlet boxes shall be complete with single or ganged plaster rings to suit application.

### **2.2 Sheet Steel Outlet boxes:**

- .1 Electro-galvanized steel single and multi-gang device boxes for flush installation, shall be minimum size 75 mm x 50 mm x 37 mm (3" x 2" x 1-1/2") unless otherwise specified or required. 100 mm (4") square outlet boxes shall be used when more than one conduit enters one side, with extension and plaster rings as required.
- .2 Boxes for door switches and push buttons shall be sized as required.
- .3 Utility boxes for connection to surface mounted EMT conduit, shall be minimum 100 x 54 x 48 mm (4" x 2-1/8" x 1-7/8") size.
- .4 Square or octagonal outlet boxes for lighting fixture outlets, shall be minimum 100 mm (4") size.

- .5 Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls, shall be minimum 100 mm (4") size.

### **2.3 Masonry Boxes:**

- .1 Electro-galvanized steel masonry single and multi-gang MBD boxes shall be used for flush mounted devices in exposed block walls.

### **2.4 Concrete boxes:**

- .1 Electro-galvanized sheet steel concrete boxes shall be used for flush mounting in concrete, with matching extension and plaster rings as required.

### **2.5 Conduit Boxes:**

- .1 Cast FS or FD ferrous boxes with factory-threaded hubs and mounting feet shall be used for outlets connected to surface mounted rigid conduit.

### **2.6 PVC Boxes:**

- .1 F series and octagon boxes shall be moulded type, with fastening ears and screwed secured covers as required.

### **2.7 Fittings - General:**

- .1 Bushing and connectors shall be with nylon insulated throats.
- .2 Provide knock-out fillers to prevent entry of foreign materials.
- .3 Use conduit outlet bodies for conduit up to and including 32 mm (1-1/4") and pull boxes for larger conduits.
- .4 Provide double locknuts and insulated bushings on sheet metal boxes.

### **3 Execution**

#### **3.1 Installation:**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, foam sponges or similar approved material to prevent entry of construction material.
- .3 Size box wiring chambers in accordance with Canadian Electrical Safety Code.
- .4 Gang boxes together where wiring devices are grouped.
- .5 Provide matching blank cover plates for boxes without wiring devices.
- .6 Use combination boxes where outlets for more than one system or voltage are grouped.
- .7 For flush installations, mount outlets flush with finished wall using plaster rings to permit wall finish to come within 5mm (1/4") of opening.
- .8 Provide correct size of openings in boxes for conduit and armored cable connections. Reducing washers are not allowed.

**End of section**

## **1 General**

### **1.1 Section includes**

- .1 Provide conduits, conduit fastenings and conduit fittings as detailed below and as required for a complete electrical installation.

## **2 Products**

### **2.1 Conduits**

- .1 Rigid and epoxy coated conduit shall be threaded, galvanized steel and shall be manufactured to CSA C22.2 No. 45.
- .2 Electrical metallic tube (EMT) conduit and couplings shall be manufactured to CSA C22.2 No. 83.
- .3 Flexible metal conduit and liquid tight - flexible metal conduit shall be manufactured to CSA C22.2 No. 56.

### **2.2 Conduit Fastenings**

- .1 Conduit straps shall be steel, double hole for rigid or EMT conduit. Single hole straps are not acceptable.

### **2.3 Conduit Fittings**

- .1 Fittings for conduits shall be manufactured to CSA C22.2 No.18. Provide coatings as per conduit.
- .2 Fittings for rigid conduit shall be steel threaded type, and for EMT conduit, to be steel set screw type.
- .3 Fittings for flexible conduit and exposed conduit outdoors to be liquid-tight type, straight or angled threaded for rigid and compression for EMT conduit.
- .4 Expansion fittings for rigid or EMT conduits shall be of the watertight type, with an integral bonding assembly, suitable for deflection in all directions.



## **2.4 Pulling Cables:**

- .1 Pulling cables shall be polypropylene and of a strength suitable for tension to be pulled.

## **2.5 Waterproof Membrane:**

- .1 Conduits penetrating waterproof membranes shall be PEM #6372

## **3 Execution**

### **3.1 Installation (General)**

- .1 The conduits for the following circuits and systems shall be run separately:
  - .1 120/208 volt utility power distribution.
  - .2 347/600 volt utility power distribution.
  - .3 Normal power to luminaries.
  - .4 Emergency power to luminaries and exit signs.
  - .5 Fire alarm system multiplex loop devices.
  - .6 Fire alarm system signaling devices.
  - .7 Security, Duress, Intrusion and CCTV system devices.
  - .8 Telephone and data systems.
  - .9 Control wiring.
  - .10 Paging System
- .2 All conduits to be surface mounted (exposed, EMT) in mechanical and electrical service spaces and rooms and concealed elsewhere unless otherwise shown.
- .3 Wiring in ceiling spaces and in all partitions shall be EMT.

- .4 Exposed conduits shall be installed to conserve headroom and cause minimum interference in spaces through which they pass.
- .5 Use rigid conduit up to 2.4 m (8' -0") above finished floor where exposed indoors.
- .6 Use RGS conduit PVC coated galvanized rigid steel Robroy Permacote in all outdoor locations and in areas that are not environmentally controlled.
- .7 Use electrical metallic tubing (EMT) above grade, and above 2.4 m (8'-0") above finished floor where exposed indoors.
- .8 Use flexible liquid tight metal conduit for connection to motors, and transformers.
- .9 Bend conduit without heating. Replace conduit if kinked or flattened more than 1/10<sup>th</sup> of its original diameter.
- .10 Mechanically bend conduit over 20 mm (3/4") diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits tight.
- .12 Install pulling cables in all conduits that are to remain "empty".
- .13 A maximum of 2 (two), 90 deg. bends, or equivalent up to 180 deg., will be permitted without installation of a pull box. Radius of bends must be no less than 10 (ten) times the conduit diameter.
- .14 Conduits must be dry, before installing wires.
- .15 Support all branch conduits from building structure. Do not clip conduits to ceiling hangers, sprinkler pipes, plumbing or BAS wiring hangers.

### **3.2 Surface Conduits:**

- .1 Surface conduits shall be run parallel or perpendicular to building lines.
- .2 Conduits located near any heat producing equipment shall have 1500 mm (5 ft.) clearance.

- .3 Conduits adjacent to structural steel, beams or columns shall be run within the flanged portion, unless otherwise shown.
- .4 Group exposed conduits on surface or suspended channels.
- .5 Do not pass conduits through structural members except where indicated and approved by Landlord.
- .6 Do not locate conduits less than 75 mm (3") parallel to steam or hot water lines. Provide a minimum clearance of 25 mm (1") at crossovers.

### **3.3 Conduit Size:**

- .1 The minimum conduit size shall be 19 mm (3/4").
- .2 All undimensioned conduits in the drawings are 19 mm (3/4").

### **3.4 Expansion Fittings:**

- .1 Conduit expansion fittings shall be provided on all conduits crossing expansion joints, and at maximum of 60 m (200 ft.) spacing.
- .2 Install expansion fittings perpendicular to expansion joint.
- .3 Refer to structural drawings for location of expansion joints.

**End of section**

## **1 General**

### **1.1 Work Included**

- .1 Provide all wiring devices indicated on Drawings and described below.

## **2 Products**

### **2.1 Standards**

- .1 Construction of manually operated general purpose AC switches is to be based on CSA C22.2 No. 111, snap switches on CSA C22.2 No.55, and receptacles, plugs and similar wiring devices on CSA C22.2 No. 42.
- .2 Devices shall be Specification Grade and of one manufacturer throughout.

### **2.2 Switches**

- .1 Switches shall be suitable for the voltage and load controlled and shall be single pole or three way as indicated.
- .2 They shall have terminal holes approved for No. 10 AWG wire, silver alloy contacts, and urea or melamine moldings for parts subject to carbon tracking.
- .3 They shall be suitable for back and side wiring, and rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 White 'Decora' style switches shall be used for 120V circuits, in all finished areas.
- .5 White 'Decora' style switches shall be used for 347V circuits in all areas.

### **2.3 Receptacles**

- .1 Duplex receptacles shall be CSA Type 5-15R, 125 volt, 15 Amp, U ground and CSA Type 5-20RA, 125 volt, 15/20 Amp, U Ground.
- .2 They shall be colour, as specified on site by interior designer, 'Decora' style.

- .3 They shall be suitable for No. 10 AWG, back and side wiring, have break-off links for use as split receptacles and shall have eight (8) back wired entrances, four (4) side wiring screws and double wipe contacts with riveted grounding contacts.

## **2.4 Coverplates**

- .1 Coverplates shall be colour, as specified on site by interior designer in finished areas and stainless steel in unfinished areas.
- .2 Use die cast aluminum coverplates for wiring devices mounted for surface mounted FS or FD boxes, and pressed steel coverplates for utility surface boxes.
- .3 Use weatherproof spring-loaded, cast aluminum coverplates complete with gaskets for exterior mounted single receptacles and switches, or where indicated.

## **3 Execution**

### **3.1 Installation**

- .1 Switches:
  - .1 Install single throw switches with lever in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one device is required in one location.
- .3 Coverplates:
  - .1 Protect coverplate finish until painting and other work is finished or install after painting is complete.

- .2 Do not use flush type coverplates on surface mounted boxes.

**End of section**

## **1 General**

### **1.1 Work Included**

- .1 Supply and install fuses in disconnect switches, etc. as required to complete this contract.

## **2 Products**

### **2.1 Fuses - General**

- .1 Plug and cartridge fuses shall be manufactured to CSA C22.2 No. 59.
- .2 HRC fuses shall be manufactured to CSA C22.2 No. 106 and to have interrupting capability of 200,000A symmetrical.
- .3 Fuses shall be the product of one manufacturer.
- .4 Fuse type reference L1, L2, J1, R1, etc. have been adopted for use in this specification.

### **2.2 Fuse Types**

- .1 HRCI - J fuses.
  - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.
  - .2 Type J2, fast acting.
- .2 HRC - L.
  - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.
  - .2 Type L2, fast acting.
- .3 HRC - R fuses (For UL Class RK1 fuses, peak let-through current and  $I^2t$  values not to exceed limits of UL 198E table 10.2.)

- .1 Type R1, (UL Class RK1), time delay capable of carrying 500% of its rate current for 10 seconds minimum, to meet UL Class RK1 maximum let-through limits.
- .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.
- .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 HRCII - C fuses.

### **3 Execution**

#### **3.1 Installation**

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure circuit fuses fitted to physically matched mounting devices. Install Class R rejection clips for HRCI-R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Fuses protecting motor loads and transformers to be type J1 for up to and including 600A and L1 for ratings above 600A.
- .5 Fuses protecting feeder circuits to be type J2 for up to and including 600A and type L2 ratings above 600A.
- .6 Fuses protecting other services or equipment shall be of the type required for that purpose.

**End of section**



## **1 General**

### **1.1 Work Included**

- .1 Provide all disconnect switches shown on the drawings and as required for motors.

## **2 Products**

### **2.1 Equipment**

- .1 Fuseholder assemblies to CSA C22.2 No. 39
- .2 Fusible and non-fusible disconnect switches shall be installed in CSA enclosures.
- .3 Provide for padlocking in “OFF” switch position by one lock.
- .4 Provide a mechanically interlocked door to prevent opening when handle in “ON” position.
- .5 Provide fuses sized as required.
- .6 Fuseholders in each switch shall be suitable without adapters, for type of fuse as specified.
- .7 Provide quick make, quick break action.
- .8 Provide ON-OFF switch position indication on switch enclosure cover.
- .9 Enclosures shall be CSA/EEMAC Type 1 modified to sprinkler proof enclosure.

## **3 Execution**

### **3.1 Installation**

- .1 Install disconnect switches with or without fuses as required.

- .2 Provide watertight connections for all services entering the top of the disconnect switches.

**End of section**

## **1 General**

### **1.1 Description**

- .1 Include in work of this section, the testing and commissioning of all new electrical and component systems.
- .2 Include any specific testing of equipment required by the Hydro Inspection or Supply Authorities.
- .3 The complete costs of the site, load bank and factory testing and commissioning witnessing of Electrical Equipment is to be included in the Bid price.
- .4 Inform manufacturers of all factory and site testing requirements and include all their costs in the Bid price.
- .5 At their own discretion, testing is to be witnessed by the Owner and the Electrical Consultant.

### **1.2 Scope**

- .1 Include factory testing and approved certification, where required.
- .2 Coordinate with the equipment manufacturer, notify the Electrical Consultant in writing, 10 (ten) days before any factory testing to confirm Consultant's desired presence, and be present for all site testing.

### **1.3 Completion of Work**

- .1 All electrical systems and equipment shall be totally commissioned and operating before date of "Substantial Completion".
- .2 Coordinate with other trades and the building operations staff for work which affects the operation of the electrical systems, before submitting request for testing and commissioning. Failing to comply, bear all costs including Consultant's time cost, incurred for re-testing and re-commissioning.

## **2 Products**

### **2.1 Materials**

- .1 Provide all tools, equipment, labour and materials required to perform electrical testing and commissioning as specified. Provide the test results report (s).

## **3 Execution**

### **3.1 Installation**

- .1 Perform site testing and commissioning only after all equipment is installed and operational.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 Provide 4 (four) copies of certificates of all factory and site testing in complete detail bearing in each case, the seal of the engineer responsible for the tests.
- .4 Submit all test results for Consultant's review.
- .5 All equipment or system deficiencies identified by factory or site testing procedures, to be corrected by the Contractor prior to obtaining a "Certificate of Substantial Completion".
- .6 Submit report, at completion of measurements, listing phase and neutral currents on panelboards, dry-type transformers and motor control centres, operating under normal load. Include hour and date on which load was measured, and voltage at time of test.
- .7 General operations: energize and operate electrical circuit and item. Repair, alter, replace, test and adjust as necessary for a complete and operating electrical system.
- .8 Test systems and obtain written confirmation from manufacturers that components have been installed correctly and system functioning as

intended. Submit certification for power distribution, communications systems and emergency power to Owner's Consultant.

- .9 Provide labour, instruments, apparatus and pay expenses required for testing. Owner's Consultant reserves right to demand proof of accuracy of instruments used.
- .10 Perform the following tests on completed power systems:
  - .1 Supply voltage: measure line voltage of each phase at load terminals of main breakers and report results in writing to Owner's Consultant. Perform test with majority of electrical equipment in use.
  - .2 Motor loading: measure line current of each phase of motors with motor operating under load, and report results in writing to Owner's Consultants.
    - .1 Upon indications of imbalances or overloads, thoroughly examine electrical connections and rectify defective parts or wiring.
    - .2 If electrical connections are correct, report overloads due to defects in driven machines in writing to Owner's Consultant.
  - .3 Insulation resistance tests:
    - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument for at least one (1) minute.
    - .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument for at least one (1) minute.
    - .3 Check resistance to ground before energizing.
    - .4 Coordinate and carry out motor testing at same time as driven equipment is being tested. In addition to motor loading tests, provide labour and instruments to read and record motor load readings required to supplement tests on

driven equipment through various load sequences, as required by driven equipment tests.

- .11 Immediately prior to occupancy, test entire electrical system by performing loss and return of utility power test. Demonstrate operation of:
  - .1 Low voltage service equipment and metering
  - .2 Exit and emergency lighting
  - .3 Re-stabilization of systems after power return. Attach report printouts as evidence of expected operation on systems.
  - .4 User equipment shut-down and auto-restart.

### **3.2 Field Tests**

- .1 Provide advance notice to Owner's Consultant of proposed testing schedule.
- .2 Perform tests at time of acceptance of work.
- .3 Conduct and pay for field tests:
  - .1 Power distribution, including phase voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and lighting control. Motors, heaters and associated control equipment, including sequenced operation.
  - .4 Emergency Power Systems
- .4 Perform tests in presence of Owner's Representative.
  - .1 Provide instruments, meters, equipment and personnel required to conduct required tests.
  - .2 Test systems to verify operation as specified.

- .5 Conduct di-electric tests, hi-pot tests, insulation resistance tests and ground continuity tests as required by nature of various systems and equipment

### **3.3 General Testing**

- .1 With the system completely connected, perform the following tests:
  - .1 Control and Switching - all circuits shall be tested for the correct operation of devices, switches and controls.
  - .2 Polarity Tests - all sockets shall be tested for correct polarity.
  - .3 Voltage Test - a voltage test shall be made at the last outlet of each circuit. The maximum drop in potential permitted will be 2% on 120 and 208 volt branch circuits and on 208 volt feeder circuits. Any deficiency in this respect shall be corrected.
  - .4 Phase Balance - measure the load on each phase at each splitter, and lighting and power panelboard and report the results in writing to the Consultant. Rearrange phase connections as necessary to balance the load on each phase as instructed by the Consultant, with the re-arrangement being restricted to the exchanging of connections at the distribution points mentioned in this paragraph. After making any such changes, make available to the Consultant drawings or marked prints showing the modified connections.
  - .5 General Operations - energize and put into operation each and every electrical circuit and item. Necessary repairs, alterations, replacements, tests and adjustments required shall be made for complete and satisfactory operating systems.

### **3.4 Sealing**

- .1 Ensure and verify that all penetrations of electrical equipment have been properly sealed with appropriate material and to the manufacturers' requirements.

### 3.5 Noise and vibration

- .1 Ensure and verify that all isolation equipment has been installed where required and to the manufacturers' recommendations. Include the locations of and measurements of static deflection of spring isolators.

### 3.6 Coordination Study

- .1 For the entire electrical distribution system provided as part of this contract and for the existing high voltage base building switchgear and low voltage base building switchgear, supply a report from an independent test agency of the short circuit, protection, co-ordination study of the electrical distribution system. **An existing coordination study is not available for contractor's use.**
- .2 Co-ordination of Protective Devices:
  - .1 Ensure circuit protective devices such as overcurrent trips, relays, circuit breakers and fuses are installed to values and settings so as to provide protection by means of opening the closest device to the fault.
  - .2 Submit a short circuit protection and co-ordination study as follows:
    - .1 Obtain and organize all electrical protection data for all the equipment. This will consist of obtaining the relay types and settings, transformer impedances, cable sizes, fuse sizes and types, motor data, etc., required to carry out the short circuit.
    - .2 Perform a short circuit analysis to determine short circuit current levels at all critical points in the distribution system, having obtained the available short circuit current available from the Hydro Supply Authority.
    - .3 Generate appropriate settings for all relays and protective devices from the level of the Hydro Supply Authority feeder protective devices to the largest downstream device on all the feeder secondary distribution levels.



- .3 Provide a complete, comprehensive report at the conclusion of the short circuit, protection and co-ordination study consisting of the following:
  - .1 A set of time current curve characteristics of all protective devices in the system plotted on log/log graph paper with corresponding short circuit current levels.
  - .2 Time current damage curves for all transformers, large motors and cables are also to be plotted.
  - .3 Provide a complete schedule of all main protective relays, fuses and other protective device listing device locations, function number, manufacturer, model number, size, range, setting, etc.
  - .4 The complete study will illustrate and ensure that the settings and sizes of all protective devices for each voltage level have been chosen to ensure maximum or optional protection and co-ordination during electrical fault or overload conditions.
  - .5 These generated settings will then be applied by “in-field” testing methods to the respective devices.

### **3.7 Ground Fault Protection System**

- .1 Inspect relays visually for condition and clean where necessary.
- .2 Check all connections for tightness.
- .3 Apply settings to each relay as specified in the short circuit, protection and co-ordination study and test operation by means of a relay test set.
- .4 Verify each protective system by means of a primary current injection through the zero phase sequence transformer. This will provide correct operation of both the transformer and relay as well as proper functioning of the circuitry through to the breaker tripping elements.

### **3.8 Arc Flash Analyses**

- .1 For the entire electrical distribution system provided as part of this contract and the existing electrical distribution system shown on the drawings,

conduct an electrical arc flash hazard analysis as prescribed under NFPA 70E (CSA Z462-15) and provide a written report summarizing the findings and recommended control measures to be taken. The arc flashing analysis results must be deemed acceptable prior to the equipment purchase.

- .2 The power systems software utilized to perform the study must be SKM Powertools or approved equal.
- .3 Provide appropriate labels for all equipment (including all prepurchased equipment and equipment supplied by owner). The labels shall warn a qualified worker who intends to open the equipment for analysis or work that a serious hazard exists and that the workers should follow appropriate work practices and wear appropriate personal protection equipment (PPE) for the specific hazard.
- .4 An existing coordination study is not available for the electrical contractor's use.

### **3.9 Emergency Light Level Measurements**

- .1 As part of this scope of work procure the services of a professional engineer to measure and record emergency lighting levels in foot candles throughout all scope of work areas with a calibrated light meter. Readings shall be taken based on a minimum of one reading for every 20' center in open office areas and corridors / hallways and one reading in each closed office, meeting room, boardroom and stairwell.
- .2 All light level readings are to be taken during non-daylight hours.
- .3 Provide a sealed letter identifying light level readings and stating that the emergency lighting levels meet the requirements of the National Building Code. Notify Owner and Consultant at least ten (10) days prior to proposed testing date and schedule testing at time and date acceptable to Owner and Consultant.

### **3.10 Test Results**

- .1 Submit test results to Owner's Consultant for review.

- .2 Testing methods and test results: to CSA, CEC and authorities having jurisdiction.
- .3 Remove and replace conductors found damaged with new materials.
- .4 Provide required labour and tools, if during testing Owner's Representative requests equipment be opened and removed from their housings to examine equipment, terminations and connections.

**End of section**

## **1 General**

### **1.1 Scope of Work**

- .1 This work of this Section includes the complete supply and installation of the data horizontal cabling, interlink cabling, riser cabling, house cabling and backbone cabling and terminating hardware and connectivity products specified within this document or shown on the drawings.
- .2 A complete Belden product and cable based solution is required for the data copper Category 6 based infrastructure.
- .3 Carry out all testing and provide documentation of the test results as specified herein.
- .4 Allow for the removal and replacement of ceiling tiles to allow the communications consultant to review all installed horizontal cabling in the ceiling space at the completion of the project.
- .5 The Contractor may not assign or sub-contract any work without the prior written consent of the Owner or his designated representative. A list of sub-contractors must be submitted with the tender response.
- .6 The specifications include the technical specifications for the copper cabling and fiber optic cabling provided as part of this scope of work, termination hardware provided as part of this scope of work and accessories provided as part of this scope of work. Refer to drawing No. T-001 through T-005 inclusive for quantity of cables and accessories provided as part of this scope of work, for cable type provided as part of this scope work and for additional requirements.
- .7 The cabling system must be certified by the manufacturer for a period of twenty five (25) years. The Contractor will provide a letter of Certification and a plaque by Belden within two (2) weeks of Substantial Performance of the project. These documents will include the following:
  - .1 Verification of the performance of the installed system:
  - .2 Category 6 –analog and data copper cabling system
  - .3 Identification of the installation by location and Project Number

## **1.2 References**

- .1 The Contractor shall do the complete installation in accordance with the latest editions of the Building Code, Electrical Safety Code, CSA, or other Codes or governing authorities of competent jurisdiction. In case of discrepancies with this or the manufacturer's specifications, the Contractor shall notify Communications Consultant immediately.
- .2 Regional Municipality of Durham Network Standards
  - .1 Contractors performing the work of this Section must read and comply with the Regional Municipality of Durham Network Standards (issued as an attachment to these specifications). The Regional Municipality of Durham Network Standards are additional requirements over and above those detailed on the drawings in the specifications. Contractor shall be responsible for and must include in base bid price for all scopes of work detailed in the Regional Municipality of Durham Network Standards and the communications drawings and specifications.

## **1.3 Qualifications**

- .1 The contractor performing the work of this Section must be trained and certified by Belden and shall provide written confirmation of this fact.
- .2 Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project. Proof of certification must be provided prior to commencement of work.

## **1.4 Preparation for Completion Inspection**

- .1 All the equipment and cabling must be cleaned and tested, before acceptance by the Consultant.
- .2 At points of termination, all cabling and terminations must be free of any cable pulling lubricants before acceptance by the Communications Consultant.

## **1.5 Warranty**

- .1 The Contractor shall warranty all equipment and work furnished under this Division for a period of five (5) years or such longer periods as may be

provided in the warranty of the manufacturer of individual components, whichever is longer from the date of Substantial Performance. The Contractor shall correct all defects developing as a whole or in part, due to defective workmanship, materials or defective arrangement of the various parts or materials damaged as a result of these defects or repairs. All defects shall be made good to the satisfaction of the Consultant at the Contractor's expense.

## **1.6 Submittals**

- .1 Obtain and pay for permits and inspection required for work performed where applicable.
- .2 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details and drawings which these authorities may require.
- .3 In addition to other conditions specified for Substantial Performance, the Contractor shall complete the following:
  - .1 Installation and testing of all cable runs.
  - .2 Submission of all testing documentation for the Communication Consultant's review.
  - .3 Submission of all record and as-built documentation (in handwritten format until typed / AutoCAD versions are available).
  - .4 Correction of any deficiencies in the horizontal cabling systems and associated outlets.
  - .5 Correction of any deficiencies in the backbone cabling systems.

## **1.7 Schedule**

- .1 Provide construction schedule as specified in Division 01.
- .2 All costs for work required to be performed after office hours and weekends (i.e.: drilling of anchors), shall be included in the Contract Price.

- .3 All cutovers must be carried out on weekends.
- .4 Contractor must provide a dedicated on-site technician for 8 hours per cutover to support the client for each and every cutover.

## **1.8 Contract Drawings**

- .1 The Drawings for the Communications work are diagrammatic performance Drawings, intended to convey the scope of work and indicate the approximate sizes and locations of equipment and outlets. The Drawings do not intend to show Designer's Architectural, Mechanical or Structural details.
- .2 Do not scale or measure Drawings, but obtain information regarding accurate dimensions, from the dimensions shown or by site measurements. Follow the Communications Drawings for laying out the work.
- .3 Make, at no additional cost, any changes or additions to materials and equipment necessary to accommodate Structural conditions (offsets around beams, columns, etc.)
- .4 Alter at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation, and do not necessitate additional materials.
- .5 Change location of termination panels and outlets at no extra cost providing cable length increase resulting from relocation does not exceed 3 m (10 ft.) and information is given before installation.
- .6 Confirm at the site, the exact location of equipment.
- .7 Any miscellaneous materials, hardware, devices, wiring, etc., not specifically described, but required for the installation and operation of the communications cabling system, shall be provided and included as part of the bid.

## **1.9 Materials and equipment**

- .1 All materials and equipment shall be completely new and unused products of only the most recent manufacturer model or version number, CSA certified, and manufactured to the Standards specified.

### **1.10 Substitutes**

- .1 All tenders must be based on specified items.
- .2 Manufacturer's names and model numbers are given in the specification as the basis for the specification and tenders, and to clearly describe the quality of the product that is desired for the work. A specific Manufacturer's name and model number may also represent a certain physical dimension or operational requirement required on this project.
- .3 Substitutes for Belden products will **not** be considered.

### **1.11 Operation and Maintenance Manuals**

- .1 Provide three (3) sets of operation and maintenance manuals for equipment and products supplied.
- .2 Provide three (3) soft copy scanned sets of operation and maintenance manuals for equipment and products supplied. Media shall be USB sticks.
- .3 Include the following information in the Operation and Maintenance manuals:
  - .1 Names and address of local suppliers for the items included.
  - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature is not acceptable.
  - .3 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
- .4 Review information provided in the maintenance instructions and manuals with the Owners' operating personnel to ensure a complete understanding of the electrical equipment and systems and their operation.



### **1.12 Shop Drawings**

- .1 Submitted Shop Drawings must indicate details of construction, dimensions, capacities, weights and electrical performance and flame spread characteristics of equipment or materials, as well as specification reference Section number and project name.
- .2 Shop Drawings shall be provided with sufficient space on the front for all Consultant's and Contractor's "review" stamps.
- .3 Work affected by submittal shall not proceed until review is complete.
- .4 Review submittal prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of the work and Contract Documents and bears the Stamp of Communications Contractor.
- .5 Changes made to the Shop Drawings by the Consultant will not affect the Contract Price.
- .6 Submit Shop Drawings for all material and equipment referred to in contract document

### **1.13 Field supervision**

- .1 Throughout the duration of the Project, a properly qualified Communications Field Supervisor must be available at all times. The Supervisor who starts the work must not be changed unless requested by the Project Manager, or written permission from the Project Manager is obtained.

### **1.14 Site responsibilities**

- .1 Maintain work areas to be free of construction debris and waste. The disposal of all materials shall be the responsibility of the Contractor.
- .2 Make all necessary arrangements to transport materials and equipment to and within the site. The Contractor shall be responsible for arranging for the use of any hoists, lifts, pulleys, winches, cranes or service elevators.

- .3 The Contractor is responsible for complete storage, handling, delivery, and installation of all materials used in the performance of the work.

#### **1.15 Deliveries / Access**

- .1 Coordinate all deliveries to site with the Building Project Manager. Book loading dock and service elevators 72 hours in advance. Contractor must pre-arrange all site access and authorization for all site personnel and subcontractor personnel with the Building Project Manager or his representative.

#### **1.16 Testing and commissioning**

- .1 Provide testing and commissioning of all items and their related components. Include maintenance manuals and operating instructions for owner's staff use.

#### **1.17 Miscellaneous work**

- .1 It is the responsibility of the Contractor to perform all cutting, patching and repair related to the communications cabling work.
- .2 The Contractor will be responsible to fish walls, columns etc., wherever conduit has not been provided by others to ensure all cabling is concealed.

#### **1.18 Record and As-Built Drawings**

- .1 On the cable pull end date, the contractor must provide the client with one copy of working drawings showing all installed outlet locations and corresponding labels.
- .2 The Contractor shall maintain two sets of drawings on site. Clearly mark on these drawings all changes and deviations from the contract drawings and in particular mark the actual location of all feeder conduit and floor monument locations.
- .3 All deviations from the contract drawings shall be recorded on the "as-built" drawings, including those changes due to Addenda, Site Instructions or Change Orders.

- .4 After the date of Substantial Performance, obtain from the Consultant, a set of AutoCAD disks of the most recent Communications Drawings, confirm AutoCAD version prior to the submission. These Drawings shall be marked up to record clearly, neatly, accurately and promptly all locations of Communications deviations as a result of Change Orders, Consultant's or Owner's Instruction, site conditions, etc. Utilize normal recognized CAD procedures that match the original drafting methodology. Submit the revised As-Built AutoCAD disks as well as a CD and Drawings with changes clearly indicated to the Consultant for review and final presentation to the Owner. Provide three (3) sets.

## **2 Products**

### **2.1 General**

- .1 The equipment, material and installation shall conform with the latest version of the applicable Codes, Standards and regulations of authorities having jurisdiction.
  - .1 CSA C22.1 Canadian Electric Code Part 1 and Ontario Hydro Electrical Safety Code
  - .2 ANSI/EIA/TIA-568-A Commercial Building Telecommunications Cabling Standard (CSA T529).
  - .3 ANSI/EIA/TIA-569 Commercial Building Standard For Telecommunications Pathways And Spaces (CSA T530).
  - .4 ANSI/EIA/TIA-606 Administration Standard For The Telecommunications Infrastructure Of Commercial Buildings (CSA T528).
  - .5 ANSI/EIA/TIA-607 Commercial Building Grounding And Bonding Requirements For Telecommunications (CSA T527).
  - .6 ANSI/EIA/TIA TSB-67 Performance Specification For Field Testing Of Unshielded Twisted-Pair Cabling Systems.
  - .7 CSA C22.2 No. 214 Communications Cables.
  - .8 CSA C22.2 No. 232-M Optical Fibre Cables.

- .9 ANSI/EIA/TIA-492AAAA Detailed Specification For 62.5µm Core Diameter / 125µm Cladding Diameter Class 1a Multimode, Graded-Index Optical Waveguide fibres.
- .10 ANSI/EIA/TIA-492BAAA Detail Specifications For Class Iva Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communication Systems.
- .11 ANSI/EIA/TIA-472CAAA Detailed Specifications For All Dielectric (Construction 1) Fibre Optic Communications Cable For Indoor Plenum Use, Containing Class 1a, 62.5µm Core Diameter / 125µm Cladding Diameter Optical Fibre(s).
- .12 ANSI/EIA/TIA-472DAAA Detailed Specifications For All Dielectric Fibre Optic Communications Cable For Outdoor Plant Use, Containing Class 1, 62.5µm Core Diameter / 250µm Cladding Diameter Optical Fibre(s).
- .13 ANSI/EIA/TIA-455 Test Procedures For Optical Fibres, Cables And Transistors.
- .14 ANSI/EIA/TIA-598 Colour Coding Of Optical Fibre Cables.
- .15 ANSI/EIA/TIA-604-3FOCIS 3 Fibre Optic Connector Intermateability Standard.
- .16 ANSI/ICEA S-83-596 Fibre Optic Premises Distribution Cable.
- .17 ANSI/ICEA S-83-640 Fibre Optic Outside Plant Communications Cable.
- .18 ANSI Z136.2 American Standards For The Safe Operation Of Optical Fibre Communication Systems Utilizing Laser Diode And LED Sources.
- .19 ISO/IEC IS 11801A Generic Cabling For Customer Premises.
- .20 CENELEC EN 50173 Performance Requirements For Generic Cabling Schemes.

- .21 IEC 603-7, PART 7 Detailed Specification For Connectors, 8-Way, Including Fixed And Free Connectors With Common Mating Features.
  - .22 FIPS PUB 174 Commercial Building Telecommunications Wiring Standard. Federal Information Standard Publication.
  - .23 UL 444 and 13 Adopted Test And Follow-Up Service Requirements For the Optional Qualification Of 100Ω Twisted-Pair (Cables).
  - .24 IEC 807-8 Rectangular Connectors For Frequencies Below 3 MHz, Part 8: Detailed Specification For Connectors, Four-Signal Contacts And Earthing Contacts For Cable Screens, First Edition.
  - .25 NEMA WC 63 Performance Standard For Field Testing Of Unshielded Twisted-Pair Cabling System.
- .2 Components to meet CSA, ULC and ANSI/EIA/TIA-568A requirements.

### **3 Execution**

#### **3.1 Examination of premises and Work**

- .1 Visit and examine the site where the work is to be done. Become familiar with all features and characteristics of the site and/or any existing structure before submitting a bid. No allowances will be made by the Owner for any difficulties encountered by this Contractor due to any peculiarities of the site, surrounding public or private property that existed when the tender was submitted.
- .2 This Contractor shall examine the structural, mechanical, architectural, electrical or any other drawings issued to satisfy themselves that the Work can be satisfactorily carried out. Before commencing work or prefabrication, examine the work of other trades and report at once any defect or interference affecting the work of the communications trade.
- .3 Where variances occur between the drawings and the specifications, or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the contract sum. The

Engineer will decide on the item and manner in which the work shall be installed.

- .4 All contractors shall familiarize themselves with and adhere to the landlord's building standards and guidelines.

### 3.2 Installation

- .1 The following minimum clearances from electrical and heat sources must be maintained when routing cables.

Item	Minimum Clearance
Motor	1.2 m (4'-0")
Transformers	1.2 m (4'-0")
Conduit and cables used for electrical distribution less than 1kV	0.3 m (1'-0")
Conduit and cables used for electrical distribution greater than 1kV	1.0 m (3'-0")
Pipes (gas, oil, water, etc.)	0.3 m (1'-0")
HVAC (equipment, ducts, etc.)	15 cm (6")
Fluorescent Luminaires	12 cm (5")

- .2 Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Consultant and documented on as-built drawings.
- .3 Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Damaged cables shall be replaced by the Contractor without any additional compensation.
- .4 Ensure that all cable lengths are sufficient to allow for slack, vertical runs, cable necessary for splicing, wastage, connectorization and future moves.
- .5 Bush, ream and remove any sharp projections on all conduits. There must be a minimum of one spare pull string in each conduit.
- .6 Supply and install non-permanent CSA approved intumescent fire stopping, to cap all empty sleeves and around cabling passing through

sleeves. All fire stopping must meet applicable Federal, Provincial and Local building codes.

- .7 When terminating copper cables remove cable jacket only enough to perform termination and untwist pairs only 13 mm (1/2") for Category 6 cables and 25 mm (1") for Category 3 cables.
- .8 Ensure ANSI/EIA/TIA-568A installation practices are followed. Consultant will determine quality of workmanship during installation. Cables that have not been properly combed and dressed will have to be redressed at the Contractor's expense.

### **3.3 Termination requirements**

- .1 Horizontal Data Termination Fields
  - .1 At the LAN room end, terminate Horizontal Distribution Data cables on rack mounted patch panels. Terminate all four (4) cable pairs.
  - .2 Communications contractor shall patch owner supplied switches.

### **3.4 Horizontal distribution**

- .1 Pull all cables in a continuous run. No cable splices will be permitted.
- .2 When bundling Category 6/6A cables, comply with manufacturer's recommended bundling practices for Category 6/6A cables installation. Ensure that no cable bundle put excess pressure on the cable at any point which may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.
- .3 Neatly comb, bundle and tie-wrap all cables every three (3) feet. Utilize Polytie style 1030 velcro nylon fasteners, as manufactured by Polygon Wire Management Ltd. Note: plastic tie wraps are unacceptable during any phase of this project. All cables bundled using plastic tie wraps will be replaced at contractor's cost.
- .4 Follow proper installation and termination practices for Category 6/6A UTP cabling. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as a bend radius if no bend radius is specified. For fiber optic cables maintain a minimum of ten

- (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.
- .5 Secure and support cables every 1.2 m (4'-0") when running in free space.
  - .6 Utilize all indicated and available cable pathways such as conduits, cable tray, raceways and furniture system channels except where otherwise noted. Exercise caution when pulling cables in such pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
  - .7 Inform Consultant immediately of any horizontal cable runs exceeding 90 m (295'-0").
  - .8 Supply Caddy J Pro hangers, threaded rod extensions, cable supports, tie-wraps and any other miscellaneous hardware required to support horizontal cabling where conduit has not been provided. Anchors for Caddy hangers must not be drilled into post tensioned beams under any circumstances.
  - .9 Bridal ring Caddy Fasteners and other alternates to 'J-hooks' or their equivalent may **not** be used to support the horizontal cabling.
  - .10 Do not support cables to T-bar ceiling hangers or have any cables laying on ceiling tiles.
  - .11 Wrap cables servicing systems furniture with corrugated tubing. Match colour with systems furniture manufacturer's power feed. Tubing to be butted so that no cables are exposed.
  - .12 Cables shall be bundled on a **per** mounting frame / patch panel basis.

### 3.5 Backbone distribution

- .1 Pull all cables in a continuous run. No cable splices will be permitted.
- .2 Install backbone cables in accordance with manufacturer's specifications ensuring that proper installation techniques are observed, and that the maximum pull-force and maximum bend radii specifications of the cable are adhered to.



- .3 Utilize vertical pipe split mesh to support the weight of the cable at the top of the riser. Use a minimum of five (5) cable ties per floor to prevent side to side movement of cable. Ensure cable ties do not deform the cable jacket.
- .4 Neatly bundle, tie-wrap and route all riser cables such that copper data cables, copper voice cables and fibre optic cables are in separate bundles. Secure cable bundles to vertical and horizontal supports and neatly fasten to plywood backboards or termination racks/cabinets when routing cables to backbone cross-connects.
- .5 Utilize Polytie style 1030 velcro nylon fasteners, as manufactured by Polygon Wire Management Ltd., or reviewed equivalent, in the Computer room.
- .6 Follow proper installation and termination practices for Category 6 UTP cabling. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as a bend radius if no bend radius is specified. For fibre optic cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.
- .7 Utilize all indicated and available cable pathways such as conduits, cable tray, ducts raceways and furniture system channels except where otherwise noted. Exercise caution when pulling cables in such pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- .8 Terminate all pairs of cable and all strands of fibre optic cable at both ends, including all spares unless indicated otherwise.

### **3.6 Testing and repairing**

- .1 Consultant must approve the testing procedure prior to testing commencing.
- .2 Consultant may request to be present during the initial testing period of all cables.
- .3 Upon completion of the testing by the Contractor, the Consultant will ask the Contractor to perform a random test of up to 10% of the cables.

- .4 All deficiencies must be corrected before Consultant will provide a certificate to release the Holdback on the project.
- .5 Horizontal and backbone cables are to be completed in accordance with the following test criteria. The testing must be completed on the Link Level (testing does not include patch and equipment cords). Testing is to be completed at both ends of the installed cable.
- .6 End to end testing for UTP copper shall be conducted for 100% of all pairs supplied and must be performed at 10 MHz, 50 MHz, 100 MHz, 155 MHz, 200 MHz, 250 MHz and 300 MHz for continuity, shorts, opens, grounds, crosses, wiring resistance, near-end cross-talk, attenuation, wire map, impedance and ACR as well as for the completeness and accuracy of the cable labeling scheme. All testing to be carried out with a Microtest Omni Scanner tester or Fluke DSP4000 incorporating the most recent software version. Each cable shall be tested in both directions.
- .7 All fiber cables (each strand) are to be tested for continuity and attenuation, including the connectors and adapters. (In practice continuity and attenuation can be combined, because if attenuation can be measured continuity exists).
- .8 Tests have to be in accordance with ANSI/TIA/EIA-526-14A and ANSI/TIA/ EIA-568-A Standard, for both wavelengths 850 nm and 1300 nm (multimode) and 1310 nm and 1550 nm (singlemode).
- .9 Clean all connections and adaptors at the optical test points prior to taking measurements.
- .10 Test jumpers must be of the same fibre core size and connector type as the cable system and shall be 1 to 5 meters long.
- .11 Before installing the cable, test the cable on the reel for continuity.
- .12 Divide the end-to-end links into segments at each cross connect and measure the attenuation of each link segment. Note: connector pairs must be included as part of link segment including test cord connectors that mate with the link interface.

- .13 Calculate the individual attenuation values for segment in the path. The end-to-end link attenuation for multimode fibre must be less than 2.6 dB at 850 nm and less than 6.2 dB at 1300 nm for single-mode fibre.
- .14 The maximum accepted loss for a mated pair shall be no greater than 0.35 dB. The maximum accepted loss utilizing a pre-connectorized cable assembly (LC and MTP) shall be 1.3 dB or less.
- .15 Contractor to produce a test report based on the cable schedules. The report should indicate for each cable, when it was tested successfully and the signature of the technician that performed the test. A copy of the test report must be submitted to the consultants for approval. The entire report must be signed by an authorized person and certified by a Professional Engineer or RCDD for the Contractor at the end of the project. **Note: Test results must be verified by Belden.**
- .16 Correct all cable faults. Splicing of any cables will not be permitted, for any reason, unless prior authorization if received in writing by the Communications Consultant.
  - .1 Hard-copy test results should also be provided in tabular form.
  - .2 Test results should be segregated into horizontal runs, inter-room runs, and patch cables by category and cable type.
  - .3 Test results should be presented in ascending order in order to allow easy retrieval of any particular link.

### 3.7 Labeling

- .1 Adhesive cable labels to meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition, the labels shall meet the general exposure requirements in UL 969 for indoor use.
- .2 Self-laminating vinyl construction cable labels with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times. Hubbell Data Symbols (PO702914) are to be used on each Data Jack along with the Alpha Numeric label for cable identification

- .3 Mechanically print labels using a laser printer and follow guidelines in ANSI/EIA/TIA-606 for colour codes. Handwritten labels are not permitted.
- .4 Labels should appear at the following locations:
  - .1 Each end of cable at maximum distance of 2" from the end of the sheath.
  - .2 Front of voice and data cable termination fields.
  - .3 Front of workstation faceplates.
- .5 Labels on connectors are to be mechanically printed and are to follow the guidelines in CSA-T528-93 for colour coding.
- .6 Labels used on the wall and system furniture outlets shall be white, metallicized plastic stickers.
- .7 Cable numbers are to be assigned by the communication contractor in accordance with these specifications.
- .8 All labels are to be as manufactured by Panduit. Provide soft copy results to the Consultant in Microsoft Excel format on USB key.

### **3.8 Naming standards**

- .1 All cables will be labeled according to the client's naming standard. Naming standard will be provided at the time of installation.

**End of section**

## **1 General**

### **1.1 Work Included**

- .1 All power and conduit work required and /or shown on Drawings related to security system (i.e.: for electric strike hardware, door release button, glass break detectors, etc.) shall be included in the electrical contractor's tender price.
- .2 Provide all conduit and junction boxes and all necessary accessories and devices to facilitate the complete installation of the security system.
- .3 Obtain exact requirements (including power requirements) from the security contractor. Installation shall be under the direct guidance of, and to the manufacturer's recommendations.

## **2 Products**

### **2.1 General**

- .1 Refer to Drawings for product details.

### **2.2 Material Standards**

- .1 All equipment will be manufactured in accordance with applicable CEMA and NEMA specifications, and CSA/ULC standards.

## **3 Execution – not used**

**End of section**

## **1 General**

### **1.1 Work Included**

- .1 All work required and /or shown on Drawings related to life safety systems (i.e.: fire alarm, EVAC speakers, etc.) shall be included in the tenant electrical contractor's tender price.

### **1.2 Work by landlord's contractor**

- .1 Employ and pay for the services of the landlord's contractor to provide all conduit, wiring, devices, final connections, modifications and provision of new interfacing devices in existing system control panels (i.e.: modules, relays, sub-panel, etc.). Ensure new devices to be used are compatible with the existing system. Maintain the integrity of the existing supervised circuits when new devices are to be connected. The system shall be tested and certified for proper operation upon completion of the work. Employ and pay for the services of the landlord's verification contractor.
- .2 Employ and pay for the services of the landlord's contractor to update the base building active graphic software system with all devices provided, deleted and relocated as part of this scope of work and with fire alarm system zone changes as part of this scope of work.
- .3 Employ and pay for the services of the landlord's contractor to update the base building passive graphics with all devices provided, deleted and relocated as part of this scope of work and with fire alarm system zone changes as part of this scope of work.
- .4 Employ and pay for the services of the landlord's contractor to provide additional power boosters, amplifiers and all other controls and accessories as required to ensure that the existing fire alarm system can accommodate all signaling devices shown on the drawings.

### **1.3 Additional devices**

- .1 In addition to the field devices indicated on the Drawings to be provided under this Contract, supply and install the following quantities of additional devices throughout the scope of contract floors, complete with 75'-0" of conduit and wiring, programming, testing and certification, labeling,

verification and 100% repeat verification for each device post City of Oshawa Fire Department inspection. Re-verify all existing fire alarm devices.

<b>Device Type</b>	<b>Quantity</b>
Fire Alarm System Bell	4
Fire Alarm System Strobe Light	4
Fire Alarm System Pull Station	1
Fire Alarm System Smoke Detector	2
End of line resistor	2

**2 Products – not used**

**3 Execution – not used**

**End of Section**

## **1 General**

### **1.1 Summary**

- .1 Furnish materials and accessories to complete the following:
  - .1 Excavation, trenching and backfilling for new buried services within the building.

### **1.2 Related requirements**

- .1 Section 03 30 00 Cast-in place concrete

### **1.3 Reference standards**

- .1 ASTM International (ASTM)
  - .1 ASTM D698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
  - .2 ASTM D1557-12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- .2 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS.MUNI 1010 Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material (November 2013)
- .3 The Occupational Health and Safety Act.

### **1.4 Definitions**

- .1 Engineered Fill: Approved material used to build-up to design elevations

### **1.5 Examination**

- .1 Examine the building to review existing conditions. Verify locations of all existing utilities and services that will affect the work.

### **1.6 Existing underground utilities**

- .1 Verify the location and elevation of all existing utilities within the limits of 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, in order to resolve the conflict.

- .2 All existing buried utilities located within the excavation zone and any structures 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.

### **1.7 Protection of existing services**

- .1 Take care not to damage or displace encountered known and unknown services.
- .2 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.
- .3 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.

### **1.8 Quality assurance**

- .1 Conform to the applicable requirements of the Ontario Provincial Standard Specifications (OPSS).

### **1.9 Inspection and testing**

- .1 Provide proper and sufficient samples, ample opportunity and access at all times for the Consultant and the Owner's Testing Agency to inspect materials, operations and completed works carried out under this Section.
- .2 Sample and test excavated material prior to shipping to landfill off the site. Samples shall be tested for compliance of acceptable material for landfill. Furnish to the Owner the results of all testing and location of landfill site used. This testing will not be undertaken by the Owner's 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 Fills under Slabs on Grade: Make three tests for every two lifts of compacted fill for each 500 m<sup>2</sup> area.

## **2 Products**

### **2.1 Materials**

- .1 Type A Fill: Granular A conforming to OPSS.MUNI 1010.
- .2 Sand Fill: Clean, well graded compactable sand to OPSS.MUNI 1010, Granular M fill.

## **3 Execution**

### **3.1 Excavation work**

- .1 Excavate to elevations and dimensions indicated or required by the work.
- .2 Remove obstructions of whatever nature encountered in the course of excavation and remove from the site.
- .3 Unauthorized Excavation - Excavation to greater than required depth shall be corrected by the Contractor at his own expense in a manner as directed by the Consultant.

### **3.2 Backfilling**

- .1 Proceed promptly with backfilling 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, have been inspected and approved by Consultant and authorities having jurisdiction.
- .3 Add water in amounts required only to achieve the optimum moisture content, in accordance with ASTM D1557.

### **3.3 Fill under concrete slabs**

- .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.

### **3.4 Fill location**

- .1 Type A Fill:
  - .1 Under all interior concrete slabs 150 mm minimum thickness.
- .2 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.

### **3.5 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.
- .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.

### **3.6 Cleaning and protection**

- .1 As excavation proceeds, keep site and work area clean of dirt and excavated material.
- .2 Clean up and wash down to remove all dirt and excavated materials caused by the work of this section daily.

**End of section**

## Appendix D, D-2 Material Disclosures

### 1. List of Designated Substance at the Site(s)

In accordance with the Region of Durham Corporate Health and Safety Policy and Program a list of designated substances must be provided to all Contractors. Reference Appendix D-1, Section 01 35 29 – Health and Safety Procedures for the list of Designated Substances.

### 2. Drawings

As issued with Tender and listed below:

Sheet No.	Drawing No.	Description
1	A-001	Drawing List & OBC Matrix
2	A-002	Life Safety Plan
3	A-003	Demolition Ground Floor Plan
4	A-004	Demolition Reflected Ceiling Plan
5	A-005	Ground Floor Plan
6	A-006	Reflected Ceiling Plan
7	A-007	Finish & Equipment Plan
8	A-008	Roof Plan
9	A-009	Demolition & New Elevations
10	A-010	Wall Sections & Building Sections
11	A-011	Wall Sections
12	A-012	Enlarged Washroom Plans & Elevations
13	A-013	Millwork Details
14	A-014	Millwork Details
15	A-015	Millwork Details
16	A-016	Millwork Details
17	A-017	Schedules
18	ST-001	Roof Framing Plan, General Notes, Typical Details & Schedule
19	M-001	Ground Floor Plan – HVAC Demolition
20	M-002	Ground Floor Plan – HVAC Sheet Metal
21	M-003	Ground Floor Plan – HVAC Piping
22	M-004	Roof Plan – Mechanical Demolition
23	M-005	Roof Plan – Mechanical Construction

## Appendix D – RFT Particulars, D-2 Material Disclosures

24	M-006	Part Ground Floor Plan – Plumbing Demolition
25	M-007	Ground Floor Plan – Plumbing Construction
26	M-008	Ground Floor Plan – Drainage Demolition
27	M-009	Ground Floor Plan – Drainage Construction
28	M-010	Ground Floor Plan – Fire Detection Demolition
29	M-011	Ground Floor Plan – Fire Detection Construction
30	M-012	Mechanical - Schedules
31	M-013	Mechanical – Details
32	M-014	Mechanical – Details (Continued)
33	M-015	Control Sequences, Legend & Drawing List
34	E-001	Electrical Legend and Details
35	E-002	Electrical Details
36	E-003	Electrical Details
37	E-004	Electrical Details
38	E-005	Electrical Details
39	E-006	Electrical Details
40	E-007	Electrical Details
41	E-008	Electrical Facility Plan
42	E-009	Electrical Roof Plan
43	E-010	Electrical Plan
44	E-011	Reflected Ceiling Plan
45	E-012	Electrical Grounding System Details
46	E-013	Electrical Demolition Plan
47	E-014	Reflected Ceiling Demolition Plan
48	E-015	Electrical Single Line Diagram
49	E-016	CCTV System Riser Diagram
50	E-017	Access Control System Conduit Riser Diagram
51	E-018	Access Control System Riser Diagram
52	E-019	Intrusion System Riser Diagram
53	E-020	Intercom System Riser Diagram
54	T-001	Communications Legend and Details
55	T-002	Communications Details
56	T-003	Communications Plan
57	T-004	Communications Riser Diagram and Wiring Schematic
58	T-005	Communications Demolition Plan
59	A0	Cover Sheet & General Notes

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60	A1	Dental Equipment Plan
61	A2	Support Plan
62	A3	X-Ray Plan
63	A3.1	X-Ray Details
64	P1	Dental Plumbing Air Compressor & Vacuum Lines
65	P2	Dental Plumbing Water & Drain Lines
66	P3	Dental Plumbing Medical Gases
67	D1	Dental Electrical & Plumbing Details
68	D2	Dental Electrical & Plumbing Details

**3. Designated Substances Report**

- A Designated Substances Survey titled “Pre-Renovation Designated Substances and Hazardous Materials Assessment Survey – 200 John Street West, Unit 5C, Oshawa Ontario”, prepared by Golder and dated August 31, 2020 is attached to the Tender Documents.
- A Designated Substances Survey titled “Pre-Renovation Designated Substances and Hazardous Materials Assessment Survey – 1615 Dundas Street East, Whitby Ontario”, prepared by Golder and dated September 29, 2020 is attached to the Tender Documents.