

ARCHITECTURAL SPECIFICATION FOR

**Major's Hill Park  
Header House, Washroom &  
Electrical Vault**

**DC-4155-5-20**

Issued for Tender  
September 1, 2013

**Robertson Martin Architects Inc.**

216 Pretoria Avenue  
Ottawa, ON K1S 1X2  
Tel.: (613) 567-1361  
Fax. (613) 567-9462  
[mail@robertsonmartin.com](mailto:mail@robertsonmartin.com)

**TABLE OF CONTENTS**

**Pages**

**Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**

Section 00 01 10 - Table of Contents ..... 4

**Division 01 - GENERAL REQUIREMENTS**

Section 01 00 10 - General Instruction ..... 14  
Section 01 14 00 - Work Restrictions..... 2  
Section 01 33 00 - Submittal Procedures ..... 4  
Section 01 45 00 - Quality Control ..... 3  
Section 01 56 00 - Temporary Barriers And Enclosures ..... 3  
Section 01 61 00 - Common Product Requirements ..... 4  
Section 01 74 11 - Cleaning..... 3  
Section 01 74 21 - Construction/demolition Waste Management And Disposal ..... 7  
Section 01 77 00 - Closeout Procedures ..... 2  
Section 01 78 00 - Closeout Submittals..... 7  
Section 01 79 00 - Demonstration and Training ..... 2

**Division 02 - EXISTING CONDITIONS**

Section 02 41 99 - Demolition for Minor Works ..... 3

**Division 03 - CONCRETE**

Section 03 20 00 - Concrete Reinforcing ..... 4  
Section 03 30 00 - Cast-in-place Concrete ..... 6

**Division 04 - MASONRY**

Section 04 03 08 - Mortar..... 4  
Section 04 03 09 - Grouting ..... 3  
Section 04 03 41 - Historic - Repairing Stone..... 6  
Section 04 03 42 - Historic - Replacing Stone ..... 5  
Section 04 03 43 - Historic - Dismantling Stone Masonry ..... 6

**Division 05 - METALS**

Section 05 50 00 - Metal Fabrications ..... 4

**Division 06 - WOOD AND PLASTICS**

Section 06 10 00 - Rough Carpentry - Short Form ..... 3

**Division 07 - THERMAL AND MOISTURE PROTECTION**

Section 07 12 13 - Cold Applied Waterproofing.....	6
Section 07 61 00 - Sheet Metal Roofing .....	6
Section 07 62 00 - Sheet Metal Flashing and Trim.....	5
Section 07 92 00 - Joint Sealants .....	5

**Division 08 - OPENINGS**

Section 08 80 50 - Glazing.....	6
---------------------------------	---

**Division 09 - FINISHES**

Section 09 21 16 - Gypsum Board Assemblies .....	6
Section 09 30 13 - Ceramic Tiling.....	6
Section 09 65 16 - Resilient Sheet Flooring.....	4
Section 09 91 23 - Interior Painting.....	12

**Division 10 - SPECIALTIES**

Section 10 21 13 - Metal Toilet Compartments .....	5
Section 10 28 10 - Toilet and Bath Accessories .....	5

**Division 21 - FIRE SUPPRESSION**

Section 21 05 01 - Common Work Results - Mechanical .....	5
---	---

**Division 22 - PLUMBING**

Section 22 05 00 - Common Work Results for Plumbing .....	5
Section 22 06 30.13 Domestic Hot Water Heater Schedule.....	1
Section 22 11 16 - Domestic Water Piping .....	6
Section 22 13 17 - Drainage Waste and Venting Piping.....	4
Section 22 30 05 - Domestic Water Heaters.....	4
Section 22 42 01 - Plumbing Specialties .....	5
Section 22 42 03 - Commercial Washroom Fixtures .....	5
Section 22 42 16 - Commercial Lavatories and Sinks .....	5

**Division 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

Section 23 05 00 - Common Work Results for HVAC .....	4
Section 23 05 13 - Common Motor Requirements for HVAC .....	5
Section 23 05 23.01 - Valves - Bronze .....	4
Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment.....	7
Section 23 05 48 - Vibration and seismic Controls for HVAC Piping and Equipment .....	5
Section 23 05 93 - Testing , Adjustment and Balancing for HVAC.....	6
Section 23 06 30.13 - Fan Schedule.....	1
Section 23 06 70.16 - Electric Resistance Furnace Schedule.....	1
Section 23 07 13 - Duct Insulation .....	6

---

Section 23 07 15 - Thermal Insulation for Piping .....	9
.....	
Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 PA.....	5
Section 23 33 00 - Air Duct Accessories.....	5
Section 23 34 00 - HVAC Fans.....	4
Section 23 37 13 - Diffusers, Registers and Grilles .....	4
Section 23 37 20- Louvers, Intakes and Vents .....	4
Section 23 65 10 - Condensers, Coolers and Cooling Towers.....	4

**Division 26 - ELECTRICAL**

Section 26 05 00 - Common Work Results for Electrical .....	6
Section 26 05 20 - Wire and Box Connectors 0-1000V .....	3
Section 26 05 21 - Wire and Cables (0-1000V) .....	3
Section 26 05 28 -Grounding - Secondary.....	4
Section 26 05 29 - Hangers and Supports for Electrical Systems .....	2
Section 26 05 31 - Splitters, Junctions, Pull Boxes, and Fittings.....	2
Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings .....	2
Section 26 05 33.01 - Surge and Lighting Fixture Raceways.....	3
Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings .....	3
Section 26 24 16.01 - Panel Board Breaker type .....	3
Section 26 27 26 - Wiring Devices .....	4
Section 26 28 16.02 - Moulded Case Circuit Breakers.....	3
Section 26 28 23 - Disconnect Switches Fused and Non-Fused .....	2
Section 26 50 00 - Lighting .....	5
Section 26 52 00 - Emergency Lighting .....	3
Schedule - Panel Schedule.....	1

**Division 31 - EARTHWORK**

Section 31 14 13 - Soil Stripping And Stockpiling.....	2
Section 31 23 16.26 - Rock Removal .....	3
Section 31 23 33.01 - Excavating, Trenching and Backfilling.....	9

**Division 32 - EXTERIOR IMPROVEMENTS**

Section 32 12 16.01 - Asphalt Paving Short Form.....	2
Section 32 14 10 - Unit paving on Sand Bed.....	4

---

**DRAWINGS:**

**ARCHITECTURAL**

- A000** COVER SHEET.
- A100** HEADER HOUSE DEMOLITION & CONSTRUCTION PLANS
- A101** HEADER HOUSE ELEVATIONS & DETAILS
- A200** WASHROOMS DEMOLITION AND CONSTRUCTION PLANS
- A201** WASHROOMS SECTIONS, ELEVATIONS, DETAILS
- A300** ELECTRICAL VAULT STAIRS CONSTRUCTION PLANS, SECTIONS, DETAILS

**MECHANICAL**

- M000** MECHANICAL DRAWING LIST AND LEGEND
- M201** WASHROOM BUILDING. PLANS MECHANICAL

**ELECTRICAL**

- E000** DRAWING LIST AND ELECTRICAL LEGEND
- E001** ELECTRICAL DETAILS
- E100** WASHROOMS ELECTRICAL SYSTEMS. DEMO & RENO

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- 1.2    Related Sections
- 1.3    Right to Accept or Reject Tenders
- 1.4    Examination of Documents and Site
- 1.5    Work Restrictions
- 1.6    Codes
- 1.7    Documents Required
- 1.8    Progress Meetings
- 1.9    Work Schedule
- 1.10   Substitutions
- 1.11   Cost Break Down
- 1.12   Payment Procedures
- 1.13   Contractors Use of Site
- 1.14   Submittal Procedures
- 1.15   Project Meetings
- 1.16   Location of Equipment and Fixtures
- 1.17   Concealment
- 1.18   Cutting and Patching
- 1.19   Alterations or Repairs to Existing Building
- 1.20   Addition Drawings
- 1.21   Taxes
- 1.22   Fees, Permits and Certificates
- 1.23   Cameras
- 1.24   Regulatory Requirements/ Environmental
- 1.25   Guaranties and Warranties
- 1.26   Building Smoking Environment
- 1.27   Subsurface Conditions
- 1.28   Health and Safety Requirements
- 1.29   Inspection and Declaration
- 1.30   Construction Progress Documentation
- 1.31   Quality Assurance
- 1.32   Rejected Work
- 1.33   Mock-ups

**1.2            RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 01 77 00 – Closeout Procedures
- .3        Section 01 78 00 – Closeout Submittals

---

**1.3 RIGHT TO ACCEPT OR REJECT TENDERS**

- .1 Notwithstanding any other provision in this Contract, National Capital Commission shall have the right to:
  - .1 Reject any tender that does not conform to tender requirements or with justification, and
  - .2 reject all Tenders.
- .2 Acceptance of the Tender shall occur at the time National Capital Commission awards the Tender and not necessarily at the time the award is communicated to the successful Tenderer.

**1.4 EXAMINATIONS OF DOCUMENTS AND SITE**

- .1 Each Tenderer, before submitting their Tender, shall carefully examine the drawings and specifications to establish the extent of the work and shall visit and examine the site and fully inform himself/herself of all the existing conditions, limitations and difficulties which may arise and include in his/her Tender the cost of all labour, materials, equipment and services required to complete the Work.
- .2 Carefully examine existing conditions prior to submitting bid. No extras will be authorized for work which could have been determined by a thorough, careful examination of site conditions by an experienced person.
- .3 Drawings and Specifications are complementary. Items shown or mentioned in one and not in the other are deemed to be included as part of the contract.
- .4 In the event of any discrepancy between the Drawings and the Specifications, the Specifications shall apply. If any item is shown on the Drawings but not in the Specifications, this does not mean that the items shown on the Drawings only are not in the Contract. See .6 below.
- .5 In the event of any discrepancy between one drawing and another, the larger scale drawing shall apply. If an item is shown on a smaller scale Drawing but not on the larger it is part of the Contract. A request to the Departmental Representative should be made for approval, if accepted a Site Instruction will be issued.
- .6 Where an item is shown on the Drawings but not in the Specifications, the Contractor shall supply and install to standard institutional quality.
- .7 The sequence and numbering of the drawings and details and the organization of the specifications into Divisions and Sections are established for convenient ordering of information. It must not be assumed that such ordering of information is intended to define or limit the scope of extent of the work of any particular subcontractor or supplier. The drawings and specifications as a whole must be fully read, in detail, to determine the extent of any portion of the Work. It is the responsibility of the Contractor to coordinate subcontractors and suppliers prices such that the stipulated Tender Price is all-inclusive as specified herein.
- .8 Sub-Contractors are responsible to familiarize themselves with the Contract Documents and the work of all trades therein. Sub-Contractors must base their quotations to the General Contractor on a thorough review of all the contract Drawings and Specifications.

**1.5 WORK RESTRICTIONS**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Provide schedule within 5 working days after contract award, showing schedule with project milestones, anticipated progress stages and final completion of work within time provide by contract documents.

- .3 Provide in form acceptable to Departmental Representative, within 5 working days of Contract award, schedule showing dates:
  - .1 Submission of shop drawings, material list, and samples.
  - .2 Commencement and completion of work of each section of specifications.
  - .3 Final Completion date within time period required by Contract Documents.
- .4 Carry out work:
  - .1 Exterior Building works; Monday to Friday from 06:00 to 18:00 hours. Co-ordinate with National Capital Commission if after hours or weekend work will be required.
  - .2 Co-ordinate with National Capital Commission project manager if scheduled work affects the clients use of facility. Schedule work to minimize disruption to the tenants. Do not proceed with any work that affects the clients /tenants without approval from National Capital Commission project manager.
  - .3 Co-ordinate with National Capital Commission project manager for access to work area and the use of vehicular equipment.

#### **1.6 CODES**

- .1 Perform work in accordance with *National Building Code of Canada (NBC)*, *Ontario Building Code (OBC)*, *CSA B651-04 Accessible Design for the built Environment* and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirement shall apply.
- .2 Meet or exceed requirement of:
  - .1 Contract Document.
  - .2 Specified standards, codes and Referenced documents
- .3 Where standards and referenced documents have changed, the most recent version shall apply.

#### **1.7 DOCUMENTS REQUIRED**

- .1 Maintain at the job site, one copy each of the following:
  - .1 Contact drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed shop drawings
  - .5 Change Orders
  - .6 Other modifications to contract
  - .7 Field test reports.
  - .8 Copy of approved work schedule.
  - .9 Manufactures' installation and application instruction.
  - .10 Site Specific Safety Plan including emergency procedures.

#### **1.8 PROGRESS MEETINGS**

- 1.1 During course of Work and 1 weeks prior to project completion, schedule progress meetings Bi-Weekly.
- 1.2 Contractor, major Subcontractors involved in Work and Departmental Representative and National Capital Commission Project Manger are to be in attendance.
- 1.3 Notify parties minimum 5 days prior to meetings.



- 1.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 days after meeting.
- 1.5 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .9 Review submittal schedules: expedite as required.
  - .10 Maintenance of quality standards.
  - .11 Review proposed changes for affect on construction schedule and on completion date.
  - .12 Other business.

**1.9 WORK SCHEDULE**

- .1 Provide Work Schedule within 5 working days after contract award, showing schedule with project milestones with anticipated progress stages and final completion of work within time provide by contract documents in coloured Gantt chart formatted in computer project software.
  - .1 Microsoft Project.
  - .2 OpenProj.
  - .3 or approved equal.
- .2 Provide in form acceptable to Departmental Representative, within 5 working days of Contract award, schedule showing dates:
  - .1 Submission of shop drawings, material list, and samples.
  - .2 Delivery of following items of equipment and materials.
  - .3 Commencement and completion of work of each section of section of specifications.
  - .4 Final Completion date within time period required by Contract documents.
- .3 Interim review of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule update by Contractor in conjunction with and to approval of Departmental Representative.

**1.10 SUBSTITUTIONS**

- .1 The Contract is based on Contract documents.
- .2 Specific materials, products and systems are specified to provide standard of acceptance. Equivalent materials, products or systems are accepted as substitutions only when approved by addendum.
- .3 Substitutions, which do not satisfy the above requirements, will be rejected by the Departmental Representative. Materials, products and systems, which are so rejected, shall be replaced by the specified item at no cost to the project.
- .4 In the event that, prior to closing of tenders, tenderer wishes of offer a substitution or a proposal of work, materials or methods as an alternate to those described in contract documents, he/she shall submit a request in writing at least 7 calendar days prior to tender close date.

- .5 The request shall include:
  - .1 A description of the proposed substitutions; and
  - .2 In the case of materials, products or systems, a direct comparison between the properties and compliances of the specified materials, product or systems with properties and compliances of the proposed substitution, arranged in tabular form in the same sequence as specified herein or in the sequence listed in specified manufacturer's published literature , as applicable ; and
  - .3 If requested by the Departmental Representative, list of no less than five projects of comparable size where the substitution has been used in similar application. Such projects shall have been completed prior within the last five years and, where applicable , shall have been subjected to climate conditions similar to experienced in Ottawa. The list shall include the name and current telephone number of the Architect and Owner of each project.
- .6 In the event that the Departmental Representative deems the information provided with the request for approval of a substitution to be inadequate, the request may be rejected.
- .7 Preference will be given to products of Canadian manufacture.
- .8 Approval of alternative proposal of work, materials or methods will be signified by the issue of an addendum.
- .9 The cost of additional work/or modification to design due to the use of alternative material, product or system shall be borne by the contractor.
- .10 Where the terms "or equal", "or equivalent" or terms of similar meaning are used in the specifications, this shall not be construed as acceptance of any alternative material, product or system to those specified. The use of these terms does not relieve the Contractor from his responsibility to follow the procedures for approval of substitutions specified herein (during tender period) or the procedures described in Section 01 00 10 - General Instructions (after award of Contract).
- .11 No substitutions will be permitted after award of the Contract except in accordance with General Conditions GC 6.1 "CHANGES" and the article Substitutions in Section 01 00 50 - General Instructions. For procedures regarding substitutions after the award of the Contract, refer to General Conditions GC 6.1 "CHANGES".

**1.11**

**COST BREAKDOWN**

- .1 Submit to Departmental Representative, at least 14 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment. After approval by Departmental Representative cost breakdown will be used a basis for progress payment.
- .2 Breakdown to follow the following format:

Item: Spec Section	Description of work	Contract value	% to Date	\$\$\$ to date	%Previous	\$ Previous	% This Claim	\$ This Claim	Balance to complete

- .3 If approved change order will become part of the breakdown under a new item heading.
- .4 The Cost will include a price of \$3000.00 for construction progress documentations and as built drawings. No progress claim can be made for this

amount prior to total completion of construction progress documentations and as built drawings.

**1.12 PAYMENT PROCEDURES**

- 1.1 Refer to CCDC 2 2008.
- 1.2 Make applications for payment on account as monthly as Work progresses.
- 1.3 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
- 1.4 Progress claim Invoice will contain the following information.
  - .1 Project description and NCC (National Capital Commission) project number.
  - .2 "Progress billing for Period Ending" "MM/DD/YYYY"
  - .3 Amounts showing:
    - .1 (\$\$\$) Total Progress This Period
    - .2 10% Holdback on Progress this period
    - .3 (\$\$\$) Subtotal (Total progress minus holdback)
    - .4 (\$\$\$) HST \_\_%
    - .5 (\$\$\$) Total payable this period.
  - .4 Departmental Representative will issue to National Capital Commission project manager , no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Departmental Representative determines to be due. If Departmental Representative amends application, Departmental Representative will give notification in writing giving reasons for amendment.
- 1.5 Statutory Declaration:
  - .1 The Contractor or supplier shall submit, with 2nd and each subsequent progress payment claim, Statutory Declaration that indicates persons, organizations, suppliers and Sub-trades required to be paid have been paid.

**1.13 CONTRACTOR USE OF SITE**

- .1 Use of site: exclusive and complete for execution of work.
- .2 Coordinate with Departmental Representative areas for work and storage.
- .3 Obtain and pay for use of additional storage containers on site. No on site storage is provided.

**1.14 SUBMITTAL PROCEDURES:**

- .1 Submit shop drawings, product Data and Samples in accordance with section 01 33 00 Submittal Procedures.
- .2 Certificates and Transcripts
  - .1 Immediately after award of Contract, submit Workers' Compensation Board status.
  - .2 Submit transcription of insurance immediately after award of Contract.

**1.15 PROJECT MEETINGS / QUALITY ASSURANCE**

- .1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial/Territorial regulations.
- .2 Site Meetings.

- .1 Convene pre-installation meeting one week prior to beginning work and on-site.
- .2 Verify project requirements.
- .3 Review installation and substrate conditions.
- .4 Co-ordination with other building subtrades.
- .5 Review manufacturer's installation instructions and warranty requirements.
- .3 Hold project meetings bi-weekly.
- .4 Ensure key personnel, site supervisor, project manager and subcontractor representatives attend.
- .5 Record minutes of meetings, and distribute to participants with 5 working days.
- .6 Project Manager will arrange project meetings, notify participants and distributing final meeting minutes.
- .7 General Contractor must provide written report on status of waste diversion activity at each meeting.

**1.16 LOCATION OF EQUIPMENT AND FIXTURES**

- .1 Location of equipment, fixtures and outlets indicated or specified to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum inference and maximum useable space and in accordance with manufacture's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain his approval for actual location.
- .4 Submit field drawings to indicate relative position of various service and equipment when required by Departmental Representative.

**1.17 CONCEALMENT**

- .1 Conceal pipes, ducts and wiring in floors, wall and ceiling construction of finished areas except where indicated otherwise.

**1.18 CUTTING AND PATCHING**

- .1 Obtain Departmental Representative's approval before cutting, boring or sleeving load-bearing members.
- .2 Make cuts with clean, true, smooth edges.
- .3 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.

**1.19 ALTERATIONS / REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Prior to any cutting, coring, or drilling, a scan or x-ray is required to locate conduits, pipes, and structural Steel. Contractor to carry the cost to perform scanning.
- .3 Where security has been reduced by work of Contract, provide temporary means to maintain security.
- .4 **Provide temporary protection, dust screens, barriers, warning signs and drop cloths in locations where renovation and alteration work is adjacent to areas used by public or tenant**

**1.20 ADDITIONAL DRAWINGS**

- .1 Departmental Representative may furnish additional drawings for clarifications. These additional drawings have the same meaning and intent as if they are included with plans referred to in Contract documents.
- .2 Clarifications:
  - .1 Clarifications are issued for the purpose of recording any clarification or interpretation of the contract documents or giving direction on problems resulting from field conditions.
  - .2 Clarifications are subject to the provisions of the contract documents.
  - .3 Should the contractor require a change in contract price or project schedule resulting from a clarification, he shall submit to the Departmental Representative with 5 days of the date hereof, an itemized proposal. If the proposal is accepted by the Departmental Representative, the clarification will be superseded by a change order.
  - .4 If specifically co-authorized by the contractor and Departmental Representative, clarifications can be issued for which is to proceed without delay and requires a change in contract amount. The cost of the work will be as submitted by the contractor upon completion, but less than the agreed 'not to exceed' amount stated on the clarifications. A Change order will be issued based on the final cost.

**1.21 TAXES**

- .1 Pay all taxes properly levied by law (including federal, provincial and municipal), except as noted elsewhere.

**1.22 FEES, PERMITS AND CERTIFICATES**

- .1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence the work conforms to the requirements of authority having jurisdiction.

**1.23 CAMERAS**

- .1 Progress document photographs as indicated 1.30.3 are to be reviewed and approved by National Capital Commission Project Manager."

**1.24 REGULATORY REQUIREMENTS/ ENVIRONMENTAL**

- .1 Hazardous Material Discovery
  - .1 Demolition of spray or trowel-applied asbestos can be hazardous to health. Should material resembling spray or towel-applied asbestos be encountered in course demolition work stop and notify Departmental Representative immediately. Do not proceed until written instruction has been received from Departmental Representative.
  - .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.
  - .3 Mould: stop work immediately when material-resembling mould is encountered during demolition work. Notify Departmental Representative.
- .2 Fires
  - .1 Fire and burning of rubbish on site are not permitted.
- .3 Disposal of waste:
  - .1 Do not bury rubbish and waste materials on site.

- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

**1.25 GUARANTEE / WARRANTY**

- .1 The guarantee / warranty is include necessary materials, labour and clean-up for repair or replacement of work under this contract resulting from faulty materials or workmanship.
- .2 Where conflicting guarantee / warranty period exist, the longer period will supersede the shorter.
- .3 For any item that is found defective and it the rectified or replaced during the guarantee / warranty period, the contractor shall extend the guarantee / warranty period a further twelve months from the date of the Departmental Representative's written acceptance of the rectified work or new material or equipment.

**1.26 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions

**1.27 SUBSURFACE CONDITIONS**

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

**1.28 HEALTH AND SAFETY REQUIREMENTS**

- .1 References
  - .1 CSA S269.1-1975 (R2003) False work for construction purposes
  - .2 CAN/CSA-S269.2-M87 Access Scaffolding for Construction Purposes.
  - .3 FC 301-2009-1-13 Standard for Construction operations
  - .4 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
  - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .6 Material Safety Data Sheets (MSDS).
  - .7 Province of Ontario
  - .8 Occupational Health and Safety Act, R.S.O. 213/91
  - .9 CAN/CSA-Z259.10.06 Full Body Harnesses
  - .10 CAN/CSA-Z259.10.12- Connecting Components for personal fall arrest systems (PFAS)
  - .11 Full Body Harnesses
- .2 Personal Fall Protection
  - .1 Contractor to follow Occupational Health & Safety Act O.Reg 213/91 subsections 26.14 to 26.9 for installation of 9th floor guardrails.
- .3 Construction Safety measures
  - .1 Observe construction safety measures of national building code, part 8, province or Ontario workers compensation board and municipal authority provided that in any case of conflict or discrepancy more stringent requirement shall apply.

- 
- .2 Comply with requirements of FC301 Standard for Construction Purposes.
  - .4 Overloading
    - .1 Ensure no part of work is subject to loading that will endanger its safety or will cause permanent damage.
  - .5 Falsework
    - .1 Design and construct falsework in accordance with CSA S269.1
  - .6 Scaffolding
    - .1 Design and construct scaffolding in accordance with CSA S269.2
  - .7 Minimum work practice for Asbestos-containing products.
    - .1 In view of fact that inhalation of asbestos fibres may be hazardous to health, but without in any way guaranteeing their effectiveness as protected against health hazards, the following practices shall apply.
    - .2 When working with asbestos-containing materials workers shall wear respirators acceptable to labour Canada or provincial labour department as suitable for asbestos exposure in work area. Workers shall also be educated as to risks, and be trained in safe practices. Power tools shall be equipped with efficiency particulate air-filtered vacuum equipment.
    - .3 When working in a enclosed area separate work area from rest of project by barrier capable of preventing spread of asbestos fibres outside work area.
    - .4 When working with asbestos-cement pipe comply with recommendations of asbestos-cement pipe producers association "recommended work practices for A/C pipe" subject to more stringent requirements of 6.2 above.
    - .5 Upon completion of work, clean work areas using wet methods or high efficiency particulate air-filtered vacuum equipment. Remove waste asbestos-containing materials in sealed containers labelled as to contents to disposal area acceptable to authorities having jurisdiction.
    - .6 In event of conflict between these requirements and those of provincial governments, labour Canada, or Heath Canada, more stringent requirements shall apply.
  - .8 WHMIS
    - .1 Comply with the requirements of workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provisions of material safety data sheets acceptable to labour Canada and heath Canada.
    - .2 Deliver copies of WHMIS data sheets to Departmental Representative on delivery of materials.
  - .9 Health and safety on site:
    - .1 Departmental will provide a security agent for the duration of the work
    - .2 Comply with the security agents instructions and pay for corrective work.
    - .3 Meet with security and sub-contractors prior to starting on work on site an co-ordinate:
      - .1 Labour relationships policies
      - .2 Site access control measures
      - .3 Safety measures on site
  - .10 Comply with and pay all associated costs related to site access control measures:
    - .1 No cards issued. Escorts will be provided.

- .2 No onsite parking is available, only loading and unloading will be permitted. Parking is at the discretion of Project Manager and must be coordinated beforehand. Inform all workers of site rules: labour relationship policies, site access control measures and safety measures on the site. Ensure workers respect the rules.
- .11 Inform the security agent of all modifications concerning the workers teams on the site.
- .12 The Departmental Representative reserves the right to verify all vehicle, parcels, ect. arriving or departing the site.
- .13 Health and Safety Submittals
  - .1 Submit site-specific health and safety plan: Within 3 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
    - .2 Results of site specific safety hazard assessment.
    - .3 Results of safety and health risk or hazard analysis for site tasks and operation.
    - .4 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
    - .5 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
    - .6 Submit copies of incident and accident reports.
    - .7 Departmental Representative will review Contractor's site specific Health and Safety Plan and provide comments to Contractor within 2 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative.
    - .8 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
- .14 General Requirements
  - .1 Develop written site specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
  - .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.
- .15 Responsibility
  - .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
  - .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .16 Compliance Requirements
  - .1 Comply with Ontario Health and Safety Act, R.S.O.
- .17 Unforeseen Hazards
  - .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.
- .18 Health And Safety Coordinator



- .19 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have site-related working experience specific to activities associated with demolition.
  - .2 Have working knowledge of occupational safety and health regulations.
  - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
  - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .20 Posting Of Documents
  - .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.
  - .2 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .21 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
  - .1 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

## 1.29

### INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
  - .1 Completion: submit written certificate that following have been performed:
    - .1 Work has been completed and inspected for compliance with Contract Documents.
    - .2 Defects have been corrected and deficiencies have been completed.
    - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
    - .4 Operation of systems have been demonstrated to Owner's personnel.
    - .5 Work is complete and ready for Final Inspection.
- .3 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .4 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

- .5 Commencement of Lien and Warranty Periods: date of Departmental Representative acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .6 Final Payment: When Departmental Representative considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .7 Payment of Holdback: After issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback.

**1.30 CONSTRUCTION PROGRESS DOCUMENTATION**

- .1 Construction Schedule.
  - .1 Completion Date
  - .2 Key Project Milestones and Partial completion dates.
- .2 As-built records
  - .1 Maintain precise and accurate as-built progress records by annotating a set of drawings and specifications set aside for this purpose.
  - .2 Update records daily to note all deviations from indicated and specified requirements, including actual locations of service lines, hidden construction and services, and materials installed in the finish work.
  - .3 Transfer records to two sets of drawings and specifications obtained from Departmental Representative prior to Departmental Representative's inspection for issuance of Final Certificate of Completion.
- .3 Construction Progress Photographs
  - .1 At start of construction, Contractor to take detailed photos of all project areas, surfaces and affected site area and transmit to Departmental Representative for approval. Annotate a set of drawings set aside for this purpose, showing photographs locations and dates.
  - .2 During construction, Contractor to take a minimum 5 photographs per day, with additional as required for complex documentation.
  - .3 Contractor to maintain precise photographs records by organizing the photos by groupings and labelling the photos, showing photograph locations and dates.
  - .4 Photographs to be in digital format.
  - .5 Provide two hard copy photographs in three ring binder format and two binder format and two CD versions For Departmental Representative's inspection for issuance of Final Certificate of Completion.

**1.31 QUALITY ASSURANCE**

- .1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial/Territorial regulations.
- .2 Site Meetings.
- .3 Convene pre-installation meeting one week prior to beginning work and on-site.
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

- .4 Hold project meetings bi-week.
- .5 Ensure key personnel, site supervisor, project manager and subcontractor representatives attend.
- .6 General Contractor must provide written report on status of waste diversion activity at each meeting.

**1.32 REJECTED WORK**

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

**1.33 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative.
- .3 Mock-up will be used:
  - .1 to judge workmanship, substrate preparation, operation of equipment and material application.
  - .2 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.
- .4 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .5 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .6 Allow 2 days for inspection by Departmental Representative.
- .7 Mock-up may remain as part of work.
- .8 NCC project manager must be notified of all mock-ups, must be present for all review and approval of all mock-ups.

**END OF SECTION**

**Part 1            General**

**1.1            ACCESS AND EGRESS**

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

**1.2            USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Closures: protect work temporarily until permanent enclosures are completed.

**1.3            ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

**1.4            EXISTING SERVICES**

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for pedestrian and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**1.5            SPECIAL REQUIREMENTS**

- .1 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .2 Keep within limits of work and avenues of ingress and egress.
- .3 Ingress and egress of Contractor vehicles at site is limited to .
- .4 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative .

---

**1.6 SECURITY**

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

**1.7 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions. Smoking is not permitted.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                ADMINISTRATIVE**

- .1        Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2        Do not proceed with Work affected by submittal 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 produced in SI Metric units converted values are acceptable.
- .5        Review submittals prior to submission to Departmental Representative . This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6        Notify Departmental Representative , in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7        Verify field measurements and affected adjacent Work are co-ordinated.
- .8        Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9        Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10       Keep one reviewed copy of each submission on site.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Refer to CCDC 2 GC 3.11.
- .2        The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .3        Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .4        Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .5        Allow 3 days for Departmental Representative's review of each submission.

- .6 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .7 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .8 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .9 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.
    - .4 Capacities.
    - .5 Performance characteristics.
    - .6 Standards.
    - .7 Operating weight.
    - .8 Wiring diagrams.
    - .9 Single line and schematic diagrams.
    - .10 Relationship to adjacent work.
- .10 After Departmental Representative's review, distribute copies.
- .11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .12 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .13 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative .

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.
- .14 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative .
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .15 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative .
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .16 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative .
- .17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .18 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative .
- .19 Delete information not applicable to project.
- .20 Supplement standard information to provide details applicable to project.
- .21 If upon review by Departmental Representative , no errors or omissions are discovered or if only minor corrections are made, electronic copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

### 1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.



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

**1.4 MOCK-UPS**

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

**1.5 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic and hard copy of colour digital photography in jpg format, fine resolution monthly with progress statement. .
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations.
  - .1 Viewpoints and their location as determined by Departmental Representative .
- .4 Frequency of photographic documentation: weekly. .
  - .1 Upon completion of: excavation, foundation, framing and services before concealment, of Work, and as directed by Departmental Representative .

**1.6 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-2008, Stipulated Price Contract.

**1.2 INSPECTION**

- .1 Refer to CCDC 2, GC 2.3 .
- .2 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .4 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .5 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

**1.3 INDEPENDENT INSPECTION AGENCIES**

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative .
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative . Pay costs for retesting and re-inspection.

**1.4 ACCESS TO WORK**

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

**1.5 PROCEDURES**

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

**1.6 REJECTED WORK**

- .1 Refer to CCDC, GC 2.4 .
- .2 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .3 Make good other Contractor's work damaged by such removals or replacements promptly.
- .4 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative .

**1.7 REPORTS**

- .1 Submit electronic copies of inspection and test reports to Departmental Representative .
- .2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested .

**1.8 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

**1.9 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative 's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

---

**1.10 MILL TESTS**

- .1 Submit mill test certificates as requested..

**1.11 EQUIPMENT AND SYSTEMS**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1      Canadian General Standards Board (CGSB)
  - .1      CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
  - .2      CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2      Canadian Standards Association (CSA International)
  - .1      CSA-O121-M1978(R2003), Douglas Fir Plywood.

**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                HOARDING**

- .1      Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.
- .2      Apply plywood panels vertically flush and butt jointed.
- .3      Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .4      Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
- .5      Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.
- .6      Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

**1.4                GUARD RAILS AND BARRICADES**

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

**1.5                WEATHER ENCLOSURES**

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

**1.6 DUST TIGHT SCREENS**

- .1 Provide dust tight 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.

**1.7 ACCESS TO SITE**

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

**1.8 PUBLIC TRAFFIC FLOW**

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

**1.9 FIRE ROUTES**

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

**1.10 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.

**1.11 PROTECTION OF BUILDING FINISHES**

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

**1.12 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal .

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

---

**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-2008, Stipulated Price Contract.
- .2 Within text of each specifications section, reference may be made to reference standards.
- .3 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .4 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .5 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

**1.2 QUALITY**

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

**1.3 AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental



Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber and on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative .
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### **1.5 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative . Unload, handle and store such products.

#### **1.6 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

#### **1.7 QUALITY OF WORK**

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

Representative if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative , whose decision is final.

**1.8 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

**1.9 CONCEALMENT**

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative .

**1.10 REMEDIAL WORK**

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

**1.11 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

**1.12 FASTENINGS**

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

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

**1.13 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

**1.14 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative .

**1.15 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Canadian Construction Documents Committee (CCDC)
  - .1        CCDC 2-2008, Stipulated Price Contract.

**1.2                PROJECT CLEANLINESS**

- .1        Maintain Work 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 at daily regularly scheduled times or dispose of as directed by Departmental Representative . Do not burn waste materials on site.
- .3        Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4        Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5        Provide on-site containers for collection of waste materials and debris.
- .6        Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7        Dispose of waste materials and debris off site.
- .8        Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9        Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10       Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11       Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12       Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

**1.3                FINAL CLEANING**

- .1        When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2        Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3        Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4        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 Departmental Representative. 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 Wax, seal or prepare floor 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 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .18 Clean roofs, downspouts, and drainage systems.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .20 Remove snow and ice from access to building.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal .

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

---

**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-2008, Stipulated Price Contract.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Acceptance of Work Procedures:
  - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
    - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
    - .2 Request Departmental Representative inspection.
  - .2 Departmental Representative Inspection:
    - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
    - .2 Contractor to correct Work as directed.
  - .3 Completion Tasks: submit written certificates for tasks have been performed as follows:
    - .1 Work: completed and inspected for compliance with Contract Documents.
    - .2 Defects: corrected and deficiencies completed.
    - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
    - .4 Operation of systems: demonstrated to Owner's personnel.
    - .5 Commissioning Decommissioning of mechanical systems: completed in accordance with General Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to Departmental Representative .
    - .6 Work: complete and ready for final inspection.
  - .4 Final Inspection:
    - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
    - .2 When Work incomplete according to Owner and Departmental Representative , complete outstanding items and request re-inspection.
  - .5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
  - .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
  - .7 Final Payment:
    - .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
    - .2 Refer to CCDC 2: when Work deemed incomplete by Departmental Representative , complete outstanding items and request re-inspection.

- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

**1.3 FINAL CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning .
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



**Part 1            General**

**1.1            ADMINISTRATIVE REQUIREMENTS**

- .1    Pre-warranty Meeting:
  - .1    Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative , in accordance with Section 01 00 10 General Conditions to:
    - .1    Verify Project requirements.
    - .2    Review manufacturer's installation instructions and warranty requirements.
  - .2    Departmental Representative to establish communication procedures for:
    - .1    Notifying construction warranty defects.
    - .2    Determine priorities for type of defects.
    - .3    Determine reasonable response time.
  - .3    Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
  - .4    Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Provide submittals in accordance with Section 01 33 00 - Submittal Procedures .
- .2    Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative three printed and electronic final copies of operating and maintenance manuals in English.
- .3    Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4    Provide evidence, if requested, for type, source and quality of products supplied.

**1.3            FORMAT**

- .1    Organize data as instructional manual.
- .2    Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3    When multiple binders are used correlate data into related consistent groupings.
  - .1    Identify contents of each binder on spine.
- .4    Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5    Arrange content by process flow, 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.
  - .1 Bind in with text; fold larger drawings to size of text pages.

#### **1.4 CONTENTS - PROJECT RECORD DOCUMENTS**

- .1 Table of Contents for Each Volume: provide title of project;
  - .1 Date of submission; names.
  - .2 Addresses, and telephone numbers of Departmental Representative, Sub-contractor, Contractors and name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control .
- .6 Training: refer to Section 01 79 00 - Demonstration and Training .

#### **1.5 AS -BUILT DOCUMENTS AND SAMPLES**

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
  - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
  - .1 Do not use record documents for construction purposes.

- .5 Keep record documents and samples available for inspection by Departmental Representative .

## **1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS**

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
  - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

## **1.7 EQUIPMENT AND SYSTEMS**

- .1 For each item of equipment and each system include description of unit or system, and component parts.
  - .1 Give function, normal operation characteristics and limiting conditions.
  - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
  - .1 Include regulation, control, stopping, shut-down, and emergency instructions.

- .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and General Commissioning (Cx) Requirements.
- .15 Additional requirements: as specified in individual specification sections.

## **1.8 MATERIALS AND FINISHES**

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
  - .1 Provide information for re-ordering custom manufactured products .
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

## **1.9 MAINTENANCE MATERIALS**

- .1 Spare Parts:
  - .1 Provide spare parts, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative .
    - .2 Include approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock 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 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative .
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 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 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative .
    - .2 Include approved listings in Maintenance Manual.

**1.10 DELIVERY, STORAGE AND HANDLING**

- .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 for review by Departmental Representative .

**1.11 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.
- .6 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .7 Conduct joint 5 month and 11 month warranty inspection, measured from time of acceptance, by Departmental Representative .
- .8 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
  - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems, .
  - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
    - .1 Name of item.
    - .2 Model and serial numbers.
    - .3 Location where installed.
    - .4 Name and phone numbers of manufacturers or suppliers.
    - .5 Names, addresses and telephone numbers of sources of spare parts.
    - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
    - .7 Cross-reference to warranty certificates as applicable.
    - .8 Starting point and duration of warranty period.
    - .9 Summary of maintenance procedures required to continue warranty in force.
    - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
    - .11 Organization, names and phone numbers of persons to call for warranty service.
    - .12 Typical response time and repair time expected for various warranted equipment.
  - .4 Contractor's plans for attendance at 5 and 11 month post-construction warranty inspections.
  - .5 Procedure and status of tagging of equipment covered by extended warranties.
  - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

**1.12 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative .
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.
  - .5 Warranty period.
  - .6 Inspector's signature.
  - .7 Construction Contractor.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                ADMINISTRATIVE REQUIREMENTS**

- .1        Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2        Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3        Preparation:
  - .1        Verify conditions for demonstration and instructions comply with requirements.
  - .2        Verify designated personnel are present.
  - .3        Ensure equipment has been inspected and put into operation in accordance with manufacturer's written instruction.
  - .4        Ensure testing, adjusting, and balancing has been performed in accordance with Section General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .4        Demonstration and Instructions:
  - .1        Demonstrate start-up, operation, control, adjustment, trouble-shooting, , servicing, and maintenance of each item of equipment at scheduled agreed upon times, at the equipment location.
  - .2        Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - .3        Review contents of manual in detail to explain aspects of operation and maintenance.
  - .4        Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5        Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:
  - .1        Section 23 05 00- Cooling and Ventilation System: 1 hours of instruction.
  - .2        Section 23 30 05 - Plumbing System: 30 minutes of instruction.
  - .3        Section 26 05 00 Common Work Results for Electrical and 26 52 00-Emergency Lighting : 45 minutes hours of instruction.
  - .4        Section 14 42 00 - Wheelchair lifts: 1 hours of instruction.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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



- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

**1.3 QUALITY ASSURANCE**

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
  - .1 Instruct Owner's personnel.
  - .2 Provide written report that demonstration and instructions have been completed.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA International
  - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and 01 74 21 - Construction/Demolition Waste Management Disposal.
- .2 Submit demolition drawings:
  - .1 Submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario Canada, showing proposed method.

**1.3 SITE CONDITIONS**

- .1 Review "Designated Substance Report" and take precautions to protect environment.
- .2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
  - .1 Proceed only after receipt of written instructions have been received from Departmental Representative .
- .3 Notify Departmental Representative before disrupting building access or services.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Inspect building and site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or

plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

- .1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.
- .2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

### **3.2 PREPARATION**

- .1 Temporary Erosion and Sedimentation Control:
  - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to: requirements of authorities having jurisdiction sediment and erosion control drawings sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work..
- .2 Protection of In-Place Conditions:
  - .1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features and parts of building to remain in place. Provide bracing and shoring required.
  - .2 Keep noise, dust, and inconvenience to occupants to minimum.
  - .3 Protect building systems, services and equipment.
  - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
  - .5 Do Work in accordance with Section 01 00 10 General Instructions - Health and Safety Requirements.
- .3 Demolition/Removal:
  - .1 Remove items as indicated.
  - .2 Removal of Pavements, Curbs and Gutters:
    - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative .
    - .2 Protect adjacent joints and load transfer devices.
    - .3 Protect underlying and adjacent granular materials.
  - .3 Remove parts of existing building to permit new construction.
  - .4 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Refer to demolition drawings and specifications for items to be salvaged for reuse.

- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .5 .
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1            General**

**1.1            PRICE AND PAYMENT PROCEDURES**

- .1 Measurement and Payment:
  - .1 Measure reinforcing steel in kilograms of steel incorporated into Work, computed from theoretical unit mass specified in CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by Departmental Representative .
  - .2 No measurement will be made under this Section.
    - .1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

**1.2            REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 SP-66-04, ACI Detailing Manual 2004.
- .2 ASTM International
  - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .4 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 CSA International
  - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.
  - .3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
  - .4 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .6 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario Canada.

- .1 Indicate placing of reinforcement and:
  - .1 Bar bending details.
  - .2 Lists.
  - .3 Quantities of reinforcement.
  - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative with identifying code marks to permit correct placement without reference to structural drawings.
  - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
- .4 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

#### **1.4 QUALITY ASSURANCE**

- .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.
  - .1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
  - .2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Departmental Representative .
- .2 Reinforcing steel: billet steel, grade 350, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.
- .6 Welded steel wire fabric: to ASTM A185/A185M.
  - .1 Provide in flat sheets only.

- .7 Welded deformed steel wire fabric: to ASTM A82/A82M.
  - .1 Provide in flat sheets only.
- .8 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .9 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m<sup>2</sup>.
  - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
  - .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
    - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
  - .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
    - .1 In this case, no restriction applies to temperature of solution.
  - .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
    - .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .10 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .11 Mechanical splices: subject to approval of Departmental Representative .
- .12 Plain round bars: to CSA-G40.20/G40.21.

## **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 SP-66 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
  - .1 SP-66 unless indicated otherwise.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative , weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
  - .1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

## **2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Galvanizing to include chromate treatment.

- .1 Duration of treatment to be 1 hour per 25 mm of bar diameter.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

### **3.2 FIELD BENDING**

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

### **3.3 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
  - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
  - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

### **3.4 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**



**Part 1 General**

**1.1 PRICE AND PAYMENT PROCEDURES**

.1 Measurement and Payment:

- .1 Measure cast-in-place concrete in sub-structure in cubic metres calculated from neat dimensions as indicated .
  - .1 Concrete placed beyond dimensions indicated will not be measured.No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.
- .2 No deductions will be made for volume of concrete less than 0.1 m<sup>3</sup> in cross sectional area in volume displaced by individual drainage openings.
- .3 Cast-in-place concrete in superstructure will not be measured but will paid for as fixed price item.
- .4 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.
- .5 Measure supply and installation of waterstops in lineal metres installed.

**1.2 REFERENCES**

.1 Abbreviations and Acronyms:

- .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
  - .1 Type GU, GUb and GUL - General use cement.
  - .2 Type MS and MSb - Moderate sulphate-resistant cement.
  - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
  - .4 Type HE, HEb and HEL - High early-strength cement.
  - .5 Type LH, LHb and LHL - Low heat of hydration cement.
  - .6 Type HS and HSb - High sulphate-resistant cement.
- .2 Fly ash:
  - .1 Type F - with CaO content less than 15%.Type CI - with CaO content ranging from 15 to 20%.
  - .2 Type CH - with CaO greater than 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

.2 Reference Standards:

- .1 ASTM International
  - .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2 ASTM C309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM D624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .2 CSA International
  - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.

- .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing inspection results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .4 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

### **1.4 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Departmental Representative , minimum 2 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
  - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
  - .5 Finishes.
  - .6 Formwork removal.Joints.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
    - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative laboratory representative and concrete producer as described in CSA A23.1/A23.2.
    - .2 Deviations to be submitted for review by Departmental Representative .
  - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

**Part 2 Products**

**2.1 DESIGN CRITERIA**

- .1 Alternative 1 - Performance : to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.
- .2 Alternative 2 - Prescription: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

**2.2 PERFORMANCE CRITERIA**

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.
- .2 Portland Cement: to CSA A3001, Type GUb.
- .3 Blended hydraulic cement: Type GUb to CSA A3001.
- .4 Portland-limestone cement: Type GUL to CSA A23.1.
- .5 Water: to CSA A23.1.
- .6 Aggregates: to CSA A23.1/A23.2.
- .7 Admixtures:
  - .1 Air entraining admixture: to ASTM C260.
  - .2 Chemical admixture: to ASTM C494 ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .8 Shrinkage compensating grout: premixed compound consisting of metallicnon-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1 Compressive strength: 30 MPa at 28 days.
  - .2 Net shrinkage at 28 days: maximum 2 %.

**2.3 MIXES**

- .1 Alternative 1 - Performance Method for specifying concrete: to meetDepartmental Representative performance criteria to CSA A23.1/A23.2.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
  - .2 Provide concrete mix to meet following plastic state requirements:
    - .1 Uniformity: .
    - .2 Workability: S2 (sump test) 50-90 mm sump.
    - .3 Finish ability: minimum bleeding.
    - .4 Set time: 2 hours maximum.
  - .3 Provide concrete mix to meet following hard state requirements:
    - .1 Durability:XC4
    - .2 Exposure Classification: X0
    - .3 Compressive strength at 28 age: 35 5070 Mpa minimum.
    - .4 Intended application: .Vertical concrete wall

- .5 Aggregate size 19 mm maximum.
- .6 Volume stability: acceptable volume change range due to shrinkage, creep and freeze thaw cycle.
- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete. Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
  - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .11 Do not place load upon new concrete until authorized by Departmental Representative .

**3.2 INSTALLATION/APPLICATION**

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: Provide written declaration that compounds used are compatible.
  - .4 Finish concrete floor to CSA A23.1/A23.2.

- .5 Concrete floor to have finish hardness equal to or greater than Mohs hardness to CSA A23.1/A23.2.
- .6 Provide screed finish where bonded topping floor tile is to be applied.
- .7 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

### **3.3 FIELD QUALITY CONTROL**

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7 and 28 days.
  - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
- .4 NCC will pay for costs of tests that they request..
- .5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .6 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

### **3.4 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative .
  - .2 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative .
  - .3 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
  - .4 Prevent admixtures and additive materials from entering drinking water supplies or streams.
  - .5 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial and National regulations.

**END OF SECTION**

**Part 1            General**

**1.1                Related Work**

- .1        Repointing and Section 04 03 07 – Historic - Masonry Repointing.

**1.2                References**

- .1        ASTM C 579(1997) Specification for Quicklime for Structural Purposes.
- .2        ASTM C 207-91(1997) Specification for Hydrated Lime for Masonry.
- .3        ASTM C 348-97 Test Method for Flexural Strength of Hydraulic - Cement Mortars
- .4        CAN/CSA-A179-M2009 Mortar and Grout for Unit Masonry.  
  
          CAN/CSA-A371-R2009 Masonry Construction for Buildings

**1.3                Allowable Tolerances**

- .1        If the mortar fails to meet the 7day compressive strength requirements, but meets the 28day compressive strength requirement, it is to be accepted. If the mortar fails to meet the 7day compressive strength requirement, but its strength at 7days exceeds two thirds of the value required for the 7day strength, the contractor may elect to continue work at his own risk whilst awaiting the results of the 28day tests, or to take down the work affected.

**1.4                Samples**

- .1        Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit samples in quantity and size in accordance with CSAA179M.

**1.5                Test Reports**

- .1        Submit 2 sets of test results to show that properties are appropriate to particular mortar mix.

**1.6                Environmental Requirements**

- .1        Execute work when ambient temperature is above 5°C. When ambient temperature is below 5°C care and heat work as directed by NCC Representative.
- .2        Prepare and maintain temperature of mortar between 5°C and 50°C until used.

**1.7                Scheduling Of Work**

- .1        Submit work schedule indicating anticipated progress stages within time of final completion shown in bid document.
- .2        Take measures necessary to complete work within approved schedule time. Schedule may not be changed without approval.

**1.8 Alternatives**

- .1 Obtain NCC Representative approval before changing manufacturer's brands or sources of supply of mortar materials during entire contract or other methods of mixing mortar specified elsewhere in this specification.

**1.9 Measurement of Payment**

- .1 Payment for this work will be on lump sum basis and will include costs associated with supplying, mixing, testing and executing masonry work as specified.

**Part 2 Products**

**2.1 Materials**

- .1 Use same brands of materials and source of aggregates for entire project.
- .2 Sand: to CSA A179. Use well graded aggregate passing 4.75mm down to 300 micron sieve where joints are greater than 6mm. Use aggregate passing 1.18mm down to 300 micron sieve where 6mm thick joints or less are indicated
- .3 Water: potable or from approved non potable supply.
- .4 Lime:
  - .1 Processed Lime (Quicklime): to ASTM C5.
  - .2 Hydrated lime: ASTM C207. Type SA
- .5 Portland cement: CAN/CSA-A5, non staining , type 50
- .6 Masonry cement: CAN/CSA-A8.
- .7 White cement: use white silica sand and white Portland cement and lime masonry cement.
- .8 Colour: coloured sand to match the existing.
- .9 Non-staining mortar: use non-staining masonry cement for cementitious portion of specified mortar type. Use for all repointing work.
- .10 Additives:
  - .1 Calcium chloride is not to be used for any mortar
  - .2 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.
- .11 Repair mortar for crack repair and patching of stone:
  - .1 Jahn Restoration Mortars by Cathedral Stone Products, Inc. For crack repair use M30, M40. For stone repair use M70 and M150. For grouting use M40 Mortar grout.
  - .2 Alternative materials: to be approved by Addendum prior to close of tender.

**2.2 Properties**

- .1 Mortar for exterior block masonry above grade:
  - .1 Loadbearing: Type S based on Property specifications.
  - .2 Non-loadbearing: Type N based on Property specifications.

- .2 .2 Mortar for interior block masonry:
  - .1 Loadbearing: Type S based on Property specifications.
  - .2 Non-loadbearing: TypeN based on Property specifications.
- .3 Mortar for interior brick masonry: Type N based on Property specifications.
- .4 Bedding and pointing mortar for stonework: type N based on proportion specifications.
- .5 Limestone: use 1:2:7 cement: lime: aggregate mix for severe exposure, such as all joints to 1200mm above grade, and below grade.
- .6 Limestone: use 1:2 1/2:8 cement: lime: aggregate mix, for all other locations.
- .7 Jahn restoration mortar; premix to manufacturer's instructions.
- .8 Vicat Cone Penetration; 15 to 25mm.
- .9 Allowable air content; 7% to 15%.

### **2.3 Mortar**

- .1 Repointing: new mortar to be used in repointing is to match the existing mortar as specified in paragraph 2.2.
- .2 Time limit: discard mix not used and placed within 2 hours.

### **2.4 Coloured Lime Mortar**

- .1 Use sand as colouring agent.
- .2 Maintain one mortar mixer exclusively for coloured mortar.

## **Part 3 Execution**

### **3.1 Preparation**

- .1 Slake processed lime in water for not less than 24hours or soak hydrated lime in water for not less than 12hours.
- .2 Place safety devices and signs near the work as directed by NCC Representative.

### **3.2 Mixing**

- .1 Prepare mortar by:
  - .1 mixing lime, cement, sand and water in specified proportions.
- .2 Mix using a regular paddle mixer. Only electric motor mixers are permissible. Mixers that run on hydrocarbons are not permitted. Mixing by hand must be preapproved by the NCC Representative.
- .3 Add water slowly while mixing until all lumps are eliminated.



**3.3 Field Quality Control**

- .1 Inspection and testing of mortar will be carried out by a Testing Laboratory designated by the NCC Representative, to CSA A179.
- .2 Owner will pay for cost of test as specified.
- .3 Frequency of mortar testing will be specified by NCC Representative.
- .4 For mortar in stonework, air content, and penetration using VICAT Cone, must be tested at the same frequency as strength tests, or more frequently as required by the NCC Representative.

**3.4 Cleaning**

- .1 Remove droppings and splashings using clean sponge and water.
- .2 Clean masonry with low pressure clean water and soft natural bristle brush.

**3.5 Protection of Completed Work**

- .1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

**END OF SECTION**

**Part 1 General**

**1.1 Related Sections**

- .1 Section 04 03 07 – Historic - Masonry Repointing.
- .2 Section 04 03 08 - Mortar
- .3 Section 04 03 31 - Masonry Brickwork
- .4 Section 04 03 41 – Historic - Repairing Stone
- .5 Section 04 03 42 - Historic - Replacing Stone

**1.2 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A179-04, Mortar and Grout for Unit Masonry.
  - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C940-98a, Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory

**1.3 Definitions**

- .1 Grout: cementitious mixture of liquid consistency suitable for pouring or pumping, to fill voids between masonry elements.

**1.4 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide cementitious grout samples to CAN/CSA A179.
- .4 Provide upon request of NCC Representative purchase orders, invoices, supplier's test certificates and documents to prove materials used in contract meet requirements of specification. Allow free access to source where materials procured.

**1.5 Delivery, Storage and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Store materials in dry area and support free of ground.
  - .3 Deliver materials in sealed containers with labels legible and intact.
  - .4 Handle materials in safe manner in accordance with manufacturer's instructions. Avoid breaking container seals.
- .2 Waste Management and Disposal:

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.6 Ambient Conditions**

- .1 Maintain temperature of masonry elements to be grouted above 5 degrees C throughout their thickness, during and 48 hours after grouting.
- .2 Maintain temperature of elements to be grouted between 21 degrees C to 24 degrees C throughout its thickness during and 48 hours after grouting.
- .3 Provide temporary enclosure to maintain heating and/or cooling equipment to maintain specified temperatures.

**Part 2 Products**

**2.1 Materials**

- .1 Portland cement : to CAN/CSA-A3000.
- .2 Water: clean and free from contaminants and organic material in accordance to CAN/CSA A23.1/A23.2.
- .3 Grout to Stonework: Hydraulic lime based injection and reinforcement grout, conforming to CSA A179, ASTM C348 and ASTM C940. Control water content to conform to CSA A179, Clause 4.2.1.2 or Clause 4.3.1.5.
  - .1 Acceptable material: Grout F-20 by Daubois Inc.

**2.2 Equipment**

- .1 Mechanical mixer: size compatible with volume of mortar grout prepared and as per manufacturer's printed instructions.
- .2 Mechanical regulator to prevent segregation of ingredients after mixing and ensure injection continuity.

**Part 3 Execution**

**3.1 Site Verification of Conditions**

- .1 Report to NCC Representative before start of work possible structural masonry problems and conditions that do not conform to those specified including existing voids or possible openings which risk being compromised when grout will flow.

**3.2 Inspection**

- .1 Mixing operations: continuously inspected by NCC Representative. Provide required assistance to facilitate taking of grout samples and inspection work.

**3.3 Measurement and Mixing**

- .1 Make volume measurement using shovel batching.
- .2 Mix as per manufacturer's printed instructions.

- .3 Keep volume measures clean and free from crusting.
- .4 Mix cementitious materials, admixtures and aggregates in mechanical mixer for period of not less than 5 minutes nor more than 10 minutes with specified amount of water.

**3.4 Preparation**

- .1 Ensure substrate is free from loose material.
- .2 Prepare voids around doors and windows and to control flow of grout.
- .3 Prepare joints before grout injection:
  - .1 Insert hemp ropes into joints.
  - .2 Point joints.
- .4 Wet surfaces, deep into substrate.

**3.5 Installation**

- .1 Insert tubes.

**3.6 Field Quality Control**

- .1 Take 2 samples of grout and submit to NCC Representative for testing in accordance with paragraph 1.5 of this section.

**END OF SECTION**

**Part 1 General**

**1.1 Related Sections**

- .1 Section 04 03 07 - Masonry Repointing
- .2 Section 04 03 08 - Mortars
- .3 Section 04 03 09 – Grouting
- .4 Section 04 03 42 - Replacement of Stone

**1.2 Alternatives**

- .1 Obtain NCC Representative's approval before changing procedures, manufacturer's brands, sources of supply of materials during entire contract.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA A179-04, Mortar and Grout for Unit Masonry.

**1.4 Definitions**

- .1 Repair of Stone: mechanical or plastic repair, done to restore original appearance and function of partly deteriorated stones. Repairs include use of repair mortar for small chips and spalls, crack repair, Dutchman repair, fracture repairs and descaling.
- .2 Filling: material used to rebuild broken or deteriorated part of stone.
- .3 Adhesive: material used to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.
- .4 Mortar: material used to repoint the adjacent mortar joints to stone element being repaired.

**1.5 Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide adhesive mortar filling samples to CAN/CSA A179.
- .4 Submit, upon request by NCC Representative, purchase orders, invoices, suppliers test certificates and documents to prove that materials used in contract meet requirements of specification. Allow free access to sources where materials were procured.

**1.6 QUALITY ASSURANCE**

- .1 Qualifications

- .1 One thoroughly experienced, reliable and competent workman must be in charge of all stone repairs.
- .2 Only Jahn mortar applicators certified in its use will be acceptable.
- .2 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control and as follows:
    - .1 two crack repairs.
    - .2 two chip repairs using repair mortar.
    - .3 two Dutchman repairs.
    - .4 two in-situ fracture repairs.
    - .5 one fracture repair, with stone removed.
    - .6 one stone face descaled.
  - .2 Do not use existing stonework when constructing job mock-up.
  - .3 Construct mock-up where directed.
  - .4 Allow 72 hours for inspection of mock-up by NCC Representative, before proceeding with stone repair work.
  - .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work. Remove mock-up at completion of work as directed by NCC Representative.
  - .6 Clean mock-up to demonstrate cleaning operations to NCC Representative before starting cleaning work.

### **1.7 Delivery, Storage and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Keep material dry. Protect from weather, freezing and contamination. Store materials in a dry area and supported free of ground.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.8 Ambient Conditions**

- .1 Maintain a minimum temperature of 10 degrees C during and 48 hours after repair, throughout thickness of stone.
- .2 Allow materials to reach minimum temperature of 10 degrees C prior to use.
- .3 Maintain temperature between 21 degrees C and 24 degrees C during repair and 48 hours after, throughout thickness of stone.
- .4 Ensure epoxy resin compatible with humidity condition of stone as specified by manufacturer.
- .5 Provide temporary enclosures and heating equipment to maintain specified temperatures. Take precautions to avoid overheating masonry.
- .6 Refer to manufacturer's instructions for environmental requirements of products.

**Part 2 Products**

**2.1 Materials**

- .1 Portland cement: to CAN/CSA-A3000.
- .2 Sand: cleaned and graded in accordance to ASTM C144.
- .3 Epoxy mixture for adhesive:
  - .1 As per Section 04 03 08 Mortar
- .4 Water: clean and free of deleterious materials such as acid, alkali and organic material in accordance to CAN/CSA A179.
- .5 Dowels: stainless steel 12 mm diameter.
- .6 Deformed wire: bronze, copper, brass or stainless steel, 3 mm diameter.
- .7 Stone slabs: to have similar mechanical and aesthetic properties to existing.

**2.2 Mortar Mixes**

- .1 It is highly recommended for historic masonry to have a separate specification section specifying the mortar characteristics.
  - .1 Mortar:
    - .1 Proportion Specification:
      - .1 In accordance with CAN/CSA A179, Section 04 03 08 - Mortar

**2.3 Filling Mixes**

- .1 In accordance with Section 04 03 08 - Mortar
- .2 Submit samples for testing.

**2.4 Adhesive Mixes**

- .1 In accordance with Section 04 03 08 - Mortar
- .2 Submit samples for testing.

**Part 3 Execution**

**3.1 Site verification Of Conditions**

- .1 Report in writing, to NCC Representative areas of deteriorated stone not identified in the documents.
- .2 Obtain NCC Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.
- .3 Stop work in that area and report to NCC Representative immediately any evidence of mould.

### **3.2 Preparation**

- .1 Remove deteriorated portions of stones using low impact removal methods until sound surface is reached.
- .2 Obtain NCC Representative's approval for methodology and tools to be employed before commencing this work.

### **3.3 Protection**

- .1 Prevent damage to building, fencing, trees, landscaping, natural features utility lines which are to remain. Make good damage.
- .2 Protect surrounding components from damage during work.
- .3 Take utmost care not to damage historic fabric. Make good any damage.

### **3.4 Crack Repair**

- .1 Drill 20 mm diameter injection ports as per injection grout manufacturer's specifications.
- .2 Clean out void with compressed air and potable water until water runs clear.
- .3 Seal joints and cracks to manufacturer's specifications.
- .4 Complete injection procedure as per manufacturer's instructions.
- .5 Seal injection ports to match the surrounding stone

### **3.5 Repair of a Fractured Stone**

- .1 Remove elements which require minor repair. Do not damage existing Work.
- .2 Drill 13 mm diameter holes, 80 mm long in each section at fracture, maximum spacing at 300mm on centre.
- .3 Insert 12 mm diameter dowels, 100 mm long, and apply specified adhesive to holes and interface. Let adhesive cure for 24 hours minimum.
- .4 Reinstall consolidated element into work and repoint with specified mortar. Joints to match existing.
- .5 Repair surface of fracture with cement-based restoration mortar to match the surrounding stonework.

### **3.6 Repair of a Fractured Stone In Situ**

- .1 Drill 13mm diameter holes, 80mm long in each section and fracture, spaced at 300o/c maximum.
- .2 Insert 12mm diameter stainless steel dowels, 100mm long and apply anchor setting mortar to holes and joints. Let set for 24 hours minimum.
- .3 Repair fracture as per Section 3.5 above.
- .4 Repair surface of fracture with cement-based restoration mortar to match the surrounding stonework.



**3.7 Refacing Partly Deteriorated Stone with Slab (Dutchman Repair)**

- .1 Remove decayed stone until sound surface is reached.
- .2 Drill 13 mm diameter holes, 80 mm long at interface of existing and new stone slabs.
- .3 Insert 12 mm diameter dowels, 100 mm long into existing stone and apply specified adhesive grout to holes and interface.
- .4 Make horizontal dovetailed grooves 12 mm deep at interface of existing and new stone slabs.
- .5 Apply specified adhesive grout to dovetailed grooves and interface of existing stone.
- .6 Fill dowel holes and dovetailed grooves of new stone slab with specified adhesive grout. Erect new stone slab into position. Secure stone temporarily to allow adhesive to set.
- .7 Repoint with specified mortar. Joints to match existing.

**3.8 Refacing Partly Deteriorated Stone With Filling (Including chips, voids, previous patches, spalls)**

- .1 Drill 10 mm holes into sound stone. Roughen stone surfaces to provide keys in back of cavity.
- .2 Wet surfaces.
- .3 Apply mortar to suit nature of stone being restored. Restore stone surfaces to match existing and bring to the same plane as adjacent existing stone surfaces that are not eroded.
- .4 Build up gradually new section in layers not exceeding 12 mm thickness allowing each layer to set 24 hours before proceeding with next.
- .5 Use wood float and avoid excessive trowelling to prevent crazing.
- .6 Form roughly to required shape with wood float, then chisel finish to final shape when mortar has set.
- .7 Moist cure restored surfaces for 4 days minimum. Apply moist cloth covered with plastic sheet. Maintain moisture in cloth by means of mist sprayer, for the entire curing period
- .8 Remove laitance with stiff, near-dry fibre brush.
- .9 Surface finish of patches must match existing stone in colour and texture.
- .10 Repoint with specified mortar. Joints to match existing.

**3.9 Mortar Joint Repair**

- .1 Make good any damage to mortar joints.

**3.10 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Obtain NCC Representative's approval of cleaning operations before starting cleaning work.
- .3 Protect plants, grass vegetation and adjacent grounds from excessive water accumulation

- .4 Clean stone work surfaces after repairs have been completed and mortar has set.
- .5 Clean stone surfaces of adhesive or mortar residue resulting from work performed without damage to stone or joints.
- .6 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

**3.11 Protection of Completed Work**

- .1 Protect finished work from impact damage for period of two weeks.

**END OF SECTION**

**Part 1            General**

**1.1                Related Sections**

- .1        Section 04 03 07 - Historic - Masonry Repointing.
- .2        Section 04 03 08 - Mortar.
- .3        Section 04 03 09 – Grouting.
- .4        Section 04 03 41 - Historic - Repairing Stone.

**1.2                References**

- .1        American Society for Testing and Materials International (ASTM)
  - .1        ASTM C97-M09, Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
  - .2        ASTM C170-M09 Standard Test Method for Compressive Strength of Dimension Stone.
  - .3        ASTM C568-08a, Standard Specification for Limestone Dimension Stone.
- .2        Canadian Standards Association (CSA International)
  - .1        CAN/CSA A179-04, Mortar and Grout for Unit Masonry.

**1.3                Definitions**

- .1        Lewis: instrument inserted at top of stone as means of attachment in raising and lowering. Holds stone by means of keys or wedges fitted to dovetailed recess.
- .2        Dogs: metal appliance for securing parts or members together by means of one or more projecting teeth or bent portions, lug, cramp.

**1.4                Submittals**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1        Submit drawings stamped and signed by professional engineer registered or licensed in Provinces of Ontario, Canada.
  - .2        Submit shop drawings describing method of stone removal and replacement
- .3        Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4        Provide samples of replacement stones not less than 30 working days before masonry work begins.
- .5        Samples from designated quarry: submit sample of replacement stones from quarry having similar stone as original quarry. Submit stones as follows:
  - .1        One stone sized and dressed to match existing stone units.
  - .2        Select samples from currently worked bed of quarry and accompanied by quarry certification.

- .6 Samples of used or previously quarried stone: submit one stone, sized and dressed to match existing stone units. Make supply of stone accessible to NCC Representative NCC Representative to select number of stones for sampling and request sizing and dressing according to requirements.
- .7 Provide maintenance data for masonry work for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.5 Quality Assurance**

- .1 Allow NCC Representative access to mason's workshop for inspection of current work-in-progress.
- .2 Execute work by personnel experienced in preservation of historic masonry.
- .3 Masons engaged by Masonry Contractor to have minimum of 5 years experience with historic masonry.
- .4 NCC Representative has right to reject masons who do not demonstrate appropriate abilities or experience. Refer to Section 01 61 00 - Common Product Requirements.
- .5 Masons employed on this project throughout course of project must meet above requirements. Where, during course of project, masons leave work force, replacement masons must also meet requirements.
- .6 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .7 Construct mock-up 1 m2 minimum of stonework to be refaced with specified materials and methods.
- .8 Do not use existing stonework when constructing job mock-up.
- .9 Construct mock-up where directed.
- .10 Allow 72 hours for inspection of mock-up by NCC Representative before proceeding with stone repair work.
- .11 Clean mock-up to demonstrate cleaning operations to NCC Representative.
- .12 When accepted, mock-up will demonstrate minimum standard for this work.
- .13 Remove mock-up at completion of work as directed by NCC Representative.
- .14 Cover top of completed and partially completed wall, not enclosed or sheltered, with weatherproof coverings at end of each working day. Drape cover over wall and extend 0.5 m down both sides. Anchor securely in position. Prevent finished work from curing too quickly.
- .15 Protect adjacent work from marking or damage due to work.
- .16 Provide temporary bracing of masonry work during erection until permanent structure provides adequate bracing.

### **1.6 Delivery, Storage and Handling**

- .1 Packing, shipping, handling and unloading:

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 Materials**

- .1 Dressed Limestone: St. Marc Limestone (formerly known as Deschambeau Limestone). Graymont (Portneuf) Inc. 595 Boul. Dussault, St-Marc, Québec. GOA 4B0. Telephone: (418) 268-3584, Fax: (418) 268-5655.

### **2.2 Stone Characteristics**

- .1 Stratification: low, bedding plane to within 15% the horizontal trim of work.

### **2.3 Anchors, Ties, Sealants**

- .1 Anchors, cramps, dowels: yellow brass commercial bronze stainless steel Type 304.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

### **2.4 Mortar**

- .1 As per Section 04 03 08 – Mortar.

## **Part 3 Execution**

### **3.1 Site Verification of Conditions**

- .1 Report in writing, to NCC Representative areas of deteriorated masonry not previously identified.
- .2 Obtain NCC Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.
- .3 Stop work in that area and report to NCC Representative immediately evidence of mould.

### **3.2 Preparation**

- .1 Prevent absorption of ground water and water accumulation on stone. Rest stones in their natural bedding during weathering.
- .2 Move and lift stone units using means to prevent damage. Submit stone units dropped or impacted to NCC Representative for inspection and approval. Do not make holes or indentations for Lewises or dogs on face or top side of stone.
- .3 Indicate bedding planes of stone units. Duplicate bedding marks on usable pieces of cut stone.
- .4 Place safety devices and signs near work area as directed in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

- .5 Install and remove self-supporting scaffolding in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .6 Cover adjacent plant material and fragile surfaces.

### **3.3 Stone Removal**

- .1 Rake out mortar joints of stones which are split through, have failed in compression and been crushed, are spalling, have eroded to less than 3/4 their original depth or are indicated on the accompanying drawings.
- .2 Remove loose material from deteriorated stones. Create level surface 50 mm from masonry face for setting of stone face plates.
- .3 Clean dust, mortar and stone fragments from slot.

### **3.4 Cutting/sizing Of Stone**

- .1 Use calipers, squares and levels to measure hole for new stone. Allow for mortar joints of 6 mm thickness maximum. Where existing joints are wider, confirm joint thickness with NCC Representative.

### **3.5 Moving Stones**

- .1 Use Lewises to lift stones to working level.
- .2 Move stones horizontally in wheelbarrows on carts, or on sleds.
- .3 Slide stones into place on wood ramps.
- .4 Protect edges of stone from damage when hoisting and lifting from position. Use separators or wood shims to isolate units from hoisting belts.
  - .1 Incorporate only undamaged stone in Work.

### **3.6 Inserting Replacement Stone**

- .1 Clean stone by washing with water and natural fibre brush before laying.
- .2 Dampen surfaces of slot and apply bedding mortar.
- .3 Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight.
- .4 Prop and anchor projecting stones until wall above is set.
- .5 Set large stones on water soaked softwood wedges to support stone in proper alignment until mortar has set. Remove wedges when dry, do not break off.
- .6 Remove mortar dropping from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.
- .7 Install anchors, dowels and cramps. Use non-corrosive anchors to fix stone face plates.
- .8 Set stones to match alignment of adjacent stones plumb, true, level as shown on drawings in full bed of mortar with vertical joints flushed full except where otherwise specified. Completely fill anchor, dowel and lifting holes and voids left by removed edges

- .9 Grout all voids behind stone using specified grout.
- .10 Prior to finish pointing, provide light sandblast finish to limestone face to lighten colour of new stone.

**3.7 Filling Joints/pointing**

- .1 Fill joints and point: in accordance with Section 04 03 07 - Historic - Masonry Repointing.

**3.8 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Confirm acceptance of mock-up cleaning operations to demonstration from NCC Representative before starting cleaning work.
- .3 Protect vegetation and adjacent grounds from water accumulation.
- .4 Clean stone work surfaces after repairs have been completed and mortar has set.
- .5 Clean stone surfaces of adhesive or mortar residue resulting from work performed without damaging stone or joints.
- .6 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 04 03 08 – Mortar.
- .2        Section 04 03 31 - Masonry Brickwork.
- .3        Section 04 03 41 – Historic - Repairing Stone.
- .4        Section 04 03 42 - Historic - Replacing Stone.

**1.2                ADMINISTRATIVE REQUIREMENTS**

- .1        Conduct a pre-dismantling meeting NCC Representative to verify project requirements, equipment, procedures and assigned storage areas.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Shop Drawings:
  - .1        Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2        Provide drawings for shoring, bracing, and temporary framing work.
- .3        Site Quality Control Submittals:
  - .1        Provide up-to-date copies of stone location recording system chart or card index, as well as chronological information concerning each numbered unit (individual cards of units), when requested.

**1.4                CLOSEOUT SUBMITTALS**

- .1        Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Include:
  - .1        Photographically record stonework to be dismantled and rebuilt.
  - .2        Record drawings of layout of stored stones.

**1.5                QUALITY ASSURANCE**

- .1        Quality assurance in accordance with Section 00 01 10 – General Instructions: Quality Assurance.
- .2        Qualifications:
  - .1        Masonry Contractor:
    - .1        Work of this Section: executed by contractor specializing in historic stone conservation work, using similar stone dismantling techniques, and with a minimum 10 year record of successful performance.
  - .2        Foreperson:
    - .1        Provide competent trade foreperson specializing in type of work required.
    - .2        Experience: minimum 10 years successful experience in deconstruction of historic stone masonry. Must be present on site throughout Work.



- .3 Dismantlers:
  - .1 Experience: minimum 5 year record of successful masonry dismantling.
- .3 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Perform mock-up 1000 m x 100 m to demonstrate dismantling procedures.
  - .3 Notify NCC Representative minimum of 24 hours prior to construction of mock-up.
  - .4 Perform mock-up under supervision of NCC Representative to demonstrate a full understanding of specified procedures and techniques is achieved before work commences.
  - .5 Perform mock-up where directed by NCC Representative.
  - .6 Work not to proceed prior to approval of mock-up. Allow 24 hours for inspection of mock-up by NCC Representative before proceeding with masonry dismantling work.
  - .7 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may not remain as part of finished work.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Protect and store stones to facilitate their resetting.
  - .1 Store dismantled masonry units on wood platforms pallets , protected from exposure to water, elements, and potential mechanical damage within a shed fully covered under polyethylene.
  - .2 Submit storage and identification system to NCC Representative for review approval.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.7 AMBIENT CONDITIONS**

- .1 Loosen wet masonry only when temperature is above 5 degrees C.
- .2 In temperature 5 degrees C and below:
  - .1 Keep stones dry.
  - .2 Protect wet stones from freezing.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Examine masonry, staging and storage areas and notify NCC Representative in writing of conditions detrimental to acceptable and timely completion of Work.

**3.2 SITE VERIFICATION OF CONDITIONS**

- .1 Report in writing, to NCC Representative areas of deteriorated stone not identified in the documents. Obtain NCC Representative's approval and instructions for repair of stone before proceeding.
- .2 Stop work in that area and report to NCC Representative immediately evidence of hazardous materials.

**3.3 PREPARATION**

- .1 Remove deteriorated portions of stones using low impact removal methods until sound surface is reached.
- .2 Remove deteriorated portions of stones by cutting scraping chiselling.
- .3 Obtain NCC Representative's approval for alternative methodology and tools to be employed before commencing the work.
- .4 Clean stone surface of dust and stone chips.

**3.4 PROTECTION**

- .1 Prevent damage to building fencing trees landscaping natural features bench marks pavement utility lines which are to remain. Make good damage incurred.
- .2 Protect surrounding components from damage during work.
- .3 Make good damage to historic fabric.
- .4 Obtain NCC Representative's approval for repair methodology.

**3.5 SPECIAL TECHNIQUES**

- .1 Before dismantling stones, indicate dimensions of each stone in removal area on a drawing or chart or index card.
- .2 Temporary Marking and Recording:
  - .1 Mark stone, on face, before removal using marking product which can be completely erased when required without damaging masonry unit:
    - .1 Ball-point pen on diachylon, attached to stone.
    - .2 Waxless chalk directly on stone.
  - .2 Tracking relocated stones and other masonry units:
    - .1 Use numbering, marking, and positioning system .
  - .3 Mark/Identify:
    - .1 Stones and other elements or components to show identity and position.
    - .2 Wood platforms or other equipment used to transport and store stones.

- .3 Work and storage areas.
- .4 Location from which stones are removed on drawings photographs chart card-index.
- .4 Stone location recording system.
  - .1 Prepare chart or card index to:
    - .1 Help locate stones or units when necessary.
    - .2 To manage availability of platforms.
    - .3 To manage work and storage areas.
  - .2 Keep chart or card index up-to-date and, if required, produce copy every day.
  - .3 Prepare chart or card index or drawing to contain relevant information.
- .5 Ensure that temporary marking will remain in use resistant to weather, handling and cleaning until final marking of stones.
- .6 Remove markings and adhesive without damaging units:
  - .1 Brush with vegetable fibre brush: either dry or with water.
  - .2 Use no solvent, acid or other chemical product

### **3.6 STRUCTURAL SUPPORT**

- .1 Construct shoring and cradling, and other temporary framing work needed to support structure, or parts of it, during removal operations and in anticipation of resetting, if structure is not to be completely dismantled, according to approved shop drawings.

### **3.7 METHOD FOR LOOSENING STONES**

- .1 Use approved methods to loosen stones which will cause no damage either to stones or to other architectural elements.
- .2 Use hand tools only.
- .3 Obtain NCC Representative's approval for use of power tools before commencing work.

### **3.8 DISMANTLING AND MOVING STONES**

- .1 Avoid damaging arrises of stone when removing mortar and freeing up.
- .2 Remove excess mortar using hand tools.
- .3 Use wood wedges where required to remove or dislocate stone.
  - .1 Use flat pry bars protected with impact absorbing protection (burlap, cardboard).
- .4 Use nylon hoisting belts. Use minimum 2 belts per stone.
- .5 Protect stone from damage when hoisting and lifting from position.
  - .1 Use separators or wood shims to isolate units from hoisting belts.
- .6 Where damage occurs to stone, report to NCC Representative and repair stone in accordance with Section 04 03 41 - Historic - Repairing Stone specified procedures.
- .7 Make good damage incurred at no additional cost to Contract.
- .8 Obtain review and approval of repaired damage by NCC Representative.

### **3.9 HANDLING**

- .1 Usage of Lewis bolts for handling stone is not permitted.
- .2 Place detached stones on wood surfaces during handling. Prevent contact with metal.
- .3 When stones are lowered to ground, place directly on wooden platform used for transport or storage.
- .4 Transport and keep stones on wooden platforms.
- .5 Ensure that sharp edges of stones do not come into contact with hard objects.

### **3.10 TEMPORARY STORAGE STAGING AREA**

- .1 Place stones in designated area of site for cleaning, detailed inspection and for final marking, before storage.
- .2 Make stones accessible and retrievable when required.

### **3.11 CLEANING**

- .1 Clean in accordance with Section 04 03 06 - Historic - Cleaning Historic Masonry.
- .2 Do cleaning operations at above freezing temperature.
  - .1 After cleaning, protect wet stones against freezing until dry.
- .3 Clean stones by wet scrubbing with vegetable fibre brush unless otherwise instructed by NCC Representative .
  - .1 Do not use high pressure water jet.
- .4 Use chemical cleaning methods only with prior written approval of NCC Representative .

### **3.12 FINAL MARKING**

- .1 Do final marking after cleaning, on surface that supports good adhesion and legibility and will not be visible after resetting.
- .2 Do marking in colour. Dimensions: legible from distance of 2 metres.
- .3 Ensure that marking product used will not affect mortar to stone adhesion when resetting.
- .4 Ensure marking product used will survive storage until resetting of stone.

### **3.13 FINAL STORAGE**

- .1 When stones are placed under shelter:
  - .1 Design and ventilate shelter to keep condensation from forming on internal surfaces.
- .2 Lay out storage so that each stone will have its numbered face visible, and be accessible or removable without having to move adjacent stones.
- .3 Show layout of stones to be stored on record drawing.
- .4 Store rubble stone in a wood box.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 00 10 – General Instructions.
- .2 Section 01 33 00 – Submittal Procedures.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A269-08, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 CSA International
  - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA S16-09, Design of Steel Structures.
  - .4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
  - .5 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for sections plates pipe tubing bolts and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
    - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario Canada.
  - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Steel pipe: to ASTM A53/A53M standard weight,galvanized finish.
- .2 Welding materials: to CSA W59.
- .3 Welding electrodes: to CSA W48 Series.
- .4 Bolts and anchor bolts: to ASTM A307.
- .5 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

**2.2 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

**2.3 FINISHES**

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m<sup>2</sup> to CAN/CSA-G164.

**2.4 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of bituminous paint:

- .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
- .2 Concrete, mortar and masonry.
- .3 Wood.

## **2.5 SHOP PAINTING**

- .1 Primer: VOC limit 250 g/L maximum to GS-11.
- .2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .3 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 degrees C.
- .4 Clean surfaces to be field welded; do not paint.

## **2.6 PIPE RAILINGS**

- .1 Steel pipe: 38mm nominal outside diameter, formed to shapes and sizes as indicated.
- .2 Galvanize exterior pipe railings after fabrication. Shop coat prime interior railings after fabrication.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative 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 Departmental Representative.

### **3.2 ERECTION**

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CSA S16.



- .7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:
  - .1 Primer: maximum VOC limit 250 g/L to GS-11.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
  - .1 Primer: maximum VOC limit 250 g/L to GS-11.

### **3.3 PIPE RAILINGS**

- .1 Install pipe railings to stairs as indicated.
- .2 Set railing standards in concrete. Grout to fill hole. Trowel surface smooth and flush with adjacent surfaces.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

**END OF SECTION**

## **1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 CSA International
  - .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
  - .2 CSA O121-08, Douglas Fir Plywood.
  - .3 CSA O141-05(R2009), Softwood Lumber.
  - .4 CSA O151-09, Canadian Softwood Plywood.
  - .5 CSA O153-M1980 (R2003), Poplar Plywood.
  - .6 CSA O325-07, Construction Sheathing.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2010.

## **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

## **1.3 QUALITY ASSURANCE**

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

## **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 LUMBER MATERIAL**

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 CAN/CSA-Z809 or FSC or SFI certified.

- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
  - .1 S2S is acceptable ].
  - .2 Board sizes: "standard" or better grade.
  - .3 Dimension sizes: "standard" light framing or better grade.
  - .4 Post and timbers sizes: "standard" or better grade.

## **2.2 PANEL MATERIALS**

- .1 Douglas fir plywood: to CSA O121, standard construction .
  - .1 Urea-formaldehyde free.
  - .2 CAN/CSA-Z809 or FSC or SFI certified. Canadian softwood plywood (CSP): to CSA O151, standard construction.
  - .3 Urea-formaldehyde free.
  - .4 CAN/CSA-Z809 or FSC or SFI certified.
- .2 Poplar Plywood: to CSA O153, standard construction, urea-formaldehyde free.
  - .1 Urea-formaldehyde free.
  - .2 CAN/CSA-Z809 or FSC or SFI certified.

## **2.3 ACCESSORIES**

- .1 Nails, spikes and staples: to CSA B111.
- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs , recommended for purpose by manufacturer.

## **2.4 FINISHES**

- .1 Galvanizing: to ASTM A123/A123M ASTM A653/A653M, use galvanized fasteners for exterior work interior highly humid areas..

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat material as follows:
  - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
  - .2 Wood furring on outside surface of exterior masonry and concrete walls.
  - .3 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

---

**3.2           INSTALLATION**

- .1       Comply with requirements of NBC, supplemented by the following paragraphs.
- .2       Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .3       Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4       Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5       Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .6       Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7       Install sleepers as indicated.
- .8       Use caution when working with particle board. Use dust collectors and high quality respirator masks.

**3.3           ERECTION**

- .1       Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2       Countersink bolts where necessary to provide clearance for other work.

**END OF SECTION**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International) CAN/CGSB-37.2: Membrane, Elastomeric, Cold Applied Liquid.
  - .2 CAN/CGSB-37.9M: Primer, Asphalt, Unfilled for Asphalt Roofing, Dampproofing and Waterproofing
  - .3 CGSB-37-GP-56M: Membrane, Bituminous, Prefabricated and Reinforced for Roofing.
  - .4 CAN/CSA-ISO 9001-00(R2005), Quality Management Systems - Requirements.
  - .5 CAN/CSA-ISO 14001-04, Environmental Management Systems - Requirements with Guidance for Use.
- .2 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide two copies of most recent technical waterproofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide two copies of WHMIS MSDS in accordance with Section 01 00 10 General Instruction - Health and Safety Requirements, and indicate VOC content for:
    - .1 Primers.
    - .2 Asphalt.
    - .3 Sealers.
    - .4 Filter fabric.
- .3 Shop Drawings:
  - .1 Provide shop drawings and indicate:
    - .1 Flashing, Control joints, details.
- .4 Manufacturer's Certificate: certify that products meet or exceed specified requirements by providing proof of manufacturer's:
- .5 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumens and roofing felts and membrane with specification requirements.
  - .1 Compatibility of materials: submit written declaration to Departmental Representative as described in PART 2, COMPATIBILITY.
- .6 Source Quality Control Submittals: provide three copies of waterproofing materials purchase order as described in DELIVERY, STORAGE AND HANDLING.
- .7 Manufacturer's Field Reports:
  - .1 Submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.
  - .2 Indicate procedures followed, weather during waterproofing application including ambient temperatures and wind velocity.

**1.3 QUALITY ASSURANCE**

- .1 Installer qualifications: company or person specializing in application of cold applied waterproofing systems with 5 years documented experience approved by manufacturer.
- .2 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up 10 m<sup>2</sup> minimum size showing typical lap joint, one inside corner and one outside corner. Accepted mock-up may form part of complete work.
  - .3 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with waterproofing work.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements .
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials in original containers, sealed, with labels intact.
    - .1 Ensure shelf life of materials has not expired.
  - .2 Deliver fasteners in boxes or kegs and keep in protective storage until used.
    - .1 Do not oil or grease fasteners. Supply three copies of purchase orders to Departmental Representative . Include following data:
      - .2 Purchase order number.
      - .3 Supplier's name and address.
      - .4 Purchaser's name and address.
      - .5 Contract number and job number.
      - .6 Material and governing specification including type, grade, colour, class and quantity.
      - .7 Bills of lading for liquid asphalt showing Equiviscous Temperature (EVT), Flash Point Temperature (FP) and Finished Blowing Temperature (FBT).
      - .8 Shipping instructions.
      - .9 Destination.
  - .3 Identification for delivery: indicate on containers or wrappings of and materials:
    - .1 Manufacturer's name and brand.
    - .2 Compliance with applicable standard.
    - .3 Mass where applicable.
- .3 Storage and Handling Requirements:
  - .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
  - .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 materials in accordance with manufacturers written instructions.
  - .6 Store insulation protected from sunlight and weather and deleterious materials exposure.
  - .7 Remove damaged and/or rejected materials from site.

**1.5 SITE CONDITIONS**

- .1 Environmental Requirements
  - .1 No installation work shall be performed during rainy or inclement weather and on frost or wet covered surfaces.
- .2 Protection
  - .1 Provide adequate protection of materials and work of this section from damage by weather backfilling operations and other causes.
  - .2 Protect work of other trades from damage resulting from work of this section. Make good such damage at own expense to satisfaction of the consultant.
  - .3 Apply protection board as soon as possible after installation of membrane.

**1.6 WARRANTY**

- .1 For the Work of this Section 07 12 13 - cold applied Waterproofing, 12 months warranty period is extended to 60 months.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Components and materials must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity. Primary cold applied elastomeric asphalt emulsion waterproofing membrane in compliance with CGSB. Elastomeric Asphalt Emulsion Waterproofing Membrane., a one component waterproofing compound compatible with sheet waterproofing membranes and substrates, having the following characteristics:
  - .1 Elongation: 2000%,
  - .2 Maximum VOC: 10 g/l
  - .3 Water vapour permeance: 10 ng/Pa.m<sup>2</sup>.s, ASTM E96,
  - .4 Chemical resistance: Alkalis, calcium chloride, mild acid and salt solutions.
- .2 Fabric reinforcement ., a glass reinforcement sheet capable of allowing the membrane to bleed through adequately to provide a monolithic reinforced membrane system.
- .3 Flashing & transition membrane ., 1.5mm (60 mils) SBS modified bitumen, self-adhering sheet membrane with a cross-laminated polyethylene film, complete with . Primer and fillet bead of .Polymer Modified Sealing Compound or . Sealant a moisture cure, medium modulus polymer modified sealing compound.
- .4 Protection Boards
  - .1 Polypropylene Protection Board shall be . extruded flexible twin-wall protection board .with the following properties:
    - .1 Thickness: 2mm
    - .2 Weight: 0.45 kg/m<sup>2</sup>
    - .3 Compressive Strength: 0.45 kg/cm<sup>2</sup>
- .5 Protection Board Adhesive, a synthetic rubber base compound having the following characteristics:
  - .1 Compatible with air/vapour barrier membrane, substrate and insulation materials,
  - .2 Long term flexibility: Pass CGSB 71-GP-24M,
  - .3 Chemical resistance: Alkalis, mild acid and salt solutions.

- .6 Termination Sealant: Polymer Modified Sealing Compound manufactured, compatible with sheet waterproofing membrane, substrate and insulation materials, complies with CGSB 37.29, remains flexible with ageing and chemically resistant to alkalis, calcium chloride, mild acid and salt solutions.

## **2.2 POLYSTYRENE INSULATION**

- .1 Extruded polystyrene (XPS): to CAN/ULC-S701
  - .1 Type: 4.
  - .2 Thickness 50 mm
  - .3 size 1220 x 2400 mm
  - .4 Edges: Shiplapped

## **Part 3 Execution**

### **3.1 QUALITY OF WORK**

- .1 Do examination, preparation and waterproofing Work in accordance with Waterproofing Manufacturer's Specification Manual
- .2 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 SUBSTRATE EXAMINATION**

- .1 Verification of Conditions: examine substrates and immediately inform of Departmental Representative in writing of defects
- .2 Evaluation and Assessment: prior to beginning of work ensure:
  - .1 Before commencing work, ensure environmental and site conditions are suitable for installation of waterproofing membrane.
  - .2 The substrate shall be clean and dry, free from surface water, ice, snow or frost, dust, dirt, oil, grease, curing compounds or any other foreign matter detrimental to the adhesion of the waterproofing membrane.
  - .3 Can be applied to damp or new green concrete. Ensure concrete is smooth and free from voids and honeycombing prior to application of waterproofing membrane.
  - .4 Voids, cracks, holes and other damages to horizontal or vertical surfaces shall be repaired before application of the membrane
- .3 Deck to Vertical Junctures, Footing/Foundation Walls, Cracks in Slab and Protrusions
  - .1 Coat penetrations, such as brackets, clips, braces, etc. that are set into the concrete with a 2.3 mm coating of primary waterproofing membrane to the height of the wearing course and around projections to ensure a complete seal prior to coating the entire area.
  - .2 Penetrations subject to movement should be flashed with fabric reinforcement set into a minimum thickness of 2.3 mm of primary waterproofing membrane to required height on the wall and at least 100 mm on the slab, embed fabric reinforcement into wet coating followed by second coat.
  - .3 To all cracks and cold joints less than 3 mm apply a coat of primary waterproofing membrane at a minimum thickness of 2.3 mm and reinforce with fabric reinforcement.
  - .4 To all cracks greater than 3 mm, prime area and install self-adhered flashing membrane. Overlap end joint of sheet a minimum 75 mm.



- .5 At monolithic wall/slab junctures, apply primary waterproofing membrane at a minimum thickness of 2.3 mm to required height on the wall and at least 100 mm on the slab and embed fabric reinforcement into wet primary waterproofing membrane followed by a second coat.
- .6 At footing to foundation wall junctions apply a coat of primary waterproofing membrane at a minimum thickness of 2.3 mm and reinforce with fabric reinforcement followed by second coat.
- .4 Primary Waterproofing Membrane Application
  - .1 Single Coat Application (Vertical Applications)
    - .1 Apply a full and continuous coat of primary waterproofing membrane with a trowel, long handled squeegee, roofing brush or spray. Apply membrane at a rate of 2.0 l/m<sup>2</sup> to provide a minimum wet thickness of 2.3 mm ensuring no pinholes or blisters. Allow membrane to fully cure/dry prior to subsequent application coatings.
  - .5 Insulation application:
    - .1 Place insulation in parallel rows with width parallel to slope, after cold applied waterproofing is cured.
    - .2 Insulation to be loose laid in parallel rows with ends staggered.

### **3.3 FIELD QUALITY CONTROL**

- .1 Inspections:
  - .1 Departmental Representative will pay for tests as specified.
  - .2 Inspection and testing of waterproofing application will be carried out by testing laboratory designated by Departmental Representative .

### **3.4 PROTECTION OF COMPLETED WORK**

- .1 Ensure membrane is undamaged before application of insulation board.
- .2 Apply protection board to cover membrane at locations as indicated below grade below concrete below paving.

### **3.5 CLEANING**

- .1 Clean work in accordance with Section 01 74 11 - Cleaning.
- .2 Clean to Departmental Representative's approval, soiled surfaces, spatters, and damage caused by work of this Section.
- .3 Check drains to ensure cleanliness and proper function, and remove debris, equipment and excess material from site.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
  - .1 Collect, package and store partly used or unused containers of asphalt, sealing compounds, primers and roofing felts for recycling, and return to recycler in accordance with Waste Management Plan.
  - .2 Plan and coordinate insulation work to minimize generation waste.
  - .3 Give preference to suppliers who take back mineral fibre insulation waste for reuse or recycling.
  - .4 Place used hazardous sealant tubes, adhesive containers and materials defined as hazardous or toxic in designated containers.

- .5 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
- .6 Ensure emptied containers are sealed and stored safely.
- .7 Divert unused aggregate materials from landfill to local quarry facility for reuse as reviewed by Departmental Representative .
- .8 Unused paint coating material must be disposed of at official hazardous material collections site as reviewed by Departmental Representative .
- .9 Unused adhesive, sealant and asphalt 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.
- .10 Dispose of unused sealant material at official hazardous material collections site approved by Departmental Representative .
- .11 Dispose of unused material at official hazardous material collections site approved by Departmental Representative .

**END OF SECTION**

**Part 1 General**

- .1 Section 01 00 10 – General Instructions.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
  - .3 ASTM B32-08, Standard Specification for Solder Metal.
  - .4 ASTM B370-11, Standard Specification for Copper Sheet and Strip for Building Construction.
  - .5 ASTM D523-89(2008), Standard Test Method for Specular Gloss.
  - .6 ASTM D822-01(R2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
  - .2 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.
  - .3 CAN/CGSB-51.32- M77, Sheathing, Membrane, Breather Type.
- .3 CSA International
  - .1 CSA A123.3-05(2010), Asphalt Saturated Organic Roofing Felt.
- .4 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
  - .1 CCMC-2011, Registry of Product Evaluations.
- .7 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Proof of manufacturer's CCMC listing and listing number.
  - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 00 10 General Instruction -- Health and Safety Requirements
- .2 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Samples:
  - .1 Submit duplicate 300 x 300 mm samples of each sheet metal material.
- 1.4 QUALITY ASSURANCE**
  - .1 Mock-ups:
    - .1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.
    - .2 Fabricate 300 x600 mm sample roofing panel using identical project materials and methods to include typical seam.
    - .3 Mock-up will be used:
      - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
    - .4 Locate where directed.
    - .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sheet metal flashing work.
    - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.
    - .7 Approved mock-up may not remain as part of finished Work.
    - .8 Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative
- 1.5 DELIVERY, STORAGE AND HANDLING**
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
  - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Storage and Handling Requirements:
    - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.
    - .3 Replace defective or damaged materials with new.
- Part 2 Products**
  - 2.1 PREFINISHED STEEL SHEET (Washroom Building)**
    - .1 Prefinished steel with factory applied silicone modified polyester.
      - .1 Finish:Pre-Painted Galvaized Steel: Colour charcoal grey
      - .2 Ribbed overlapping metal roofing with 915mm exposure and overall panel width of 990mm.
      - .3 Base Steel thickness 0.40 mm
      - .4 Coating thickness: not less than 25 micrometres.
      - .5 Resistance to accelerated weathering for chalk rating of 8 , colour fade 5 units or less and erosion rate less than 20 % to ASTM D822 as follows:
        - .1 Outdoor exposure period 1000 hours.

- .2 Humidity resistance exposure period 1000 hours.
- .6 Acceptable Product:
  - .1 'Ameri-cana' by *Ideal Roofing*

## 2.2 Roof Guards

- .1 Roof Bar Guards:
  - .1 Acceptable product:
    - .1 2 bar 'Ideal Guard' by *Ideal Roofing*
- .2 Snow cleats:
  - .1 Acceptable product:
    - .1 'SNO-GEM' by *SNO-GEM INC* Supplied by *Ideal Roofing*
- .3 Vent & Chimney Guard
  - .1 Acceptable Products
    - .1 Vent Saver P-383 by *Metal Roof Snow Guard.com*

## 2.3 SHEET METAL MATERIALS (Lead Coated Copper, Double standing seam Roof , Header house)

- .1 Copper sheet: to ASTM B370-09, H00 20 oz base sheet with 15 lb lead coating weight.

## 2.4 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5.
- .3 Slip sheet: reinforced sisal paper or a heavy felt kraft paper.
- .4 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer Caulking see Section 07 92 00 - Joint Sealants.
- .5 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.
- .6 Cleats: of same material, and temper as sheet metal:50 mm minimum wide.
  - .1 same as sheet metal being secured.
- .7 Fasteners: , concealed.
- .8 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .9 Flux: rosin, cut muriatic acid, or commercial preparation suitable for materials to be soldered.
- .10 Touch-up paint: as recommended by sheet metal roofing manufacturer.

## 2.5 FABRICATION

- .1 Fabricate aluminum sheet metal in accordance with AA ASM-35.
- .2 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.

- .3 Hem exposed edges on underside 12 mm, mitre and seal.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.
- .6 Protect metals against oxidization by backpainting with isolation coating where indicated.
- .7 Tin edges of copper sheets to be soldered for width of 40 mm both sides with solder.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative 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 Departmental Representative.

#### **3.2 INSTALLATION**

- .1 Use concealed fastenings except where approved in writing by Departmental Representative before installation.
- .2 Include underlay under sheet metal roofing.
  - .1 Secure in place and lap joints 100 mm minimum.
- .3 Apply slip sheet over asphalt felt underlay to prevent bonding between sheet metal and felt.
  - .1 Secure with anchorage and lap joints 50 mm minimum in direction of waterflow.
- .4 Install sheet metal roof panels using cleats spaced at 600 mm maximum on centre.
- .5 Secure cleats with 2 fasteners each and cover with cleat tabs.
- .6 Align transverse seams in adjacent panels.
- .7 Flash roof penetrations with material matching roof panels, and make watertight.
- .8 Form seams in direction of water-flow and make watertight.
- .9 Perform soldering with well heated coppers, heat seam thoroughly and sweat solder through its full width. Clean and flux metals before soldering.
- .10 Follow sheet metal manufacturer's recommendations for soldering procedures.
- .11 As work progresses, neutralize excess flux with 5% to 10% washing soda solution, and thoroughly rinse. Leave work clean and free of stains.

**3.3 STANDING SEAM ROOFING (Lead Coated Copper Roofing)**

- .1 Use panel widths as indicated in drawings by full length sheets to make roofing with standing seams 600 mm on centre without straight run of standing seam exceeding 10 m.
- .2 Fold lower end of each pan under 20 mm.
  - .1 Slit fold 25 mm away from corner to form tab where pan turns up to make standing seam.
  - .2 Fold upper end of each pan over 50 mm.
  - .3 Hook 20 mm fold on lower end of upper pan into 50 mm fold on upper end of underlying pan.
- .3 Apply sheet metal roofing beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.
- .4 Finish standing seams 25 mm high on flat surfaces and 12 mm high on curved surfaces. Bend up one side edge 40 mm and other 45 mm.
  - .1 Make first fold 6 mm wide single fold and second fold 12 mm wide, providing locked portion of standing seam with 5 plies in thickness.
  - .2 Fold lower ends of seams at eaves over at 45 degrees angle.
  - .3 Terminate standing seams at ridge and hips by turning down in tapered fold.
- .5 Form valleys of sheets not exceeding 3 m in length. Lap joints 150 mm in direction of flow.
  - .1 Extend valley sheet minimum 150 mm under roofing sheets.
  - .2 At valley line, double fold valley and roofing sheets and secure with cleats spaced 450 mm on centre.

**3.4 BUILT-IN GUTTERS**

- .1 Form built-in box gutter lining with matching lead coated copper sheeting.
- .2 Use 1000 mm long sheets if section profile of gutter exceeds 1000 mm. Use 2.4 m or 3 m long sheets if sectional profile is less than 1000 mm.
- .3 Longitudinal joints not acceptable.
- .4 Secure gutter lining to substrate with screws, washers and expansion shields spaced maximum 1200 mm on centre along centre of lining.
- .5 At roof edges extend gutter lining under metal roofing 150 mm minimum and terminate in 20 mm folded edge secured by cleats. Hook lower end of roofing into lock strip to form 20 mm wide loose-lock seam.

**3.5 FINISH**

- .1 Let copper roof weather through 2 heavy rains minimum after final cleaning.
- .2 Rub exposed surfaces with clean rags soaked in boiled linseed oil until desirable shade of brown is obtained.
- .3 Touch up solder with copper bronze.

**3.6 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by sheet metal roofing installation.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 00 10 – General Instructions.

**1.2 REFERENCES**

- .1 The Aluminum Association Inc. (AAI)
  - .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
  - .2 AAI DAF45-03, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A167-99(2004), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM A240/A240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .3 ASTM A606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
  - .4 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5 ASTM A792/A792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .6 ASTM B32-04, Standard Specification for Solder Metal.
  - .7 ASTM B370-03, Standard Specification for Copper Sheet and Strip for Building Construction.
  - .8 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
  - .9 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian Roofing Contractors Association (CRCA)
  - .1 Roofing Specifications Manual 1997.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
  - .2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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

- .2 Product Data:
  - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 00 10 General Instructions.
- .3 Shop Drawings:
  - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .4 Samples:
  - .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colours.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and .
  - .2 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.

**1.4 QUALITY ASSURANCE**

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 00 10 General Instructions to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2**

**Products**

**2.1**

**SHEET METAL MATERIALS**

- .1 Lead coated copper: to B101-02 Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
  - .1 Roofing Flashings; as detailed on drawings
  - .2 Gutters: cold rolled '150x 20 oz' (with front lip) half-round lead coated copper, H00 temper designation.

**2.2**

**ACCESSORIES**

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168 to GSES GS-36.
- .3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32 No. 15 perforated asphalt felt to CSA A123.3.
- .4 Sealants: in accordance with 07 62 00 .
- .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness mm same as sheet metal being secured.
- .6 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.

**2.3**

**FABRICATION**

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- .3 Form pieces in 2400 mm maximum lengths.
  - .1 Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm.
  - .1 Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

**2.4**

**METAL FLASHINGS**

- .1 Form flashings, copings and fascias to profiles indicated.

**2.5 EAVES TROUGHS AND DOWNPIPES**

- .1 Form eaves troughs and downpipes from galvanized or as indicated.
- .2 Sizes and profiles as indicated.
- .3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Install sheet metal work in accordance with CRCA FL series details, AAI-Aluminum Sheet Metal Work in Building Construction as detailed.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal.
  - .1 Secure in place and lap joints 100 mm.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
  - .1 Flash joints using S-lock forming tight fit over hook strips.
- .5 Lock end joints and caulk with sealant.
- .6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .7 Insert metal flashing into reglets under cap flashing to form weather tight junction.
- .8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .9 Caulk flashing at reglet cap flashing with sealant.
- .10 Install pans, where shown around items projecting through roof membrane.

**3.3 EAVES TROUGHS AND DOWNPIPES**

- .1 Install eaves troughs and secure to building at 750 mm on centre as indicated.
  - .1 Slope eaves troughs to downpipes as indicated.
  - .2 Solder joints watertight.
- .2 Install downpipes and provide goosenecks back to wall.
  - .1 Secure downpipes to wall with straps as indicated.
- .3 Install splash pans as indicated.

---

**3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Leave work areas clean, free from grease, finger marks and stains.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .2 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Manufacturer's product to describe:
    - .1 Caulking compound.
    - .2 Primers.
    - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 00 10 General Instruction - Health and Safety Requirements.
- .3 Samples:
  - .1 Submit 2 samples of each type of material and colour.
  - .2 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .4 Manufacturer's Instructions:
  - .1 Submit instructions to include installation instructions for each product used.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **1.5 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Proceed with installation of joint sealants only when:
    - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
    - .2 Joint substrates are dry.
    - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
  - .2 Joint-Width Conditions:
    - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.
  - .3 Joint-Substrate Conditions:
    - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

## **1.6 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.
- .2 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

## **Part 2 Products**

### **2.1 SEALANT MATERIALS**

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .3 Where sealants are qualified with primers use only these primers.

### **2.2 SEALANT MATERIAL DESIGNATIONS**

- .1 Type 1: Polyurethane one part:

- .1 Self-levelling: to CAN/CGSB-19.13, Type 1, colour selected from manufactures standard range.
- .2 Acceptable product:
  - .1 Temco- Dymonic or approved equal.
- .2 Type 2: Silicones one part: to CAN/CGSB-19.13.
  - .1 Mildew resistance.
- .3 Type: 3 :Acrylic latex one part: to CAN/CGSB-19.17.
- .4 Preformed compressible and non-compressible back-up materials:
  - .1 Polyethylene, urethane, neoprene or vinyl foam:
    - .1 Extruded closed cell foam backer rod.Size: oversize 30 to 50 %.
  - .2 Neoprene or butyl rubber:
    - .1 Round solid rod, Shore A hardness 70.
  - .3 High density foam:
    - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m<sup>3</sup>; density, or neoprene foam backer, size as recommended by manufacturer.
  - .4 Bond breaker tape:
    - .1 Polyethylene bond breaker tape which will not bond to sealant.

### **2.3 SEALANT SELECTION**

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): sealant type: 1.
- .2 Expansion and control joints in exterior surfaces of poured-in-place concrete walls: sealant type:1 .
- .3 Coping joints and coping-to facade joints: sealant type: 1.
- .4 Exterior joints in horizontal wearing surfaces (as itemized): sealant type:1 .
- .5 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: sealant type:1 .
- .6 Interior control and expansion joints in floor surfaces: sealant type:2 .
- .7 Perimeters of interior frames, as detailed and itemized: sealant type:3 .
- .8 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): sealant type:1 .
- .9 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: sealant type:1 .
- .10 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): sealant type:2 .



---

**2.4 JOINT CLEANER**

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.
- .2 Primer: in accordance with sealant manufacturer's written recommendations.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative .
  - .2 Inform Departmental Representative 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 Departmental Representative .

**3.2 SURFACE PREPARATION**

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces 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 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

**3.3 PRIMING**

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

**3.4 BACKUP MATERIAL**

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

**3.5 MIXING**

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

**3.6 APPLICATION**

- .1 Sealant:
  - .1 Apply sealant in accordance with manufacturer's written instructions.
  - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .3 Apply sealant in continuous beads.
  - .4 Apply sealant using gun with proper size nozzle.
  - .5 Use sufficient pressure to fill voids and joints solid.
  - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing:
  - .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.

**3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day. Clean adjacent surfaces immediately.
  - .2 Remove excess and droppings, using recommended cleaners as work progresses.
  - .3 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.8 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 00 10 – General Instructions

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C542-05, Standard Specification for Lock-Strip Gaskets.
  - .2 ASTM D790-07e1, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .3 ASTM D1003-07e1, Standard Test Method for Haze and Luminous Transmittance of Plastics.
  - .4 ASTM D1929-96(R2001)e1, Standard Test Method for Determining Ignition Temperature of Plastics.
  - .5 ASTM D2240-05, Standard Test Method for Rubber Property - Durometer Hardness.
  - .6 ASTM E84-10, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .7 ASTM E330-02, 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-12.1-M90, Tempered or Laminated Safety Glass.
  - .2 CAN/CGSB-12.6-M91, Transparent (One-Way) Mirrors.
  - .3 CAN/CGSB-12.8-97, Insulating Glass Units.
  - .4 CAN/CGSB-12.8-97 (Amendment), Insulating Glass Units.
  - .5 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
  - .6 CAN/CGSB-12.12-M90, Plastic Safety Glazing Sheets.
- .3 Environmental Choice Program (ECP)
  - .1 CCD-045-95(R2005), Sealants and Caulking Compounds.
- .4 Glass Association of North American (GANA)
  - .1 GANA Glazing Manual - 2008.
  - .2 GANA Laminated Glazing Reference Manual - 2009.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meetings:
  - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with Contractor's Representative and Departmental Representative to:
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.Co-ordination with other building subtrades.
    - .3 Review manufacturer's written installation instructions and warranty requirements.

- .2 Arrange for site visit with Departmental Representative prior to start of Work to examine existing site conditions adjacent to demolition Work.
- .3 Hold project meetings every week.
- .4 Ensure key personnel attend.
- .5 Departmental Representative will submit written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Submit duplicate 300 mm size samples of units and sealant material.
- .5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
  - .1 Submit testing and analysis of glass under provisions of Section 01 45 00 - Quality Control.
  - .2 Submit shop inspection and testing for glass.

#### **1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

#### **1.6 QUALITY ASSURANCE**

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up to include glass glazing, and perimeter air barrier and vapour retarder seal. Mock-up will be used:

- .1 To judge quality of work, substrate preparation, operation of equipment and material application.
- .3 Locate where directed.
- .4 Allow 24 hours for inspection of mock-up before proceeding with work.
- .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

**1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect glazing and frames from nicks, scratches, and blemishes.
  - .3 Protect prefinished aluminum surfaces with wrapping.
  - .4 Replace defective or damaged materials with new.

**1.8 AMBIENT CONDITIONS**

- .1 Ambient Requirements:
  - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
  - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Design Criteria: Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
  - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
  - .2 Size glass to withstand wind loads, dead loads and positive and negative live loads to ASTM E330.
  - .3 Limit glass deflection to flexural limit of glass with full recovery of glazing materials.
- .2 Flat Glass:
  - .1 Safety glass: to CAN/CGSB-12.1, coloured, 12 mm thick.
    - .1 Type laminated and tempered.
    - .2 Class B-float.
  - .2 Silvered mirror glass: 3 mm thick.
    - .1 Type 1A-float glass for normal use.
- .3 Insulating Glass Units:
  - .1 Insulating glass units: to CAN/CGSB-12.8, double unit, 6 mm overall thickness.

- .1 Glass: to CAN/CGSB-12.3 CAN/CGSB-12.1 CAN/CGSB-12.2  
CAN/CGSB-12.4 CAN/CGSB-12.10.
- .2 Glass thickness: 6 mm each light.
- .3 Inter-cavity space thickness: 12mm with low conductivity spacers.
- .4 Glass coating: surface number low "E" grey colour.
- .5 Inert gas fill: argon.
- .4 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 VOC limit 250 g/L maximum
    - .1 VOC limit: 5 % maximum by weight to CCD-045.
    - .2 Ensure sealant does not contain chemical restrictions to CCD-045.

## **2.2 ACCESSORIES**

- .1 Setting blocks: silicone, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .2 Spacer shims: silicone, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .3 Glazing splines: resilient silicone, extruded shape to suit glazing channel retaining slot, colour as selected.
- .4 Glazing clips: manufacturer's standard type.
- .5 Lock-strip gaskets: to ASTM C542.
- .6 Mirror attachment accessories:
  - .1 Stainless steel clips.
  - .2 Plastic rosettes.
  - .3 Mirror adhesive, chemically compatible with mirror coating and wall substrate.
  - .4 Mirror frames: stainless steel.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
  - .1 Verify that openings for glazing are correctly sized and within tolerance.
  - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
  - .3 Visually inspect substrate in presence of Departmental Representative.
  - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 PREPARATION**

- .1 Clean contact surfaces with solvent and wipe dry.

- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

### **3.3 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)**

- .1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .3 Cut glazing spline to length; install on glazing light. Seal corners by butting spline and sealing junctions with sealant.
- .4 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .5 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .6 Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- .7 Trim protruding tape edge.

### **3.4 INSTALLATION: MIRRORS**

- .1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.
- .2 Set mirrors with clips. Anchor rigidly to wall construction.
- .3 Set in frame.
- .4 Place plumb and level.

### **3.5 INSTALLATION: PLASTIC FILM**

- .1 Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
- .2 Place without air bubbles, creases or visible distortion.
- .3 Fit tight to glass perimeter with razor cut edge.

### **3.6 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
    - .1 Remove traces of primer, caulking.
    - .2 Remove glazing materials from finish surfaces.
    - .3 Remove labels.
    - .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
  - .1 Do not mark heat absorbing or reflective glass units.
- .3 Repair damage to adjacent materials caused by glazing installation.

**END OF SECTION**



## **1.1 REFERENCES**

- .1 Aluminum Association (AA)
  - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International
  - .1 ASTM C475-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .2 ASTM C840-08, Standard Specification for Application and Finishing of Gypsum Board.
  - .3 ASTM C1002-07, 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.
  - .4 ASTM C1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .5 ASTM C1280-99, Standard Specification for Application of Gypsum Sheathing.
  - .6 ASTM C1177/C1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - .7 ASTM C1178/C1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
  - .8 ASTM C1396/C1396M-09a, Standard Specification for Gypsum Wallboard.
- .3 Association of the Wall and Ceilings Industries International (AWCI)
  - .1 AWCI Levels of Gypsum Board Finish-97.
- .4 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

## **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit duplicate 300 x 300 mm size samples of vinyl faced gypsum board and 300 mm long samples of corner and casing beads .

## **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
  - .1 Store gypsum board assemblies materials level off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
  - .3 Protect from weather, elements and damage from construction operations.
  - .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
  - .5 Protect prefinished aluminum surfaces with wrapping strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
  - .6 Replace defective or damaged materials with new.

#### **1.4 AMBIENT CONDITIONS**

- .1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Standard board: to ASTM C1396/C1396M Type X, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges squared.
- .2 Backing board and coreboard: to ASTM C1396/C1396M regular, 16mm thick 1200 mm wide x maximum practical length, ends square cut, edges squared.
- .3 Water-resistant board: to ASTM C1396/C1396M regular, 16 mm thick, 1220 mm wide x maximum practical length.
- .4 Glass mat water-resistant gypsum backing board: to ASTM C1178/C1178M, 16 mm thick, 1200 mm wide x maximum practical length.
- .5 Metal furring runners, hangers, tie wires, inserts, anchors: to .Drywall furring channels: 0.5 mm core thickness, galvanized steel channels for screw attachment of gypsum board.
- .6 Resilient drywall furring : 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .7 Nails: to ASTM C514.
- .8 Stud adhesive: to CAN/CGSB-71.25.
- .9 Laminating compound: as recommended by manufacturer, asbestos-free.
- .10 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process , 0.5 mm base thickness, perforated flanges, one piece length per location.

- .11 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .12 Polyethylene: to CAN/CGSB-51.34, Type 2.
- .13 Joint compound: to ASTM C475, asbestos-free.

## **2.2 FINISHES**

- .1 Texture finish: asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative .
  - .2 Inform Departmental Representative 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 Departmental Representative .

### **3.2 ERECTION**

- .1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.
- .2 Do application of gypsum sheathing to ASTM C1280.
- .3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.
- .4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .5 Install work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .7 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .8 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .9 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.
- .10 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .11 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

- .12 Erect drywall resilient furring transversely across studs joists between the layers of gypsum board, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.
- .13 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

### 3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply single layer gypsum board to woodfurring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.
  - .1 Single-Layer Application:
    - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C840.
    - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- .3 Apply water-resistant gypsum board where wall tiles to be applied and adjacent to slop sinks in janitors closets . Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.
- .5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .7 Install gypsum board with face side out.
- .8 Do not install damaged or damp boards.
- .9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

### 3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre
- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant. Splice corners and intersections together and secure to each member with 3 screws.
- .3 Install access doors to electrical and mechanical fixtures specified in respective sections.
  - .1 Rigidly secure frames to furring or framing systems.

- .4 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .5 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
  - .1 Levels of finish:
    - .1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
- .6 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .7 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .8 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .9 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .10 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .11 Mix joint compound slightly thinner than for joint taping.
- .12 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .13 Allow skim coat to dry completely.
- .14 Remove ridges by light sanding or wiping with damp cloth.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day. Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
  - .1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
  - .2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
  - .3 CTI A118.4-92, Specification for Latex Cement Mortar (included in ANSI A108.1).
  - .4 CTI A118.5-92, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1).
  - .5 CTI A118.6-92, Specification for Ceramic Tile Grouts (included in ANSI A108.1).American Society for Testing and Materials International (ASTM)
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 71-GP-22M-78(AMEND.), Adhesive, Organic, for Installation of Ceramic Wall Tile.
  - .2 CAN/CGSB-75.1-M88, Tile, Ceramic.
  - .3 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .3 Terrazzo Tile and Marble Association of Canada (TTMAC)
  - .1 Tile Specification Guide 09 30 00 2006/2007, Tile Installation Manual.
  - .2 Tile Maintenance Guide 2000.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Include manufacturer's information on:
    - .1 Ceramic tile, marked to show each type, size, and shape required.
    - .2 Chemical resistant mortar and grout (Epoxy and Furan).
    - .3 Cementitious backer unit.
    - .4 Dry-set cement mortar and grout.
    - .5 Divider strip.
    - .6 Reinforcing tape.
    - .7 Levelling compound.
    - .8 Latex cement mortar and grout.
    - .9 Commercial cement grout.
    - .10 Organic adhesive.
    - .11 Slip resistant tile.
    - .12 Fasteners.
- .3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Base tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

- .2 Floor tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
- .3 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.
- .4 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

**1.3 QUALITY ASSURANCE**

- .1 Quality Assurance Submittals:
  - .1 Manufacturer's Instructions: manufacturer's installation instructions.
  - .2 Manufacturer's Field Reports: manufacturer's field reports specified.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.5 AMBIENT CONDITIONS**

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.
- .2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

**1.6 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals. Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
  - .2 Maintenance material same production run as installed material.

**Part 2 Products**

**2.1 FLOOR TILE**

- .1 Porcelain tile: to CAN/CGSB-75.1 ANSI A118.4, Type , Class MR (02 -3.0%), 300 x 600x mm size, square edges, frost resistant, slip resistant surface, pattern, colour as selected by Departmental Representative .

**2.2 WALL TILE**

- .1 Ceramic tile: to CAN/CGSB-75.1, Type 3 5, Class MR , 300x600 mm size, square edges, matt glazed , colour as selected by Departmental Representative .

**2.3 ACCENT TILE**

- .1 Ceramic tile: to CAN/CGSB-75.1, Type 3 5, Class MR , 75x300 mm size, square edges, matt glazed , colour as selected by Departmental Representative .

**2.4 MORTAR AND ADHESIVE MATERIALS**

- .1 Cement: to CSA-A5, type 10.
- .2 Sand: to ASTM C144, passing 16 mesh.Hydrated lime: to ASTM C207, Type N .
- .3 Latex additive: formulated for use in cement mortar and thin set bond coat.
- .4 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

**2.5 BOND COAT**

- .1 Dry set cement mortar: to ANSI A108.1.
- .2 Latex Cement mortar: to ANSI A108.1, two-component universal dry-set mortar.
- .3 Epoxy bond coat: non-toxic, non-flammable, non-hazardous during storage, mixing, application, and when cured. To produce shock and chemical resistant mortars having the following physical characteristics:
  - .1 Compressive Strength: 246 kg/cm<sup>5</sup>.
  - .2 Bond Strength: 53 kg/cm<sup>5</sup>.
  - .3 Water Absorption: 4.0% Max.
  - .4 Ozone Resistance, 200 hours @ 200 ppm: no loss of strength.
  - .5 Smoke Contribution Factor: 0.
  - .6 Flame Contribution Factor: 0.
  - .7 Finished mortar and grout to be resistant to urine, dilute acid, dilute alkali, sugar, brine and food waste products, petroleum distillates, oil and aromatic solvents.
  - .8 Bond Coat: maximum VOC limit 65 g/L to SCAQMD Rule 1168.
- .4 Chemical-Resistant Bond Coat:
  - .1 Epoxy Resin Type: CTI A118.3.
  - .2 Furan Resin Type: CTI A118.5.
  - .3 Bond Coat: maximum VOC limit 65 g/L to SCAQMD Rule 1168.

**2.6 GROUT**

- .1 Colouring Pigments:
  - .1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
  - .2 Colouring pigments to be added to grout by manufacturer.
  - .3 Job coloured grout are not acceptable.
  - .4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.
- .2 Cement Grout: to ANSI A108.1.
  - .1 Use one part white cement to one part white sand passing a number 30 screen.
- .3 Commercial Cement Grout: to CTI A118.6.



- .4 Dry-Set Grout: to CTI A118.6. Latex Cement Grout: to ANSI A108.1, fast curing, high early strength, polymer-modified, stain resistant, sanded mix for floors, unsanded mix for walls and floors with polished tiles commercial tile grout.
- .5 Chemical-Resistant Grout:
  - .1 Epoxy grout: to ANSI A108.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer.
  - .2 Furan grout: to CTI A118.5.

## **2.7 ACCESSORIES**

- .1 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.
- .2 Transition Strips: purpose made metal extrusion; brushed stainless steel .
- .3 Reducer Strips: purpose made metal extrusion; brushed stainless steel ; maximum slope of 1:2.
- .4 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .5 Floor sealer and protective coating: to CAN/CGSB-25.20, to tile and grout manufacturers recommendations.

## **2.8 MIXES**

- .1 Cement:
  - .1 Scratch coat: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, and latex additive where required. Adjust water volume depending on water content of sand.
  - .2 Slurry bond coat: cement and water mixed to creamy paste. Latex additive may be included.
  - .3 Mortar bed for floors: 1 part cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.
  - .5 Mortar bed for walls and ceilings: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.
  - .6 Levelling coat: 1 part cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
  - .7 Bond or setting coat: 1 part cement, 1/3 part hydrated lime, 1 part water.
  - .8 Measure mortar ingredients by volume.
- .2 Dry set mortar: mix to manufacturer's instructions.
- .3 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .4 Adjust water volumes to suit water content of sand.

## **2.9 PATCHING AND LEVELLING COMPOUND**

- .1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:

- .1 Compressive strength - 25 MPa.
- .2 Tensile strength - 7 MPa.
- .3 Flexural strength - 7 MPa. Density - 1.9.
- .3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in 48 hours after application.

## **2.10 CLEANING COMPOUNDS**

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 WORKMANSHIP**

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2006/2007, "Ceramic Tile", except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.
- .3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond. Make internal angles square, external angles rounded.
- .8 Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .9 Install divider strips at junction of tile flooring and dissimilar materials.
- .10 Allow minimum 24 hours after installation of tiles, before grouting.
- .11 Clean installed tile surfaces after installation and grouting cured.

---

**3.3 FLOOR SEALER AND PROTECTIVE COATING**

- .1 Apply in accordance with manufacturer's instructions.

**3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.5 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM F1303-04, Standard Specification for Sheet Vinyl Floor Covering with Backing.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long.
- .4 Closeout Submittals:
  - .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.4 AMBIENT CONDITIONS**

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

**1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide 1 m<sup>2</sup> of each colour, pattern and type flooring material required for project for maintenance use.
  - .3 Extra materials one piece and from same production run as installed materials.
  - .4 Identify each roll of sheet flooring and each container of adhesive.
  - .5 Deliver to Departmental Representative , upon completion of the work of this section.
  - .6 Store where directed by Departmental Representative .

---

**Part 2            Products**

**2.1                MATERIALS**

- .1 Sheet vinyl with backing : to ASTM F1303, commercial.
  - .1 Type I - PVC binder content 90%
  - .2 Grade: 1
  - .3 Backing: B-non-foam plastic .
  - .4 Pattern: smooth
  - .5 Texture: selected by Departmental Representative.
  - .6 Colour: indicated selected by Departmental Representative .
  - .7 Thickness: 2 mm.
- .2 Feature strips: of same material and thickness as adjacent work mm wide, in colour indicated selected by Departmental Representative .
- .3 Resilient base: continuous, top set, complete with premoulded end stops and external corners:
  - .1 Type: rubber.
  - .2 Style: straight and cove.
  - .3 Thickness: 3.17 mm.
  - .4 Height: 101.6 mm.
  - .5 Lengths: cut lengths minimum 2400 mm.
  - .6 Colour: selected by Departmental Representative .
- .4 .
- .5 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
- .6 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste 2 part latex-type filler requiring no water as recommended by flooring manufacturer for use with their product.
- .7 Metal edge strips:
  - .1 Aluminum extruded, smooth, polished stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .8 External corner protectors: stainless steel, type recommended by flooring manufacturer.
- .9 Edging to floor penetrations: stainless steel aluminum, type recommended by flooring manufacturer.
- .10 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.

**Part 3            Execution**

**3.1                MANUFACTURER'S INSTRUCTIONS**

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

**3.2 SITE VERIFICATION OF CONDITIONS**

- .1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

**3.3 PREPARATION**

- .1 Remove existing resilient flooring.
- .2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.
- .3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .4 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .5 Prime and seal concrete slab, and plywood sub-floor to resilient flooring manufacturer's printed instructions.

**3.4 APPLICATION: FLOORING**

- .1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system.
- .2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.
- .4 Run sheets in direction of traffic. Double cut sheet joints and heat weld according to manufacturer's printed instructions.
- .5 Heat weld seams of linoleum sheet flooring in accordance with manufacturer's printed instructions.
- .6 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.
- .7 Install feature strips and floor markings where indicated. Fit joints tightly.
- .8 Continue flooring over areas which will be under built-in furniture.
- .9 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .10 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .11 Install metal edge strips at unprotected or exposed edges where flooring terminates.
- .12 over entire surface and fit accurately.

**3.5 APPLICATION: BASE**

- .1 Lay out base to keep number of joints at minimum.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

**3.6 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.7 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Remove excess adhesive from floor, base and wall surfaces without damage.
- .3 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

**3.8 PROTECTION**

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.
- .3 Use only water-based coating for linoleum.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Material and installation of site applied paint finishes to new interior surfaces, including site painting of shop primed surfaces.

**1.2 REFERENCES**

- .1 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33
- .2 Environmental Protection Agency (EPA)
  - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 Master Painters Institute (MPI)
  - .1 MPI Architectural Painting Specifications Manual, 2010.
- .5 National Fire Code of Canada - 2010
- .6 Society for Protective Coatings (SSPC)
  - .1 SSPC Painting Manual, Volume Two, 2012 Edition, Systems and Specifications Manual.
- .7 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34 .

**1.3 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
  - .2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
  - .3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.
- .2 Mock-Ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control .
    - .1 Provide 5 m x 2 m mock-up. Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.
    - .2 Mock-up will be used:



- .1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.
  - .3 Locate where indicated
  - .4 Allow 48 hours for inspection of mock-up before proceeding with work.
  - .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work. Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative .
- .3 Pre-Installation Meeting:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 10 00 General Instruction.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Coordination with other building subtrades.
    - .4 Review manufacturer's installation instructions and warranty requirements.
- .4 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 00 10 General Instruction- Health and Safety Requirements .

#### **1.4 SCHEDULING**

- .1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Schedule painting operations to prevent disruption of occupants.

#### **1.5 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures .
- .2 Product Data:
  - .1 Submit product data and instructions for each paint and coating product to be used.
  - .2 Submit product data for the use and application of paint thinner.
  - .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures . Indicate VOCs during application and curing .
- .3 Samples:
  - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
  - .2 Submit duplicate 200 x 300 mm sample panels of each paint stain clear coating special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
    - .1 3 mm plate steel for finishes over metal surfaces.
    - .2 13 mm birch plywood for finishes over wood surfaces.
    - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

- .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
- .5 10 mm cedar for finishes over wood surfaces.
- .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
- .4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .1 Lead, cadmium and chromium: presence of and amounts.
  - .2 Mercury: presence of and amounts.
  - .3 Organochlorines and PCBs: presence of and amounts.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation and application instructions.
- .7 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
  - .1 Product name, type and use.
  - .2 Manufacturer's product number.
  - .3 Colour numbers.

## **1.6 MAINTENANCE**

- .1 Extra Materials:
  - .1 Deliver extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals .
  - .2 Quantity: provide one four litre can of each type and colour of stain finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
  - .3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
  - .1 Identify products and materials with labels indicating:
    - .1 Manufacturer's name and address.
    - .2 Type of paint or coating.
    - .3 Compliance with applicable standard.
    - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:

- .1 Provide and maintain dry, temperature controlled, secure storage.
- .2 Store materials and supplies away from heat generating devices.
- .3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Fire Safety Requirements:
  - .1 Provide two 9 kg Type ABC fire extinguisher adjacent to storage area.
  - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .9 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal .
  - .2 Place materials defined as hazardous or toxic in designated containers.
  - .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.
  - .4 Ensure emptied containers are sealed and stored safely.
  - .5 Unused paint coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative .
  - .6 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
  - .7 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
  - .8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
  - .9 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
    - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
    - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
    - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
    - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
    - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).

- .10 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .11 Set aside and protect surplus and uncontaminated finish materials: . Deliver to or arrange collection by organizations for verifiable re-use or re-manufacturing.

## 1.8 **SITE CONDITIONS**

- .1 Heating, Ventilation and Lighting:
  - .1 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
  - .2 Provide continuous ventilation during and after for seven days after completion of application of paint.
  - .3 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
  - .4 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Unless pre-approved written approval by Paint Inspection Agency Authority or product manufacturer, perform no painting when:
    - .1 Ambient air and substrate temperatures are below 10 degrees C.
    - .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
    - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
    - .4 The relative humidity is under 85 % or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
    - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
    - .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
  - .2 Perform painting work when maximum moisture content of the substrate is below:
    - .1 Allow new concrete and masonry to cure minimum of 28 days.
    - .2 15 % for wood.
    - .3 12 % for plaster and gypsum board.
  - .3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
  - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
  - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
  - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:

- .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
- .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.
- .4 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
- .7 Provide paint products meeting MPI "Environmentally Friendly" E1, E2 E3 ratings based on VOC (EPA Method 24) content levels.
- .8 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.
- .9 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
  - .1 Water clean-up .
  - .2 non-flammable biodegradable .
  - .3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
  - .4 Manufactured without compounds which contribute to smog in the lower atmosphere.
  - .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .11 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.
- .12 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:

- .1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
- .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.
- .13 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

## **2.2 COLOURS**

- .1 Departmental Representative will provide Colour Schedule after Contract award Departmental Representative for review.
- .2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.
- .3 Selection of colours from manufacturers full range of colours.
- .4 Where specific products are available in restricted range of colours, selection based on limited range.
- .5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

## **2.3 MIXING AND TINTING**

- .1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

## **2.4 GLOSS/SHEEN RATINGS**

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated and as noted on Finish Schedule.

## **2.5 INTERIOR PAINTING SYSTEMS**

- .1 Concrete horizontal surfaces: floors and stairs:
  - .1 INT 3.2D - Pigmented polyurethane finish.
- .2 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
  - .1 INT 5.3M - High performance architectural latex G5 finish.
- .3 Aluminum: Refer to 08 11 16 Aluminum Doors & Frames Entrance System.
- .4 Wood floors and stairs: including hardwood flooring: (Header House Threshold)
  - .1 INT 6.5C - Polyurethane varnish gloss finish.
- .5 Wood shingle and shake siding:
  - .1 INT 6.6H - Clear fire retardant coating (ULC rated).
- .6 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
  - .1 INT 9.2B - High performance architectural latex G4 finish.

## **2.6 SOURCE QUALITY CONTROL**

- .1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.
  - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
  - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
  - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 GENERAL**

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

### **3.3 EXAMINATION**

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
  - .1 Stucco, plaster and gypsum board: 12 %.
  - .2 Concrete: 12 %.
  - .3 Clay and Concrete Block/Brick: 12 %.
  - .4 Wood: 12 %.

### **3.4 PREPARATION**

- .1 Protection:
  - .1 Protect existing building surfaces and adjacent structures from paint splatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative .
  - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
  - .3 Protect factory finished products and equipment.
  - .4 Protect passing pedestrians, building occupants and general public in and about the building.
- .2 Surface Preparation:
  - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
  - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
  - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative .
- .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
  - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air .
  - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
  - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
  - .4 Allow surfaces to drain completely and allow to dry thoroughly.
  - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
  - .6 Use trigger operated spray nozzles for water hoses.
  - .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.



- .5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air or vacuum cleaning .
- .7 Touch up of shop primers with primer as specified.
- .8 Do not apply paint until prepared surfaces have been accepted by Departmental Representative

### **3.5 APPLICATION**

- .1 Method of application to be as approved by Departmental Representative . Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
  - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
  - .2 Work paint into cracks, crevices and corners.
  - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
  - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
  - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
  - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
  - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
  - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
  - .4 Brush out immediately all runs and sags.
  - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.

- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

**3.6 MECHANICAL/ELECTRICAL EQUIPMENT**

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .2 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .4 Do not paint over nameplates.
- .5 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .6 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .7 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .8 Do not paint interior transformers and substation equipment.

**3.7 SITE TOLERANCES**

- .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
- .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

**3.8 FIELD QUALITY CONTROL**

- .1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
- .2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.
- .3 Standard of Acceptance:
  - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
  - .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .4 Field inspection of painting operations to be carried out by independent inspection firm as designated by Departmental Representative
- .5 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .6 Cooperate with inspection firm and provide access to areas of work.
- .7 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative .

### **3.9 RESTORATION**

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative . Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative .

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM A240/A240M-02, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .3 ASTM A480/A480M-03, Specification for General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.
  - .4 ASTM A653/A653M-02a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
  - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel Air Drying and Baking.
  - .3 CAN/CGSB-1.104M-91, Semigloss Alkyd, Air Drying and Baking Enamel.
- .3 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-B651-95(R2001), Barrier-Free Design.

**1.2 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures .
  - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures . Indicate VOC's:
    - .1 For caulking materials during application and curing .
- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures .
  - .2 Indicate fabrication details, plans, elevations, hardware, and installation details.
- .3 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures .
  - .2 Submit duplicate 300 x 300 mm samples of panel showing finished edge and corner construction and core construction.
  - .3 Submit duplicate representative samples of hardware items, including brackets, fastenings and trim.
- .4 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
- .5 Manufacturers' Field Reports: submit copies of manufacturers' field reports.

**1.3 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control .
    - .1 Provide 600 mm x 600 mm mock-up including components as follows:
      - .1 Floor, Ceiling and wall attachment.
      - .2 Door hinges.
    - .2 Mock-up will be used:
      - .1 To judge workmanship, substrate preparation, and material application.
    - .3 Locate where indicated.
    - .4 Allow 48 hours for inspection of mock-up before proceeding with work.
    - .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may not remain as part of finished work. Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative .
  - .4 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with Waste Reduction Workplan.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Metal toilet partitions & urinal privacy screens.
  - .1 Floor Mounted, ceiling braced, system to include 'D'-grips, latches, and coat hooks, as required to meet CSA B651-04.
- .2 Sheet steel: commercial quality tension levelled zinc coated steel galvanneal ASTM A653 GR33 formed and cemented under pressure to a structural 32psisound deadening core with waterproof thermal setting adhesive. Formed edges of doors, panels, and pilasters shall be welded at intervals around the entire perimeter to construct a rigid one-piece integral unit. Edges to be capped with a rolled form locking clip moulding. Corner is to be welded and ground smooth for a clean appearance.
- .3 Minimum base steel thickness:
  - .1 Panels and doors shall be 25mm thick with cover sheets to be not less than 0.8mm (22ga),
- .4 Steel sheet metal: zinc coated steel galvanneal ASTM A653 GR33.

- .5 Headrails to be extruded aluminum 6063-T5 with a clear anodized finish and anti-grip profile, chrome plated die cast brackets,
- .6 Pilasters shall be 32mm thick with cover sheets to be not less than 0.9mm (20ga),
- .7 Attachment: chrome plated tamperproof type screws and bolts.

## 2.2 COMPONENTS

- .1 Hinges:
  - .1 Heavy duty, wrap around type.
  - .2 Material/finish: stainless steel casting.
  - .3 Swing: Standard stalls to have in-swinging doors. Barrier-free stall to have out-swinging door, to meet CSA B651-04,
  - .4 Return movement: Top hinge secured by threaded locking pin. Bottom hinge being equipped with gravity threaded locking pivot. This is adjustable to permit the door to come to the desired set position when not latched, to meet CSA B651-04.
  - .5
- .2 Latch set: Barrier-free concealed door latch emergency access feature
- .3 Wall and connecting brackets: stainless steel extrusion or casting.
- .4 Coat hook: combination hook and rubber door bumper, stainless steel.
- .5 Door pull: Barrier-free type suited for out swinging doors, stainless steel.

## 2.3 FABRICATION

- .1 Doors, panels and screens: 25 mm thick, two steel sheets faces pressure bonded to honeycomb core, to sizes indicated mm wide x mm high.
- .2 Pilasters: 32 mm thick, constructed same as door, to sizes indicated
- .3 Provide formed and closed edges for doors, panels and pilasters. Miter and weld corners and grind smooth.
- .4 Provide internal reinforcement at areas of attached hardware and fittings. Temporarily mark location of reinforcement for tissue holders and grab bars.
- .5 Provide 0.8 mm thick type 316 stainless steel protective shields on urinal side of toilet partition panels next to urinals and on urinal screens. Make protective shields 1000 mm high with top of shield 1200 mm above finished floor. Make shields to full width of partition or screen panel. Fasten with stainless steel screws.

## 2.4 FINISHES

- .1 Clean, degrease and neutralize steel components with phosphate or chromate treatment.
- .2 Spray apply primer electrostatically to CAN/CGSB-1.81, 1 coat.
- .3 Protective finish: high-performance hybrid powder epoxy, applied electrostatically and cured at 375 degrees for 10 minutes to achieve a uniform smooth protective finish.

Thickness of coating shall be min. 1.5mm. Submit colour samples from manufacturer's full range, to be approved Departmental Representative.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Ensure supplementary anchorage, if required, is in place.
- .2 Do work in accordance with CAN/CSA-B651.

**3.3 ERECTION**

- .1 Partition erection.
  - .1 Install partitions secure, plumb and square.
  - .2 Leave 12 mm space between wall and panel or end pilaster.
  - .3 Anchor mounting brackets to masonry/concrete surfaces using screws and shields: blocking/backing must be provided to hollow walls using bolts and toggle type anchors.
  - .4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.
  - .5 Provide for adjustment of floor-braced pilasters variations with screw jack through steel saddles made integral with pilaster. Conceal floor and ceiling fixings with stainless steel shoes.
  - .6 Provide templates drilling dimensions for locating threaded studs through finished ceilings.
  - .7 Equip doors with hinges, latch set, and each stall with coat hook mounted on door, mounting heights 1000 mm. Adjust and align hardware for easy, proper function. Set door open position at 30 degrees to front. Install door bumper door mounting, type.
  - .8 Equip outswinging doors with door pulls on inside and outside of door in accordance with CAN/CSA-B651 .
  - .9 Install hardware grab bars .
- .2 Floor supported and overhead braced partition erection.
  - .1 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device .
    - .1 Secure pilaster shoes in position.
    - .2 Secure headrail to pilaster face with not less than two fasteners per face.
    - .3 Set tops of doors parallel with overhead brace when doors are in closed position.
  - .2 Screens erection:
    - .1 Provide urinal stall screens consisting of panel , pilaster as indicated.
    - .2 Anchor wall-hung screen panels to walls with 3 panel brackets and wing brackets

---

**3.4 FIELD QUALITY CONTROL**

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits to review Work at stages listed:
  - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
  - .2 Once during progress of Work.
  - .3 Upon completion of Work, after cleaning is carried out.

**3.5 ADJUSTING**

- .1 Adjust doors and locks for optimum, smooth operating condition.
- .2 Lubricate hardware and other moving parts.

**3.6 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
- .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .4 Clean and polish hardware and stainless components.
- .5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM B456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .3 ASTM A653/A653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 ASTM A924/A924M-09, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
  - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
  - .3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .3 CSA International
  - .1 CAN/CSA-B651-04, Accessible Design for the Built Environment.
  - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario Canada.
  - .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Tools:
  - .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

- .2 Deliver special tools to Departmental Representative .

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products materials**

- .1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A167, Type 304, with brushed finish.
- .3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

## **2.2 COMPONENTS**

- .1 Toilet tissue dispenser: double roll type, surface mounted, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.
- .2 Combination towel dispenser/waste receptacle: semi-recessed wall unit, approximately 430 mm wide, 1360 mm high, 190 mm deep. Interior of 0.8 mm galvanized steel, exterior of 0.8 mm stainless steel. Suitable for dispensing folded or roll paper towels. Removable galvanized steel waste receptacle, lockable access door with continuous full height stainless steel hinge.
- .3 Soap dispenser: lather push-in valve 102 mm spout, self contained 340 mL translucent polyethylene 1.14 L tank 1.5 L tank, stainless steel piston and valve assembly, tamper proof filler lock, surface mounted, exposed metal components chrome plated.
- .4 Feminine napkin disposal bin: stainless steel, surface unit including rough-in frame, continuous hinged door, self closing, embossed with universally accepted symbol, removable stainless steel plastic receptacles fitted with spring clip for deodorizer block.
- .5 Grab bars: 30/32 mm diameter x 1.6 mm wall 38 mm diameter x 1.6 mm wall tubing of stainless steel, 38 76 mm diameter wall flanges, concealed screw attachment, flanges

welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

- .6 Tilt mirror: wall mounted unit, fixed framed mirror 6 mm, stainless steel frame.
- .7 Diaper changing station: surface mounted wall unit, stainless steel, stainless steel insert, moulded-in steel-on-steel hinge assembly, moulded-in integral support mechanism, 864 mm wide x 533 mm high, concealed gas shock, tamper resistant hardware, steel backer plate, diaper bag hook, liner dispenser, safety belt, safety instructions in both official languages graphic illustration, labeled with universally accepted symbol "changing station."

### **2.3 FABRICATION**

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative .

### **3.2 INSTALLATION**

- .1 Install and secure accessories rigidly in place as follows:
  - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
  - .2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.

- .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
- .4 Toilet and shower compartments: use male to female through bolts.
- .2 Install grab bars on built-in anchors provided by bar manufacturer.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.

### **3.3 ADJUSTING**

- .1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.
- .2 Lubricate moving parts to operate smoothly and fit accurately.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

### **3.6 SCHEDULE**

- .1 Locate accessories where indicated and as follows. Exact locations determined by Departmental Representative .
- .2 Toilet tissue dispenser: one in each toilet compartment mounting height as indicated.
- .3 Combination towel dispenser/waste receptacles: one in each public washroom where indicated. Maximum height of dispenser and operable part from floor 1200 mm.
- .4 Soap dispenser: one at each wash basin
- .5 Feminine napkin disposal bin: one in each female toilet compartment mounting height as indicated.
- .6 Hand dryer: one in each washroom. Maximum height of dispenser and operable part from floor 1200 mm.
- .7 Grab bar: two in each handicapped toilet compartment Height of grab bar from floor 750 mm. Side grab bar: maximum distance from rear wall 300 mm, minimum distance passed front edge of toilet 450 mm.
- .8 Tilt mirror: one at each wash basin, height of bottom edge of mirror from floor 1000 mm.

- .9 Diaper changing station: one in each washroom mounting height from floor 1000 mm.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2 STRIPPING OF TOPSOIL**

- .1 Ensure that procedures are conducted in accordance with applicable Provincial and Municipal requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by composting.
- .5 Remove brush from targeted area by non-chemical means and dispose of through mulching.
- .6 Strip topsoil by scraper to depths as directed by Departmental Representative .
  - .1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil by mechanical hoe in berms in locations as directed by Departmental Representative .
  - .1 Stockpile height not to exceed 2.0 m.

- .8 Dispose of unused topsoil in location as indicated by Departmental Representative for later use.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

**3.3 PREPARATION OF GRADE**

- .1 Verify that grades are correct and notify Departmental Representative if discrepancies occur do not begin work until instructed by Departmental Representative .
  - .1 Grade area only when soil is dry to lessen soil compaction.
  - .2 Grade soil with scrapers establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

**3.4 PLACING OF TOPSOIL**

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 200 mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.

**3.5 SUB-SOILING**

- .1 Apply sub-soil, following spreading and cultivating procedures to designated areas to improve drainage and agricultural potential of soil.
- .2 Work sub-soil area following natural grade contour lines, with vibrating sub-soiler to depth of 40 cm.
- .3 Cross sub-soil the area following the first pass.
- .4 Cultivate the soil with a chain harrow to de-clod the soil.

**3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning .
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 PRICE AND PAYMENT PROCEDURES**

- .1 Allowances:
  - .1 Cost of blast survey and monitoring will be paid by Departmental Representative .
  - .2 Measurement Procedures:
    - .1 Quantities will be taken from cross section showing original rock surface and actual grade line set by Departmental Representative.

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Rock: any solid material in excess of 0.25 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
  - .2 PPV: peak particle velocity.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Blasting Submittals: submit for approval, written proposal of operations for removal of rock by blasting to Departmental Representative and local authorities having jurisdiction.
  - .1 Indicate proposed method of carrying out work types and quantities of explosives to be used, loading charts and drill hole patterns, type of caps, blasting techniques, blast protection measures for items such as flying rock, vibration, dust and noise control. Include details on protective measures, time of blasting and other pertinent details.
  - .2 Submit records to Departmental Representative at end of each shift. Maintain complete and accurate record of drilling and blasting operations.
- .3 Sustainable Standards Certification:
  - .1 Construction Waste Management: submit copy of Waste Management Plan for project highlighting recycling and salvage requirements
  - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75 % of construction wastes were recycled or salvaged.
  - .3 Erosion and Sedimentation Control: submit copy of Erosion and Sedimentation Control Plan for project highlighting implementation measures.
- .4 Qualification Statements:
  - .1 Retain licensed explosives expert to program and supervise blasting work, to interpret recommendations of pre-blasting report, and to determine precautions, preparation and operations techniques.
  - .2 Submit documentation verifying explosives expert's qualifications.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.



## 1.5 QUALITY ASSURANCE

- .1 Blasting Survey and Monitoring:
  - .1 Departmental Representative will visit property holders of adjacent buildings and structures to determine existing conditions and describe blasting and seismic recording operations and obtain their permission for setting up seismographs.
  - .2 Seismographic monitoring will be conducted during entire progress of blasting operations.
- .2 Blasting and Vibration Control:
  - .1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.
  - .2 In general, vibration from blasting not exceed 6mm/s at distance of m, or mm/s at m from blast.
  - .3 Blasting not permitted within distance of 50m of fresh concrete or grout poured within 24 hours.
  - .4 In vicinity of structure, PPV not to exceed mm/s at distance of m, from structure at structure.
  - .5 Complete blasting before any structural element including socketed piles and caissons, rock anchors, concrete footings, walls and columns are installed within 1 m from blast holes.

## Part 2 Products materials

- .1 Not used.

## Part 3 Execution

### 3.1 ROCK REMOVAL

- .1 Perform excavation in accordance with Erosion and Sedimentation Control Plan.
- .2 Remove rock to alignments, profiles, and cross sections as indicated.
- .3 Explosive blasting.
  - .1 Do blasting operations in accordance with local and provincial codes requirements of authority having jurisdiction.
- .4 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.
- .5 Excavate rock to horizontal surfaces with slope not to exceed.
- .6 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
- .7 Use pre-shearing, cushion blasting or other smooth wall drilling and blasting techniques unless specified otherwise or directed by Departmental Representative .
- .8 Remove boulders and fragments which may slide or roll into excavated areas.
- .9 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Rock Disposal:
  - .1 Dispose of surplus removed rock off site in accordance with Section 01 74 21 - Construction/demolition Waste Management and Disposal.
  - .2 Do not dispose removed rock into landfill. Send material to appropriate quarry location as approved by Departmental Representative .
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**3.3 PROTECTION**

- .1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures. Erect fencing, post guards, sound warnings and display signs when blasting to take place.

**END OF SECTION**

**Part 1            General**

**1.1                MEASUREMENT PROCEDURES**

- .1        Excavated materials will be measured in cubic metres in their original location.
  - .1        Common excavation quantities measured will be actual volume removed within following limits:
    - .1        Width for trench excavation as indicated.
    - .2        Width for excavation for structures as indicated.
    - .3        Depth from ground elevation and surface of pavement surface of sidewalk immediately prior to excavation, to elevation as indicated
  - .2        Rock quantities measured will be actual volume removed within following limits:
    - .1        Width for trench excavation as indicated.
    - .2        Width for excavation for structures to be bounded by vertical planes up to 500 mm outside of and parallel to neat lines of footings as indicated.
    - .3        Depth from rock surface elevations immediately prior to excavation, to elevation as indicated.
    - .4        Where design elevation is less than 300 mm below original rock surface, depth will be considered to be 300 mm below original rock surface.
    - .5        Volume of individual boulders and rock fragments will be determined by measuring three maximum mutually perpendicular dimensions.
- .2        Shoring, bracing, cofferdams, underpinning and de-watering of excavation will not be measured separately for payment.

**1.2                REFERENCES**

- .1        American Society for Testing and Materials International (ASTM)
  - .1        ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2        ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3        ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.
  - .4        ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ; ) (600 kN-m/m ; ).
  - .5        ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ; ) (2,700 kN-m/m ; ).
  - .6        ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2        CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3        U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1        EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3 DEFINITIONS**

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock : solid material in excess of 1.00 m ; and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m ; bucket. Frozen material not classified as rock.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
    - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.

- .2 Submit for review by Departmental Representative proposed dewatering and heave prevention methods as described in PART 3 of this Section.
- .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
- .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
- .5 Submit to Departmental Representative testing inspection results and report as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
  - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
  - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field clearance record from utility authority location plan of relocated and abandoned services, as required.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of unshrinkable fill materials and provide access for sampling.

**1.5 QUALITY ASSURANCE**

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Departmental Representative is employee of Contractor, submit proof that Work by Departmental Representative is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.
- .7 Do not use soil material until written report of soil test results are reviewed and approved by Departmental Representative .
- .8 Health and Safety Requirements:
  - .1 Do construction occupational health and safety in accordance with Section 01 00 10 General Instruction- Health and Safety Requirements.

**1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert excess aggregate materials from landfill to local facility for reuse as directed by Departmental Representative .

**1.7 EXISTING CONDITIONS**

- .1 Buried services:
  - .1 Before commencing work establish location of buried services on and adjacent to site.
  - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work.
  - .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .4 Prior to beginning excavation Work, notify applicable Departmental Representative authorities having jurisdiction establish location and state of use of buried utilities and structures. Departmental Representative authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
  - .5 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .6 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before re-routing. Costs for such Work to be paid by Departmental Representative .
  - .7 Record location of maintained, re-routed and abandoned underground lines.
  - .8 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative , condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative
  - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative .

**Part 2 Products**

**2.1 MATERIALS**

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:

- .1 Crushed, pit run or screened stone, gravel or sand.
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
- .3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-

Sieve Designation	% Passing	
	Type 1	Type 2
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

### **Part 3 Execution**

#### **3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

#### **3.2 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with Section 02 41 13 - Selective Site Demolition .

#### **3.3 PREPARATION/PROTECTION**

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

#### **3.4 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as indicated as directed by Departmental Representative after area has been cleared of brush weeds and grasses and removed from site.
- .2 Strip topsoil to depths as directed by Departmental Representative.

- .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil as directed by Departmental Representative off site.

**3.5 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Departmental Representative .
  - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

**3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 00 10 General Instruction - Health and Safety Requirements Health and Safety Act for the Province of Ontario.
  - .1 Where conditions are unstable, Departmental Representative to verify and advise methods.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .3 Construct temporary Works to depths, heights and locations as directed by Departmental Representative approved by Departmental Representative.
- .4 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental Representative , remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
- .5 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring and bracing.
  - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative .

**3.7 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.



- .5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

### 3.8 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken. Excavate to lines, grades, elevations and dimensions as indicated and as directed by Departmental Representative.
- .2 Remove concrete and paving walks and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative .
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material off site.
- .9 Do not obstruct flow of surface drainage or natural watercourses. Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Notify Departmental Representative when bottom of excavation is reached.
- .11 Obtain Departmental Representative approval of completed excavation.
- .12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative .
- .13 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.
  - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .14 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative .

**3.9 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.
  - .1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.
  - .2 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill topped with shearmat filler as indicated to underside of slab. Compact base course to 100 %.
  - .3 Retaining walls: use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95 %. For remaining portion, use Type 3 fill compacted to 95 %.
  - .4 Place unshrinkable fill in areas as indicated.

**3.10 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Departmental Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
  - .4 Removal of concrete formwork.
  - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative or:
    - .2 If approved by Departmental Representative , erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative .
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 Install drainage system in backfill as indicated .

**3.11 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative .
- .2 Replace topsoil as indicated.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by Departmental Representative .
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

## **1.1 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D698-00a, 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 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.5-M91(March 1999), Low Flash Petroleum Spirits Thinner (Reaffirmation of December 1991).]
- .3 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 302-April 1999, Construction Specification for Primary Granular Base.
  - .2 OPSS 310-March 1993, Construction Specification for Hot Mixed, Hot Laid Asphaltic Concrete Paving and Hot Mix Patching.
  - .3 OPSS 314-December 1993, Construction Specification for Untreated Granular, Subbase, Base, Surface Shoulder and Stockpiling.
  - .4 OPSS 1010-March 1993, Material Specification for Aggregates, Granular A, B, M and Select Subgrade Material.
  - .5 OPSS 1103-February 1996, Material Specification for Emulsified Asphalt.
  - .6 OPSS 1150-May 1994, Material Specification for Hot Mixed, Hot Laid Asphalt Concrete.

## **1.2 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

## **1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Divert unused aggregate materials from landfill to facility for reuse as approved by Departmental Representative .
- .4 Dispose of unused paint and paint thinner materials at official hazardous material collections site as approved by Departmental Representative .
- .5 Do not dispose of unused paint and paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.
- .6 Divert unused asphalt from landfill to facility capable of recycling materials.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Aggregates to: OPS 1010.
  - .1 Granular A.
  - .2 Granular B Type II.

- .3 Select subgrade.
- .2 Prime coat: MTO Primer to OPSS 1103.
- .3 Tack coat: SS-1 to OPSS 1103.
- .4 Asphalt concrete: to OPSS 1150.
- .5 Aggregates: to CCDG.
  - .1 Crushed Granular MG 56 .
  - .2 Natural Gravel 80-0 .
  - .3 Gravel and sand.
- .6 Prime coat: RC-30 to CCDG.
- .7 Tack coat: SS-1 to CCDG.
- .8 Asphalt concrete: to CCDG.
- .9 Paint thinner: to CAN/CGSB-1.5.

**Part 3 Execution**

**3.1 FOUNDATIONS**

- .1 Foundations for roadways comprise:
  - .1 300 mm compacted thickness of granular subbase B Type II.
  - .2 150 mm compacted thickness of granular base A20-0.
- .2 Compaction: compact each lift of granular material to 100% maximum density to ASTM D698. Maximum lift thickness: 150 mm.

**3.2 PAVEMENT THICKNESS**

- .1 Pavements for roadways:
  - .1 Base course: 50 mm HL8.
  - .2 Wear course: 25 mm HL3.

**3.3 PAVEMENT CONSTRUCTION**

- .1 Application of prime coat: OPSS 302.
- .2 Construction of asphalt concrete: OPSS 310.
- .3 Surface preparation: CCDG.
- .4 Application of prime coat and tack coat: CCDG.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Materials and installation for sand-set unit paving without mortared joints for pedestrian or light vehicular traffic.

**1.2 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

**1.3 MEASUREMENT PROCEDURES**

- .1 Unit paving will be measured for payment in square metres.

**1.4 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C117-95, Standard Test Method for Material Finer Than 75-mu m (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-01, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM C902-02, Standard Specification for Pedestrian and Light Traffic Paving Brick.
  - .4 ASTM C1272-02, Standard Specification for Heavy Vehicular Paving Brick.
  - .5 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>(600kN-m/m<sup>3</sup>)).
  - .6 ASTM D1557-00, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700kN-m/m<sup>3</sup>)).
  - .7 ASTM E11-01, Standard Specification for Wire-Cloth Sieves for Testing Purposes.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International).
  - .1 CSA A23.1/A23.2-00, Concrete Materials and Methods of Construction/Methods of Test for Concrete.
  - .2 CSA A179-94(R1999), Mortar and Grout for Unit Masonry.
  - .3 CSA-A231.1-99, Precast Concrete Paving Slabs.

**1.5 SUBMITTALS**

- .1 Submit following product test data:
  - .1 Sieve analysis for gradation of bedding and joint material.
  - .2 Unit paver test data.
- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures .
- .3 Indicate layout, pattern and relationship of paving joints to fixtures and project formed details.

- .4 Submit samples in accordance with Section 01 33 00 - Submittal Procedures .
- .5 Submit full size sample of each type paving unit.

**1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal .
- .2 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative .
- .3 Divert unused aggregate materials from landfill to facility for reuse as approved by Departmental Representative .
- .4 Divert unused geotextiles from landfill to plastic recycling facility approved by Departmental Representative.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Unit pavers: uniform in material, colour, size and from one manufacturer.
- .2 Precast concrete paving slabs: to CSA-A231.1, plain face, varying sizes paver size, 60 mm thick. Colour natural as selected from standard range.
- .3 Crushed stone or gravel base: consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

- .1 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 rather than ASTM E11 .

Sieve Designation	% Passing
19 mm	100
12.5 mm	70-100
4.75 mm	40- 70
2.00 mm	23- 50
0.425 mm	7- 25
0.075 mm	3- 8

- .4 Manufactured sand for bedding: hard, durable, crushed stone particles, conforming to gradation of concrete sand as specified in CAN/CSA A23.1 . Sand: free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Do not use limestone screenings or stone dust.

- .1 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 rather than ASTM E11 . 0% to pass 0.075 mm sieve.

Sieve Designation	% Passing
10 mm	100
5 mm	95-100
2.5 mm	80-100
1.25 mm	50- 90
0.630 mm	25- 60
0.315 mm	10- 35
0.160 mm	2- 10

- .5 Joint sand: to CSA A179 , hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .6 Edging: .
- .7 Geotextile filter: 4.0 oz Geotextile, needle punched nonwoven 100% polypropylene fibers.

**Part 3 Execution**

**3.1 PROTECTION**

- .1 Prevent damage to buildings, landscaping, curbs, sidewalks, trees, fences, roads and adjacent property. Make good any damage.
- .2 Provide access to building at all times. Coordinate paving schedule to minimize interference with normal use of premises.

**3.2 SUBGRADE**

- .1 Ensure that subgrade preparation conforms to levels and compaction required to allow for installation of granular base.

**3.3 GEOTEXTILE**

- .1 Install geotextile filter as indicated.

**3.4 GRANULAR BASE**

- .1 Base minimum thickness: 100 mm .
- .2 Spread and compact crushed stone or gravel base in uniform layers not exceeding 100 mm compacted thickness.
- .3 Compact base to a density of not less than 98% Standard Density in accordance with ASTM D698.
- .4 Shape and roll alternately to obtain smooth, even and uniformly compacted granular base and ensure conformity of grades with finish surface.
- .5 Apply water as necessary during compaction to obtain specified density. If granular base is excessively moist, remove it and install more granular material to rid it of sponginess.
- .6 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.
- .7 Ensure top of granular base does not exceed plus or minus 5 mm over 1 m straightedge.

**3.5 EDGING**

- .1 Install edging true to grade, in location, layout and pattern as indicated.

**3.6 BEDDING SAND**

- .1 Place and spread bedding sand to 20-30 mm.



- .2 Maximum thickness after compaction: 25 mm.
- .3 Use material other than bedding sand to compensate for depressions that exceed specified tolerances in surface of base.
- .4 Do not use joint sand for bedding sand.

**3.7 SURFACE COURSE**

- .1 Ensure bedding sand and granular base are not saturated prior to placement of unit pavers.
- .2 Install unit paving true to grade on the bedding sand, in location, layout and pattern as indicated.
- .3 Where required, cut units accurately without damaging edges.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures
- .2    Section 01 45 00 - Quality Control
- .3    Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .4    Section 01 78 00 - Closeout Submittals
- .5    Section 09 91 23 - Interior Painting
- .6    Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

**1.2            SUBMITTALS**

- .1    Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .3    Shop drawings to show:
  - .1    Mounting arrangements.
  - .2    Operating and maintenance clearances.
- .4    Shop drawings and product data accompanied by:
  - .1    Detailed drawings of bases, supports, and anchor bolts.
  - .2    Acoustical sound power data, where applicable.
  - .3    Points of operation on performance curves.
  - .4    Manufacturer to certify current model production.
  - .5    Certification of compliance to applicable codes.
- .5    In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6    Closeout Submittals:
  - .1    Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2    Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .3    Operation data to include:
    - .1    Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

- .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4 Operation instruction for systems and component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Valves schedule and flow diagram.
- .7 Colour coding chart.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.

- .9 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

**1.3 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**1.4 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
  - .1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 NOT USED.**

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2 CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

**3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.4 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative will record these demonstrations on video tape for future reference.

**3.5 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 22 11 16 – Domestic Water Piping
- .3        Section 22 13 17 – Drainage Waste and Vent Piping
- .4        Section 22 30 05 – Domestic Water Heaters
- .5        Section 22 42 01 – Plumbing Specialties and Accessories
- .6        Section 22 42 03 – Commercial Washroom Fixtures
- .7        Section 22 42 16 – Commercial Lavatories and Sinks

**1.2            SUBMITTALS**

- .1        Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .3        Shop drawings to show:
  - .1        Mounting arrangements.
  - .2        Operating and maintenance clearances.
- .4        Shop drawings and product data accompanied by:
  - .1        Detailed drawings of bases, supports, and anchor bolts.
  - .2        Acoustical sound power data, where applicable.
  - .3        Points of operation on performance curves.
  - .4        Manufacturer to certify current model production.
  - .5        Certification of compliance to applicable codes.
- .5        In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6        Closeout Submittals:
  - .1        Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2        Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.



- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

- .9 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

### **1.3 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### **1.4 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2 CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

**3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.4 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative will record these demonstrations on video tape for future reference.

**3.5 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

EQUIPMENT NO.	DHWH-02		
Storage Capacity	USgal	L	50 189
ELECTRICAL DATA			
Number of Elements			2
Max kW per Element	KW		3.0
Total kW	KW		6.0
Volt/Phase/Cycle			208/1/60
Remarks			Electric Water Heater

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 21 05 01 – Common Work Results – Mechanical
- .2        Section 22 05 00 – Common Work Results for Plumbing

**1.2                REFERENCES**

- .1        American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1        ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2        ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3        ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4        ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2        ASTM International Inc.
  - .1        ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2        ASTM A536-84 (2004) e1, Standard Specification for Ductile Iron Castings.
  - .3        ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
- .3        American National Standards Institute/American Water Works Association (ANSI)/(AWWA).
  - .1        ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4        Canada Green Building Council (CaGBC).
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.
  - .2        Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
  - .3        LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.
- .5        Canadian Standards Association (CSA International).
  - .1        CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .6        Department of Justice Canada (Jus).

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



- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67-02a, Butterfly Valves.
  - .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .9 National Research Council (NRC)/Institute for Research in Construction.
  - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.
- .10 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
- .4 Prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
  - .2 Buried or embedded: copper tube, soft annealed, type L: to ASTM B88M, in long lengths and with no buried joints.

**2.2 FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 1/2 and smaller: wrought copper to ANSI/ASME B16.22; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380b kPa.

**2.3 JOINTS**

- .1 Rubber gaskets, 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

## **2.4 BALL VALVES**

- .1 NPS 2 and under, screwed:
  - .1 Class 150.
  - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, soldered:
  - .1 To ANSI/ASME B16.18, Class 150.
  - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

## **Part 3 Execution**

### **3.1 APPLICATION**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with National Building Code and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

### **3.3 VALVES**

- .1 Isolate equipment, fixtures and branches with ball valves.

- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

**3.4 PRESSURE TESTS**

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 time maximum system operating pressure or 860 kPa.

**3.5 FLUSHING AND CLEANING**

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, and then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper.

**3.6 PRE-START-UP INSPECTIONS**

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

**3.7 DISINFECTION**

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

**3.8 START-UP**

- .1 Timing: start up after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  - .3 Bring HWS storage tank up to design temperature slowly.
  - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
  - .5 Check control, limit, and safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

### **3.9 PERFORMANCE VERIFICATION**

- .1 Scheduling:
  - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
- .2 Procedures:
  - .1 Verify that flow rate and pressure meet Design Criteria.
  - .2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
  - .4 Sterilize HWS and HWC systems for Legionella control.
  - .5 Verify performance of temperature controls.
  - .6 Verify compliance with safety and health requirements.
  - .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
  - .8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

### **3.10 OPERATION REQUIREMENTS**

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 05 - Installation of Pipework.

### **3.11 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 21 05 01 – Common Work Results – Mechanical
- .2        Section 22 05 00 – Common Work Results for Plumbing

**1.2                REFERENCES**

- .1        ASTM International Inc.
  - .1        ASTM B32-08, Standard Specification for Solder Metal.
  - .2        ASTM B306-02, Standard Specification for Copper Drainage Tube (DWV).
  - .3        ASTM C564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2        Canada Green Building Council (CaGBC).
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations (including Addendum 2007).
  - .2        LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.
- .3        Canadian Standards Association (CSA International).
  - .1        CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories. CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .2        CAN/CSA-B125.3-05, Plumbing Fittings.
- .4        Green Seal Environmental Standards (GSES)
  - .1        Standard GS-36-00, Commercial Adhesives.
- .5        South Coast Air Quality Management District (SCAQMD), California State
  - .1        SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **Part 2 Products**

- .1 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Maximum VOC limit [30] [70] [250] g/L [to SCAQMD Rule 1168] [GSES GS-36] and in accordance with Section, 01 35 21 - LEED Requirements.

#### **2.2 COPPER TUBE AND FITTINGS**

- .1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
  - .1 Fittings.
    - .1 Cast brass: to CAN/CSA-B125.3.
    - .2 Wrought copper: to CAN/CSA-B125.3.
  - .2 Solder: tin-lead, 50:50, and type 50A 95:5, type TA, to ASTM B32.

#### **2.3 CAST IRON PIPING AND FITTINGS**

- .1 Buried sanitary, storm, and vent minimum NPS 3, to: CAN/CSA-B70.
  - .1 Joints:
    - .1 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.ASTM C564 or
      - .2 Stainless steel clamps.
    - .2 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
      - .2 Cold caulking compounds.



- .2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
  - .1 Joints:
    - .1 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
    - .2 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

**Part 3 Execution**

**3.1 APPLICATION**

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

**3.2 INSTALLATION**

- .1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

**3.3 TESTING**

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

**3.4 PERFORMANCE VERIFICATION**

- .1 Cleanouts:
  - .1 Ensure accessible and that access doors are correctly located.
  - .2 Open, cover with linseed oil and re-seal.
  - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
  - .1 Verify domes are secure.
  - .2 Ensure weirs are correctly sized and installed correctly.
  - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

**3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 21 05 01 – Common Work Results – Mechanical
- .2        Section 22 05 00 – Common Work Results for Plumbing

**1.2                REFERENCES**

- .1        American National Standards Institute/Canadian Standards Association (ANSI/CSA)
  - .1        ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
  - .2        ANSI Z21.10.1A-2006/CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
  - .3        ANSI Z21.10.1b-2006/CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
  - .4        ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.
- .2        Canada Green Building Council (CaGBC).
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.
  - .2        Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
  - .3        LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.
- .3        Canadian Standards Association (CSA International)
  - .1        CSA B51-03 (R2007), Boiler, Pressure Vessel, and Pressure Piping Code.
  - .2        CAN/CSA-B139-04, Installation Code for Oil Burning Equipment.
  - .3        CAN/CSA-B140.0-03, Oil Burning Equipment: General Requirements.
  - .4        CAN/CSA-B149.1-05, Natural Gas and Propane Installation Code.
  - .5        CAN/CSA-B149.2-05, Propane Storage and Handling Code.
  - .6        CSA B140.12-03, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
  - .7        CAN/CSA C22.2 No.110-94 (R2004), Construction and Test of Electric Storage Tank Water Heaters.

- .8 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.
- .9 CAN/CSA-C309-M90 (R2003), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
  - .2 Indicate:
    - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.6 WARRANTY**

- .1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.
- .2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

**Part 2 Products**

**2.1 ELECTRIC WATER HEATER**

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191, with immersion type elements, and surface mounted or immersion type adjustable thermostats.
- .2 Tank: glass lined steel, 50 mm mineral wool or fibreglass insulation, enamelled steel jacket, minimum 3 year warranty certificate.
- .3 Refer to Section 22 0630.13 – Domestic Water Heater Schedule for size and performance of each water heater.

**2.2 TRIM AND INSTRUMENTATION**

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer, syphon, and shut-off cock.
- .4 Thermowell filled with conductive paste for control valve temperature sensor.
- .5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

**Part 3 Execution**

**3.1 APPLICATION**

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

**3.2           INSTALLATION**

- .1       Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2       Provide insulation between tank and supports.

**3.3           FIELD QUALITY CONTROL**

- .1       Manufacturer's factory trained, certified Engineer to start up DHW heaters.

**3.4           CLEANING**

- .1       Clean in accordance with Section 01 74 11 - Cleaning.
  - .1       Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2       Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for plumbing specialties and accessories.
- .2 Related Sections:
  - .1 Section 01 33 00 - Submittal Procedures.
  - .2 Section 01 45 00 - Quality Control.
  - .3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
  - .4 Section 01 78 00 - Closeout Submittals.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA).
  - .1 AWWA C700-02, Cold Water Meters-Displacement Type, Bronze Main Case.
  - .2 AWWA C701-02, Cold Water Meters-Turbine Type for Customer Service.
  - .3 AWWA C702-1-01, Cold Water Meters-Compound Type.
- .3 Canadian Standards Association (CSA International).
  - .1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.
  - .2 CSA-B79-94 (R2000), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
  - .3 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .5 Plumbing and Drainage Institute (PDI).
  - .1 PDI-G101-96, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
  - .2 PDI-WH201-92, Water Hammer Arresters Standard.



### **1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
  - .2 Indicate dimensions, construction details and materials for specified items.
- .3 Shop Drawings:
  - .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details, and accessories
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  - .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
  - .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.1 FLOOR DRAINS**

- .1 Floor Drains and Trench Drains: to CSA B79.
- .2 Type 1: general duty; cast iron body round, adjustable head, nickel bronze strainer, integral seepage pan, and clamping collar.

**2.2 CLEANOUTS**

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
  - .1 Wall Access: face or wall type, polished nickel bronze round or square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .2 Floor Access: round, cast iron body and frame with adjustable secured nickel bronze top and:
    - .1 Plugs: bolted bronze with neoprene gasket.
    - .2 Cover for Unfinished Concrete Floors: nickel bronze, [round] [or] [square], gasket, vandal-proof screws.
    - .3 Cover for Terrazzo Finish: polished [nickel bronze] [brass] with recessed cover for filling with terrazzo, vandal-proof locking screws.
    - .4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
    - .5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

**2.3 TRAP SEAL PRIMERS**

- .1 Brass, with integral vacuum breaker, NPS1/2 solder ends, NPS1/2 drip line connection.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

### **3.3 CLEANOUTS**

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

### **3.4 TRAP SEAL PRIMERS**

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.
- .3 Install soft copper tubing to floor drain.

### **3.5 START-UP**

- .1 General:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx)  
Requirements: General Requirements, supplemented as specified herein.
- .2 Timing: start-up only after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
- .3 Provide continuous supervision during start-up.

### **3.6 TESTING AND ADJUSTING**

- .1 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by authority having jurisdiction.
- .2 Application tolerances:
  - .1 Pressure at fixtures: +/- 70 kPa.

.2 Flow rate at fixtures: +/- 20%.

- .3 Adjustments:
  - .1 Verify that flow rate and pressure meet design criteria.
  - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .4 Floor drains:
  - .1 Verify operation of trap seal primer.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check operations of flushing features.
  - .4 Check security, accessibility, removeability of strainer.
  - .5 Clean out baskets.
- .5 Access doors:
  - .1 Verify size and location relative to items to be accessed.
- .6 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 21 05 01 – Common Work Results – Mechanical
- .2 Section 22 05 00 – Common Work Results for Plumbing

**1.2 REFERENCES**

- .1 Canada Green Building Council (CaGBC).
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.
  - .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.
- .2 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-B45 Series-02 (R2008), Plumbing Fixtures.
  - .2 CAN/CSA-B125.3-05, Plumbing Fittings.
  - .3 CAN/CSA-B651-04, Accessible Design for the Built Environment.
- .3 Green Seal Environmental Standards (GSES).
  - .1 Standard GS-36-00, Commercial Adhesives.
- .4 South Coast Air Quality Management District (SCAQMD), California State.
  - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Indicate fixtures and trim:
  - .1 Dimensions, construction details, roughing-in dimensions.
  - .2 Factory-set water consumption per flush at recommended pressure.
  - .3 (For water closets, urinals): minimum pressure required for flushing.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for washroom fixtures, for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MANUFACTURED UNITS**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: as indicated
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

**2.2**

.1 Water closets:

WC type	Mounting		Bowl	Reg	Flush tank	Barrier Free
	Wall	Floor	Elong			
WC-1		X	X		X	X
WC-2		X	X		X	

- .1 WC-1: Floor-mounted, flush tank for barrier free.
  - .1 Top of seat to be between 400 mm and 460 mm from finished floor.
  - .2 Bowl: vitreous china, floor mounted, syphon jet, elongated rim, close-coupled, bolt caps.
  - .3 Closet tank: vitreous china with tank liner, flapper type flush valve assembly, factory set to 5.7 litres/flush.
- .2 WC-2: floor-mounted, flush tank.
  - .1 Bowl: vitreous china, syphon jet, elongated rim, close-coupled combination, and bowl and bolt caps.
  - .2 Closet tank: vitreous china with tank liner, flapper type flush valve assembly, factory set to 5.7 litres/flush.

.2 Water Closet Seats.

- .1 Seat: white, elongated, open front, moulded solid plastic, less cover, stainless steel check hinges, stainless steel insert post.

.3 Urinals:

- .1 U-1: wall mounted, ultra-low flush, exposed flush valve, top spud.
  - .1 Urinal: vitreous china, washout type, integral flushing rim, extended shields, integral trap, removable stainless steel strainer, back outlet.
- .2 Urinal Flush Valves:
  - .1 Manual flush valves: chrome plated, non-hold-open, exposed, diaphragm, externally adjustable, with NPS 3/4 angle screwdriver stop, chrome plated oscillating handle, wall and spud flange, and vacuum breaker. Ultra low flush cycle: set to 3.8 litres/flush

.4 Washroom Lavatories:

- .1 L-1: Wall-hung, barrier free:
- .2 Vitreous china, with splash lip, soap depressions, supply openings on 100 mm centres, overflow. Size: 500 x 450 mm.



- .5 Washroom Lavatory Trim:
  - .1 Barrier-free electronic faucet:
    - .1 Infra-red motion sensor activated by hand motion in lavatory.
    - .2 Sensor: waterproof, incorporated in body of unit, with impact-resistant plastic lens and anti-scratch coating, sensitivity adjustable from 100 mm to 450 mm.
    - .3 Water conservation: 30 second maximum run time.
    - .4 Electronic faucet shall be battery-operated using standard AA batteries..
    - .5 Spout: Chrome plated, with integral flow control aerator rated at 8.35 l/minute at 413 kPa maximum.
    - .6 Controls in body of unit.
- .6 Fixture piping:
  - .1 Hot and cold water supplies to fixtures:
    - .1 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.
  - .2 Waste:
    - .1 Brass P trap with clean out on fixtures not having integral trap.
    - .2 Chrome plated in exposed places.
- .7 Chair carriers:
  - .1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.

### **Part 3 Execution**

#### **3.1 APPLICATION**

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

#### **3.2 INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to manufacturer's recommendations, measured from finished floor.
  - .2 Wall-hung fixtures: as indicated by architectural.
  - .3 Barrier free: to most stringent of NBCC and CAN/CSA B651.

#### **3.3 ADJUSTING**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:

- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Adjust flush valves to suit actual site conditions.
- .4 Adjust urinal flush timing mechanisms.
- .3 Checks:
  - .1 Water closets, urinals: flushing action.
  - .2 Aerators: operation, cleanliness.
  - .3 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.

**3.4 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 21 05 01 – Common Work Results – Mechanical
- .2        Section 22 05 00 – Common Work Results for Plumbing

**1.2                REFERENCES**

- .1        Canada Green Building Council (CaGBC).
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.
  - .2        Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
  - .3        LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.
- .2        Canadian Standards Association (CSA International).
  - .1        CAN/CSA-B45 Series-02 (R2008), Plumbing Fixtures.
  - .2        CAN/CSA-B125.3-05, Plumbing Fittings.
  - .3        CAN/CSA-B651-04, Accessible Design for the Built Environment.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                CLOSEOUT SUBMITTALS**

- .1        Provide maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2        Include:
  - .1        Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2        Details of operation, servicing, maintenance.
  - .3        List of recommended spare parts.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MANUFACTURED UNITS**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: architectural drawings to govern.
- .5 Fixtures to be product of one manufacturer.
- .6 Trim to be product of one manufacturer.
- .7 Mop sinks:
  - .1 Sink: moulded stone, 300 mm high undrilled integral back. Size: 610 x 610 x 254 mm.
  - .2 Supply fitting: with built-in elevated vacuum breaker, indexed cross handles, 1400 mm long rubber hose, escutcheons, union inlets, heavy cast brass spout with pail hook, aerator, brace to wall, integral stop valves. Provide accessories to limit maximum flow rate to 8.35 l/minute at 413 kPa.
- .8 Fixture piping:
  - .1 Hot and cold water supplies to each fixture:
    - .1 Chrome plated rigid supply pipes each with screwdriver stop, reducers, escutcheon.
    - .2 Waste:
      - .1 Brass P trap with clean out on each fixture not having integral trap.
      - .2 Chrome plated in all exposed places.

- .9 Chair carriers:
  - .1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

**Part 3 Execution**

**3.1 APPLICATION**

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

**3.2 INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
  - .2 Wall-hung fixtures: as indicated on architectural drawings, measured from finished floor.
  - .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA-B651.

**3.3 ADJUSTING**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:
  - .1 Aerators: operation, cleanliness.
  - .2 Vacuum breakers, backflow preventers: operation under all conditions.
  - .3 Wash fountains: operation of flow-actuating devices.
- .4 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.

**3.4 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 45 00 - Quality Control.
- .3      Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4      Section 01 78 00 - Closeout Submittals.
- .5      Section 09 91 23 - Interior Painting.
- .6      Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

**1.2                SUBMITTALS**

- .1      Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .3      Shop drawings to show:
  - .1          Mounting arrangements.
  - .2          Operating and maintenance clearances.
- .4      Shop drawings and product data accompanied by:
  - .1          Detailed drawings of bases, supports, and anchor bolts.
  - .2          Acoustical sound power data, where applicable.
  - .3          Points of operation on performance curves.
  - .4          Manufacturer to certify current model production.
  - .5          Certification of compliance to applicable codes.
- .5      In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6      Closeout Submittals:
  - .1          Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2          Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.



.4 Make available for reference purposes and inspection.

- .9 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

**1.3 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

**1.4 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
  - .1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
  - .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 NOT USED.**

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2 CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

**3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.4 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

**3.5 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1    Section Includes:
  - .1    Electrical motors, drives and guards for mechanical equipment and systems.
  - .2    Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
  - .3    Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.
  
- .2    Related Sections:
  - .1    Section 23 34 00 – HVAC Fans
  - .2    Section 23 54 13 – Electric Resistance Furnaces

**1.2                REFERENCES**

- .1    American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1    ASHRAE 90.1-01, Energy Standard for Buildings except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2    Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1    Material Safety Data Sheets (MSDS).

**1.3                SUBMITTALS**

- .1    Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
  
- .2    Product Data:
  - .1    Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1    Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
  - .2    Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.

- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .4 Closeout Submittals
  - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial regulations.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 GENERAL**

- .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

#### **2.2 MOTORS**

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120V, unless otherwise specified or indicated.

- .3 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 208V, unless otherwise indicated.

### **2.3 TEMPORARY MOTORS**

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

### **2.4 BELT DRIVES**

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 Correct size of sheave determined during commissioning.
- .5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment plates to allow for centre line adjustment.
- .7 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

### **2.5 DRIVE GUARDS**

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives;
  - .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
  - .3 38 mm diameter holes on both shaft centres for insertion of tachometer.
  - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.

- .5 Guard for flexible coupling:
  - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
  - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
  - .2 Net free area of guard: not less than 80% of fan openings.
  - .3 Securely fasten in place.
  - .4 Removable for servicing.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 INSTALLATION**

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.4 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1      Section 21 05 01 – Common Work Results – Mechanical
- .2      Section 22 05 00 – Common Work Results for Plumbing
- .3      Section 22 11 16 – Domestic Water Piping
- .4      Section 22 42 01 – Plumbing Specialties and Accessories

**1.2                REFERENCES**

- .1      American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  - .1      ANSI/ASME B1.20.1-1983 (R2006), Pipe Threads, General Purpose (Inch).
  - .2      ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2      ASTM International.
  - .1      ASTM A276-08, Standard Specification for Stainless Steel Bars and Shapes.
  - .2      ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .3      ASTM B283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  - .4      ASTM B505/B505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3      Canada Green Building Council (CaGBC).
  - .1      LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations (including Addendum 2007).
  - .2      LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.
- .4      Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
  - .1      MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2      MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
  - .3      MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in [Province] [Territory] of Canada.
  - .2 Submit data for valves specified in this Section.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
  - .1 Furnish following spare parts:
    - .1 Valve seats: one for every 10 valves each size, minimum 1.
    - .2 Discs: one for every 10 valves, each size. Minimum 1.
    - .3 Stem packing: one for every 10 valves, each size. Minimum 1.
    - .4 Valve handles: 2 of each size.
    - .5 Gaskets for flanges: one for every 10 flanged joints.
  - .2 Tools:
    - .1 Furnish special tools for maintenance of systems and equipment.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Valves:
  - .1 Except for specialty valves, to be single manufacturer.
  - .2 Products to have CRN registration numbers.
- .2 End Connections:
  - .1 Connection into adjacent piping/tubing:
    - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
    - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
- .3 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: Class 125, 860 kPa.
    - .3 Connections: solder ends to ANSI.
    - .4 Stem: tamperproof ball drive.
    - .5 Stem packing nut: external to body.
    - .6 Ball and seat: replaceable hard chrome solid ball and Teflon seats.
    - .7 Stem seal: TFE with external packing nut.
    - .8 Operator: removable lever handle.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

**3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 21 05 01 – Common Work Results – Mechanical.
- .2        Section 22 05 00 – Common Work Results for Plumbing.

**1.2                REFERENCES**

- .1        American Society of Mechanical Engineers (ASME).
  - .1        ASME B31.1-07, Power Piping.
- .2        ASTM International.
  - .1        ASTM A125-1996 (2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2        ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3        ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3        Canada Green Building Council (CaGBC).
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations (including Addendum 2007).
  - .2        LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.
- .4        Factory Mutual (FM).
- .5        Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS).
  - .1        MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2        MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
  - .3        MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6        Underwriter's Laboratories of Canada (ULC).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
  - .2 Submit shop drawings for:
    - .1 Bases, hangers and supports.
    - .2 Connections to equipment and structure.
- .4 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
  - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:
  - .1 Design supports, platforms, catwalks, hangers to withstand seismic events as designed by a Professional Engineer licensed in the province of Ontario and as per the Ontario Building Code.

**2.2 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

**2.3 PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized
  - .2 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.

- .3 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel galvanized.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .4 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
- .5 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .6 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: galvanized.
  - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated.
- .7 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

## **2.4 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
  - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

## **2.5 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

## **2.6 HOUSE-KEEPING PADS**

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.



**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .3 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .4 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variation in supporting effect does not exceed 25 % of total load.

**3.3 HANGER SPACING**

- .1 Plumbing piping: to National Plumbing Code.
- .2 Copper piping: up to NPS 1/2: every 1.5 m.
- .3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .4 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m

- .5 Pipework greater than NPS 12: to MSS SP69.

### **3.4 HANGER INSTALLATION**

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### **3.5 HORIZONTAL MOVEMENT**

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

### **3.6 FINAL ADJUSTMENT**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

### **3.7 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1 Section Includes:
  - .1 Vibration isolation materials and components, seismic control measures and their installation.
- .2 Related Sections:
  - .1 Section 21 05 01 – Common Work Results – Mechanical.

**1.2                REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA).
  - .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC) - 1995

**1.3                SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 Provide system shop drawings complete with performance and product data.
  - .3 Provide detailed drawings of seismic control measures for equipment and piping complete with the seal of a Professional Engineer licensed in the Province of Ontario specializing in the design of seismic control measures.

- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
  - .3 Manufacturer's Field Reports: manufacturer's field reports specified.
- .4 Following the completion of the project, the seismic engineer responsible for the design shall inspect the installation and issue a sealed letter or report indicating that the installation has been completed as per their design and as per the requirements of the National Building Code.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

#### **Part 2 Products**

##### **2.1 GENERAL**

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

##### **2.2 HANGERS**

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.

## **2.3 SEISMIC CONTROL MEASURES**

- .1 General:
  - .1 Seismic control systems to work in every direction.
  - .2 Fasteners and attachment points to resist same maximum load as seismic restraint.
  - .3 Drilled or power driven anchors and fasteners not permitted.
  - .4 No equipment, equipment supports or mounts to fail before failure of structure.
  - .5 Supports of cast iron or threaded pipe not permitted.
  - .6 Seismic control measures not to interfere with integrity of firestopping.
- .2 Static equipment:
  - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
  - .2 Seismic restraints:
    - .1 Cushioning action gentle and steady.
    - .2 Never reach metal-like stiffness.
- .3 Vibration isolated equipment:
  - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
  - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.
  - .3 As indicated.
- .4 Piping systems:
  - .1 Piping systems: hangers longer than 300 mm; brace at each hanger.
  - .2 Compatible with requirements for anchoring and guiding of piping systems.
- .5 Bracing methods:
  - .1 Approved by Departmental Representative.
  - .2 Structural angles or channels.
  - .3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Seismic control measures to meet requirements of NBC
- .2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
  - .1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.
  - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .5 Where isolation is bolted to floor use vibration isolation rubber washers.
- .6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

**3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
  - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
    - .1 After delivery and storage of Products.
    - .2 After preparatory work is complete but before installation commences.
    - .3 Twice during the installation, at 25% and 60% completion stages.
    - .4 Upon completion of installation.

- .3 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.
- .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
  - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC system[s] after start up and TAB of systems to Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
  - .2 Provide Departmental Representative with notice 24h in advance of commencement of tests.
  - .3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
  - .4 Submit complete report of test results.

**3.4 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**



**Part 1 General**

**1.1 SUMMARY**

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

**1.2 QUALIFICATIONS OF TAB PERSONNEL**

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
  - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

### **1.3 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

### **1.4 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

### **1.5 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

### **1.6 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

### **1.7 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

**1.8 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

**1.9 START OF TAB**

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weather stripping, sealing, and caulking.
  - .3 Pressure, leakage, other tests specified elsewhere Division 23.
  - .4 Provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  - .1 Proper thermal overload protection in place for electrical equipment.
  - .2 Air systems:
    - .1 Filters in place, clean.
    - .2 Duct systems clean.
    - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
    - .4 Correct fan rotation.
    - .5 Fire, smoke, volume control dampers installed and open.
    - .6 Coil fins combed, clean.
    - .7 Access doors, installed, closed.
    - .8 Outlets installed, volume control dampers open.

**1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 5%, minus 5%.

**1.11 ACCURACY TOLERANCES**

- .1 Measured values accurate to within plus or minus 2% of actual values.

**1.12 INSTRUMENTS**

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

**1.13 SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

**1.14 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
  - .1 Details of instruments used.
  - .2 Details of TAB procedures employed.
  - .3 Calculations procedures.
  - .4 Summaries.

**1.15 TAB REPORT**

- .1 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .2 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in both official languages in D-ring binders, complete with index tabs.

**1.16 VERIFICATION**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

**1.17 SETTINGS**

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, and ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

**1.18 COMPLETION OF TAB**

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

**1.19 AIR SYSTEMS**

- .1 Standard: TAB to most stringent of this section or TAB standards of SMACNA and ASHRAE.
- .2 Do TAB of following systems, equipment, components, and controls:
  - .1 Supply air system
- .3 Qualifications: personnel performing TAB qualified to standards of AABC or NEBB.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
  - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
  - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

**1.20 OTHER TAB REQUIREMENTS**

- .1 General requirements applicable to work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
  - .2 Quality assurance: as for air systems specified this section.
- .2 Building pressure conditions:
  - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times.
- .3 Zone pressure differences:
  - .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combination of normal operating modes.

- .4 Smoke management systems:
  - .1 Test for proper operation of all smoke and fire dampers, installed as component parts of air systems specified Division 23.

**1.21 POST-OCCUPANCY TAB**

- .1 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

EQUIPMENT NO.			F-01	
System			General Exhaust	
Location			Attic Space	
Service			General Exhaust	
Airflow Rate	cfm	L/s	100	47
External Static Pressure	In H2O	Pa	0.1	25
Brake	hp	kW	0.01	0.01
Motor	hp	kW	0.17	0.13
Type			Direct Drive Inline Fan	
RPM			1300	
Variable Inlet Vanes	Yes/No		No	
Variable Frequency Drive	Yes/No		No	
Remarks				



EQUIPMENT NO.			FUR-1	
SUPPLY FAN	cfm	L/s	1,000	472
External Static Pressure	In H2O	Pa	0.6	149
Fan Control (vfd/viv/cv)			CV	
COOLING (total)	MBH	kW	30.0	9
Sensible Capacity	MBH	kW	21.0	6
Entering Air Temperature (db)	°F	°C	80.0	26.7
Entering Air Temperature (wb)	°F	°C	67.0	19.4
Leaving Air Temperature (db)	°F	°C	60.6	15.9
Leaving Air Temperature (wb)	°F	°C	57.6	14.2
HEATING	MBH	kW	36.9	11
Entering Air Temperature (db)	°F	°C	60.0	15.6
Type (gas/elec/glycol)			Electric	
CONDENSER				
Ambient Air Temperature	°F	°C	95.0	35.0
Compressor Motor (each)	hp	kW	3	2.46
CONDENSER ELECTRICAL				
Volts/Phase/Cycle			208/1/60	
Maximum Circuit Ampacity			18	
MOCP			30	
FURNACE ELECTRICAL				
Volts/Phase/Cycle			208/1/60	
Maximum Circuit Ampacity			68.4	
MOCP			70	
REMARKS				

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 21 05 01 – Common Work Results – Mechanical
- .2        Section 23 05 00 – Common Work Results for HVAC

**1.2                REFERENCES**

- .1        Definitions:
  - .1        For purposes of this section:
    - .1        "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
    - .2        "EXPOSED" - means "not concealed" as previously defined.
    - .3        Insulation systems - insulation material, fasteners, jackets, and other accessories.
  - .2        TIAC Codes:
    - .1        CRD: Code Round Ductwork,
    - .2        CRF: Code Rectangular Finish.
- .2        Reference Standards:
  - .1        American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
    - .1        ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
  - .2        ASTM International Inc.
    - .1        ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
    - .2        ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
    - .3        ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
    - .4        ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
    - .5        ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
    - .6        ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
    - .7        ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

- .8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB).
  - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Canada Green Building Council (CaGBC).
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.
  - .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .5 Green Seal Environmental Standards (GSES).
  - .1 Standard GS-36-00, Commercial Adhesives.
- .6 South Coast Air Quality Management District (SCAQMD), California State.
  - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .7 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .8 Underwriters Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
    - .2 Details of operation, servicing and maintenance.
    - .3 Recommended spare parts list.

- .3 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .4 Samples:
  - .1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
  - .2 Mount sample on 12 mm plywood board.
  - .3 Affix typewritten label beneath sample indicating service.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacture's written duct insulation jointing recommendations, special handling criteria, installation sequence, and cleaning procedures

#### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 FIRE AND SMOKE RATING**

- .1 To CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25
  - .2 Maximum smoke developed rating: 50.

## 2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C means temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to ASTM C553.

## 2.3 ACCESSORIES

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 Tape: self-adhesive, aluminum, [plain] [reinforced], [50] [75] mm wide minimum.
- .5 Contact adhesive: quick-setting.
- .6 Tie wire: 1.5 mm stainless steel.
- .7 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .8 Fasteners: 2mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

## Part 3 Execution

### 3.1 APPLICATION

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

### **3.2 PRE-INSTALLATION REQUIREMENTS**

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, and free from foreign material.

### **3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

### **3.4 DUCTWORK INSULATION SCHEDULE**

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Supply, return and exhaust ducts exposed in space being served			None
Outside air ducts to mixing plenum	C-1	Yes	25
Acoustically lined ducts	None		

**3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1 Section Includes:
  - .1 Thermal insulation for piping and piping accessories in commercial type applications.
- .2 Related Requirements
  - .1 Section 21 05 01 – Common Work Results – Mechanical.
  - .2 Section 22 05 00 – Common Work Results for Plumbing.

**1.2                REFERENCES**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
  - .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
  - .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB).
  - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.



- .4 Department of Justice Canada (Jus) Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations.
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings.
  - .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

### **1.3 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish.

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

- .3 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
    - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

## **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
- .2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, [qualified to standards] [member] of TIAC.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
  - .1 Protect from weather, construction traffic.
  - .2 Protect against damage.
  - .3 Store at temperatures and conditions required by manufacturer.

- .3 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
  - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
  - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

**Part 2 Products**

**2.1 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC-S102.
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

**2.2 INSULATION**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702.
  - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].
- .5 TIAC Code C-2: mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/ULC-S702.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702.

- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
  - .1 Insulation: with vapour retarder jacket.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
- .7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: to ASTM C533.
  - .2 Design to permit periodic removal and re-installation.

### **2.3 INSULATION SECUREMENT**

- .1 Tape: self-adhesive, aluminum, [plain] [reinforced], [50] mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19vmm wide, 0.5 mm thick.

### **2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Air drying on mineral wool, to ASTM C449/C449M.

### **2.5 VAPOUR RETARDER LAP ADHESIVE**

- .1 Water based, fire retardant type, compatible with insulation.

### **2.6 INDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.

### **2.7 OUTDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m<sup>5</sup>.

## **2.8 JACKETS**

- .1 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colours: by Departmental Representative.
  - .3 Minimum service temperatures: -20 degrees C.
  - .4 Maximum service temperature: 65 degrees C.
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
  - .7 Special requirements:
    - .1 Outdoor: UV rated material at least 0.5 mm thick.
- .2 ABS Plastic:
  - .1 One-piece moulded type with pre-formed shapes as required.
  - .2 Colours: [to match adjacent finish paint] by Departmental Representative.
  - .3 Minimum service temperatures: -40 degrees C.
  - .4 Maximum service temperature: 82 degrees C.
  - .5 Moisture vapour transmission: 0.012 perm.
  - .6 Thickness: 0.75 mm.
  - .7 Fastenings:
    - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
  - .8 Locations:
    - .1 For outdoor use ONLY.

## **2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS**

- .1 Caulking to: Section 07 92 00 - Joint Sealants.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

**3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification. Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Install hangers, supports outside vapour retarder jacket.
- .4 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

**3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: at expansion joints, valves, primary flow measuring elements and flanges and unions at equipment.
- .2 Design: [to permit movement of expansion joint] [and] [to permit periodic removal and replacement] without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.

**3.5 INSTALLATION OF ELASTOMERIC INSULATION**

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

**3.6 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.  
TIAC Code: A-1.
  - .1 Securements: SS bands.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .2 TIAC Code: A-3.
  - .1 Securements: SS bands Tape.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .3 TIAC Code: A-6.
  - .1 Seals: lap seal adhesive, lagging adhesive.
  - .2 Installation: TIAC Code.
- .4 TIAC Code: C-2 with vapour retarder jacket.
  - .1 Seals: lap seal adhesive, lagging adhesive.
  - .2 Installation: TIAC Code: 1501-C.

.5 Thickness of insulation as listed in following table.

- .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
- .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic HWS		A-1	25	25	25	38	38	38
Domestic CWS		A-3	25	25	25	25	25	25
Domestic CWS with vapour retarder		C-2	25	25	25	25	25	25
Refrigerant (hot gas, liquid and suction)	below 4	A-6	25	25	38	38	38	38

.6 Finishes:

- .1 Exposed indoors: canvas jacket.
- .2 Exposed in mechanical rooms: None.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Finish attachments: SS [screws] [bands], at [150] mm on centre. Seals: [wing] [closed].
- .6 Installation: to appropriate TIAC code CRF/1 through CPF/5.

### 3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**



**Part 1            General**

**1.1                SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.
- .2 Related Sections:
  - .1 Section 01 33 00 - Submittal Procedures.
  - .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .3 Section 07 84 00 - Firestopping.
  - .4 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

**1.2                REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
  - .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
  - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  - .3 NFPA 96-01, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
  - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.
- .7 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

### **1.3 SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4 QUALITY ASSURANCE**

- .1 Certification of Ratings:
  - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
  - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  - .3 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.
  - .4 Place materials defined as hazardous or toxic in designated containers.
  - .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.1 SEAL CLASSIFICATION**

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

.2 Seal classification:

- .1 Class C: transverse joints and connections made air tight with sealant, or combination thereof. Longitudinal seams unsealed.
- .2 Unsealed seams and joints.

**2.2 SEALANT**

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

**2.3 TAPE**

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

**2.4 DUCT LEAKAGE**

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual

**2.5 FITTINGS**

.1 Fabrication: to SMACNA

.2 Radiused elbows.

- .1 Rectangular: standard radius
- .2 Round: smooth radius, five piece. Centreline radius: 1.5 times diameter.

.3 Branches:

- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
- .2 Provide volume control damper in branch duct near connection to main duct.
- .3 Main duct branches: with splitter damper.

.4 Transitions:

- .1 Diverging: 20 degrees maximum included angle.

- .2      Converging: 30 degrees maximum included angle.

- .5 Offsets:
  - .1 Full radiused elbows

## **2.6 FIRE STOPPING**

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 – Firestopping.
- .2 Fire stopping material and installation must not distort duct.

## **2.7 GALVANIZED STEEL**

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA standards.
- .3 Joints: to SMACNA.

## **2.8 HANGERS AND SUPPORTS**

- .1 Hangers and Supports: in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Do work ASHRAE and SMACNA standards.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Support risers in accordance with SMACNA standards.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining

### **3.2 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA

- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA standards.

**3.3 WATERTIGHT DUCT**

- .1 Provide watertight duct for:
  - .1 Fresh air intake.
- .2 Form bottom of horizontal duct without longitudinal seams.
  - .1 Seal other joints with duct sealer.

**3.4 SEALING AND TAPING**

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of two coats of sealant to manufacturers recommendations.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.
- .2 Related Sections:
  - .1 Section 01 33 00 - Submittal Procedures.
  - .2 Section 01 45 00 - Quality Control.
  - .3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .4 Section 01 78 00 - Closeout Submittals.

**1.2 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

**1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
    - .1 Flexible connections.
    - .2 Duct access doors.
    - .3 Turning vanes.
    - .4 Instrument test ports.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
  - .1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.



- .6 Manufacturer's Field Reports: manufacturer's field reports specified.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
  - .4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan (WMP).
  - .5 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

#### **Part 2 Products**

##### **2.1 GENERAL**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

##### **2.2 FLEXIBLE CONNECTIONS**

- .1 Material:
  - .1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m<sup>2</sup>.

##### **2.3 ACCESS DOORS IN DUCTS**

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:

- .1 Up to 300 x 300 mm: two sash locks complete with safety chain.

## **2.4 TURNING VANES**

- .1 Factory or shop fabricated single thickness with trailing edge, to recommendations of SMACNA and as indicated.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

- .1 Flexible Connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans.
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of connection: 100 mm.
  - .3 Minimum distance between metal parts when system in operation: 75 mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on sides of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
  - .1 Size:
    - .1 300 x 300 mm for servicing entry.
  - .2 Locations:
    - .1 Fire and smoke dampers.
- .3 Instrument Test Ports:
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .3 Install insulation port extensions as required.

- .4 Locations:
  - .1 For traverse readings:
    - .1 Ducted inlets to roof and wall exhausters.
    - .2 Inlets and outlets of other fan systems.
    - .3 Main and sub-main ducts.
    - .4 And as indicated.
  - .2 For temperature readings:
    - .1 At outside air intakes.
    - .2 In mixed air applications in locations as approved by Departmental Representative.
    - .3 At inlet and outlet of coils.
    - .4 Downstream of junctions of two converging air streams of different temperatures.
    - .5 And as indicated.
- .4 Turning vanes:
  - .1 Install in accordance with recommendations of SMACNA and as indicated.

### **3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, and protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
  - .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, at stages listed:
    - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
    - .2 Twice during progress of Work at 25% and 60% complete.
    - .3 Upon completion of the Work, after cleaning is carried out.
  - .4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

**3.4 CLEANING**

- .1 Perform cleaning operations as specified in Section 01 74 11 – Cleaning and in accordance with manufacturer's recommendations.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1 Section Includes:
  - .1 Fans, motors, accessories and hardware for commercial use.
- .2 Related Sections:
  - .1 Section 21 05 01 – Common Work Results – Mechanical.

**1.2                REFERENCES**

- .1 Air Conditioning and Mechanical Contractors (AMCA).
  - .1 AMCA Publication 99-2003, Standards Handbook.
  - .2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.
  - .3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3                SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
  - .2 Capacity: flow rate, total and static pressure, bhp, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
  - .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
  - .4 Sound ratings: comply with AMCA 301, tested to AMCA 300.
  - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

#### **1.4 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
    - .1 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .3 Provide :
  - .1 Fan performance curves showing point of operation, [BHP] [kW] and efficiency.
  - .2 Sound rating data at point of operation.
- .4 Indicate:
  - .1 Motors, sheaves, bearings, shaft details
  - .2 Minimum performance achievable
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .6 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
    - .1 Spare parts to include:
      - .1 Matched sets of belts.

- .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
  - .1 Bearings and seals.
  - .2 Addresses of suppliers.
  - .3 List of specialized tools necessary for adjusting, repairing or replacing.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 FANS GENERAL**

- .1 Motors:
  - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
  - .2 Sizes as specified.
  - .3 Two speed with two windings and speeds as indicated.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and or [outlet] safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Vibration isolation: to Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.
- .7 Flexible connections: to Section 23 33 00 – Air Duct Accessories.



**2.2 IN-LINE CENTRIFUGAL FANS**

- .1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct drive.
- .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 FAN INSTALLATION**

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 – Air Duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

**3.3 ANCHOR BOLTS AND TEMPLATES**

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

**3.4 FIELD QUALITY CONTROL**

- .1 Low-emitting materials.

**3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.
- .2 Related Sections:
  - .1 Section 21 05 01 – Common Work Results – Mechanical.
  - .2 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

**1.2 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

**1.3 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate following:
    - .1 Capacity.
    - .2 Throw and terminal velocity.
    - .3 Noise criteria.
    - .4 Pressure drop.
    - .5 Neck velocity.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

**1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Include:
    - .1 Keys for volume control adjustment.
    - .2 Keys for air flow pattern adjustment.

**Part 2 Products**

**2.1 GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: standard.

**2.2 MANUFACTURED UNITS**

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

### **2.3 SUPPLY GRILLES AND REGISTERS**

- .1 Floor diffusers:
  - .1 Fixed blades: provide diverging air pattern along length of diffuser with dampers.
  - .2 Housing and diffuser face to form rigid structure with duct connection collar and flanges.
- .2 Finish: white.
- .3 Model: EH Price Linear Bar Grille, Model LBP or approved equivalent.

### **2.4 RETURN AND EXHAUST GRILLES AND REGISTERS**

- .1 General: with opposed blade dampers.
- .2 Type RA: steel, 19 mm border, single 0 degrees deflection, horizontal face bars.
- .3 Model: [\_\_\_\_\_]

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with flat head screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.

**3.3 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1            SUMMARY**

- .1 Section Includes:
  - .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Related Sections:
  - .1 Section 21 05 01 – Common Work Results – Mechanical.

**1.2            REFERENCES**

- .1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA).
  - .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .5 Society of Automotive Engineers (SAE).

**1.3            SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

**1.4            SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Indicate following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .3 Test Reports:
  - .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 FIXED LOUVRES - ALUMINUM**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm maximum centres.

- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum bird screen on inside face of louvres in formed U-frame.
- .8 Finish: factory applied enamel. Colour: to Departmental Representative approval.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.



**3.3 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials, components, framing, installation and testing for an evaporative condenser closed circuit cooling tower.
- .2 Related Sections:
  - .1 Section 21 05 01 – Common Work Results – Mechanical.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International).
  - .1 CSA B52-1999 (R2004), Mechanical Refrigeration Code.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .3 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA MG 1-2003, Motors and Generators

**1.3 PERFORMANCE REQUIREMENTS**

- .1 Performance certified in accordance with CTI-STD-201.
- .2 Condensing Unit.
  - .1 Capacity: 8.8 kW heat rejection, operating with R-410A refrigerant at 35 degrees C design wet bulb temperature.
- .3 Electrical:
  - .1 Voltage: 208/230-1-60
  - .2 Unit MCA: 18.1 A
  - .3 Unit Max Over-Current Protection: 30 A
  - .4 Power Input: 2.35 kW

**1.4 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
    - .1 Submit drawings: stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
    - .2 Indicate:
      - .1 Connections, piping, fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.
      - .2 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.
      - .3 Vibration and seismic control measures.
      - .4 Manufacturers recommended clearances.
  - .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .4 Closeout Submittals:
    - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
    - .2 Include:
      - .1 Description of equipment giving manufacturers name, type, model year, capacity.
      - .2 Start-up and commissioning procedures.
      - .3 Details of operation, servicing and maintenance.
      - .4 Recommended spare parts list.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .2 Storage and Protection:
  - .1 Store materials [indoors] [in dry location].
  - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .3 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 GENERAL**

- .1 Factory assembled split-system unitary condensing unit.
- .2 Equipment shall comply with the requirements of the Federal Halocarbon Regulations under CEPA and Safety Code for Mechanical Refrigeration, ASHRAE 15 -1994.
- .3 UACU shall be split system type with furnace add-on coil and remote outdoor compressor/condensing unit.
- .4 Model arrangements shall be as shown, and specified in the Schedules.
- .5 The combination of the evaporator and condensing sections shall be provided with the capacities designated in Schedules.

**2.2 COIL SECTION**

- .1 Tube bundle: copper, type M, isolated from steel support with poly propylene spacers or steel tubing and supporting steel framework hot-dip galvanized after fabrication.

**2.3 VIBRATION ISOLATORS**

- .1 To Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 GENERAL**

- .1 Mount on structural supports and to manufacturer's recommendations.
- .2 Ensure clearance for servicing and maintenance as recommended by manufacturer.
- .3 Manufacturers field service representative to approve installation, to supervise start up and to instruct operators.

**3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.4 ADJUSTING**

- .1 Lubricate bearings with oil or grease as recommended by manufacturer.
- .2 Tighten belts to manufacturer's specified tension.

**3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Wipe equipment clean, and remove traces of oil, dust, dirt, or paint spots.
- .3 Maintain system in clean condition until final acceptance.
- .4 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC).
  - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

**1.2                DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

**1.3                DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for both languages.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control. Provide CSA certified equipment and material.
  - .1 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
  - .2 Submit test results of installed electrical systems and instrumentation.

- .3 Permits and fees: in accordance with General Conditions of contract.
- .4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
- .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

**1.5 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.7 SYSTEM STARTUP**

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

**1.8 OPERATING INSTRUCTIONS**

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.

**Part 2 Products**

**2.1 MATERIALS AND EQUIPMENT**

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

**2.2 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

**2.3 WIRING TERMINATIONS**

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

**2.4 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoïd, 3 mm thick plastic engraving sheet, black matte finish face, white core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.
  - .2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters



- .2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.

- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. \_\_\_\_" as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

**2.5 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, numbered, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
  - .2 Maintain phase sequence and colour coding throughout.
  - .3 Colour coding: to CSA C22.1.
  - .4 Use colour coded wires in communication cables, matched throughout system.
- CONDUIT AND CABLE IDENTIFICATION**

- .5 Colour code conduits, boxes and metallic sheathed cables.
- .6 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .7 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Other Security Systems	Red	Yellow

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

**3.2 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

**3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

**3.4 LOCATION OF OUTLETS**

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

**3.5 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200 mm.
  - .2 Panelboards: as required by Code or as indicated.

### **3.6 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### **3.7 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Lighting and its control.
  - .2 Systems: fire alarm system.
  - .3 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

### **3.8 CLEANING**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1            CSA International
  - .1            CAN/CSA-C22.2 No.18-98 (R2003), Outlet Boxes, Conduit Boxes and Fittings.
  - .2            CAN/CSA-C22.2 No.65-13, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2            Electrical and Electronic Manufacturers' Association of Canada (EEMAC).
  - .1            EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3            National Electrical Manufacturers Association (NEMA)

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2            Store and protect wire and box connectors from nicks, scratches, and blemishes.
  - .3            Replace defective or damaged materials with new.
- .4            Develop Construction Waste Management Plan related to Work of this Section.

- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to NEMA to consist of:
  - .1 Connector body and stud clamp for copper conductors.
  - .2 Clamp for copper bar.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper bar.
  - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable and flexible conduit as required to: CAN/CSA-C22.2 No.18.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and cables and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
  - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with NEMA.

**3.2 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 26 05 00 - Common Work Results for Electrical.
- .2        Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3        Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

**1.2                REFERENCES**

- .1        CSA C22.2 No .0.3-09, Test Methods for Electrical Wires and Cables.

**1.3                PRODUCT DATA**

- .1        Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1        Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2            Products**

**2.1                BUILDING WIRES**

- .1        Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2        Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.
- .3        Utilize RWU90 for wet locations.

**2.2                TECK 90 CABLE**

- .1        Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical].
- .2        Conductors:
  - .1        Grounding conductor: copper.
  - .2        Circuit conductors: copper, size as indicated.
- .3        Insulation:
  - .1        Cross-linked polyethylene XLPE.
  - .2        Rating: , 600 V.

- .4 Inner jacket: polyvinyl chloride material.

- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
  - .1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Channel type supports for two or more cables at 1500 mm centers.
  - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
  - .1 Watertight approved for TECK cable.

### **2.3 ARMoured CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.
- .5 Connectors: anti short connectors.

## **Part 3 Execution**

### **3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

### **3.2 GENERAL CABLE INSTALLATION**

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.

- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

### **3.3 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### **3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)**

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps.

### **3.5 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible on channels.
- .2 Maximum length of armoured cables to be 3 metres outside of walls.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE 837-2002, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for [grounding equipment] for incorporation into manual.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Insulated grounding conductors: green, copper conductors, size as indicated.
- .3 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative 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 Departmental Representative.

**3.2 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories.
- .2 Run ground wire in conduit.

- .3 Install connectors in accordance with manufacturer's instructions.
- .4 Protect exposed grounding conductors from mechanical injury.
- .5 Make buried connections, and connections to conductive water main using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .7 Soldered joints not permitted.
- .8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 Ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

### **3.3 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, duct systems, frames of motors, motor control centres, starters, control panels, building steel work and distribution panels.

### **3.4 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

### **3.5 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
  - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
  - .2 Sound, fire alarm, security systems, intercommunication systems as indicated.

**3.6 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

**1.2 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal of paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.1 SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3 Beam clamps to secure conduit to exposed steel work.

- .5 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .6 For surface mounting of two or more conduits use channels at 3m on centre spacing.
- .7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 - Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.1-12, Canadian Electrical Code, Part 1, 22nd Edition.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Waste Management and Disposal:
  - .1            Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2            Products**

**2.1                JUNCTION AND PULL BOXES**

- .1            Construction: welded steel enclosure.
- .2            Covers Flush Mounted: 25 mm minimum extension all around.
- .3            Covers Surface Mounted: screw-on flat covers.

**Part 3            Execution**

**3.1                JUNCTION AND PULL BOXES INSTALLATION**

- .1            Install pull boxes in inconspicuous but accessible locations.
- .2            Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3            Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

**3.2 IDENTIFICATION**

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, 22nd Edition.

**1.2 SUBMITTALS**

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

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

**2.2 GALVANIZED STEEL OUTLET BOXES**

- .1 One-piece electro-galvanized construction.
- .2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

**2.3 FITTINGS - GENERAL**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2 No. 62-93 (R2008), Surface Raceway Systems.

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's Instructions: provide manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.
- .4 Indicate types of raceways with terminology similar to that used in this Section.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 NON-METALLIC SURFACE RACEWAY**

- .1 The raceway and all system components must be UL Listed and exhibit nonflammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0.
- .2 The raceway shall be a three-piece design with a base, snap-on cover and snap-on trim cover. Total width shall be 146.8mm by 24.4mm deep with an approximate thickness of 2.3mm. The raceway base, cover and trim cover shall be available in 2.4m lengths.
- .3 The base shall have two wiring channels separated by an integral barrier, and ribs in the top channel for mounting device brackets. The base shall be manufactured of rigid PVC compound. The base shall have smooth texture, and be natural in color.

- .4 The cover shall have flanges for snapping onto the base. The cover shall be manufactured of a rigid PVC compound. The cover shall have a full selection of finishes available including but not limited to, matte texture, white, black and gray in color, gray and black vinyl laminates, maple, mahogany, cherry and oak wood veneers. The cover shall match the finish on the trim cover.
- .5 The trim cover shall have tabs to interlock to the base and cover. The trim cover shall be manufactured of a rigid PVC compound. The trim cover shall have a full selection of finishes available including but not limited to, matte texture, white, black and gray in color, gray and black vinyl laminates, maple, mahogany, cherry and oak wood veneers. The trim cover shall match the finish on the cover.
- .6 Finish shall be chosen by architect.

## **2.2 FITTINGS**

- .1 A full complement of fittings must be available including but not limited to internal and external elbows, wire guards, cover clips and end caps. They shall be manufactured of a rigid PVC in a matte textured finish. They shall overlap the cover and trim cover to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering.

## **2.3 Device Brackets and Plates**

- .1 Device brackets and device plates shall be available for mounting standard devices in the raceway. Faceplates shall be match and fit flush in the device plate. They shall be manufactured of rigid PVC compound.

## **2.4 Communication Devices and Accessories**

- .1 The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (including Category 5), STP (150 ohm) Fiber Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting. A complete line preprinted station and port identification labels, snap-in icon buttons as well as write-on station identification labels shall be available.



**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install raceway systems as indicated and in accordance with manufacturer's instructions.
- .2 Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.
- .3 Keep number of elbows, offsets and connections to minimum.
- .4 Use wiring with mechanical protection in channel raceways.
- .5 Install barriers in raceways for different services where required by code.
- .6 Install wiring after installation of raceway system is complete.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CAN/CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
  - .2        CSA C22.2 No. 83-M1985 (R2008), Electrical Metallic Tubing.

**1.2                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2        Place materials defined as hazardous or toxic waste in designated containers.
- .3        Ensure emptied containers are sealed and stored safely for disposal away from children.

**Part 2            Products**

**2.1                CABLES AND REELS**

- .1        Provide cables on reels or coils.
  - .1        Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2        Each coil or reel of cable to contain only one continuous cable without splices.
- .3        Identify cables for exclusively dc applications.
- .4        Reel and mark shielded cables rated 2,001 volts and above.

**2.2                CONDUITS**

- .1        Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

**2.3                CONDUIT FASTENINGS**

- .1        One hole steel straps to secure surface conduits 50 mm and smaller.
  - .1        Two hole steel straps for conduits larger than 50 mm.
- .2        Beam clamps to secure conduits to exposed steel work.
- .3        Channel type supports for two or more conduits at 1.5 m on centre.
- .4        Threaded rods, 6 mm diameter, to support suspended channels.

## **2.4 CONDUIT FITTINGS**

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
  - .1 Set-screws are not acceptable.

## **2.5 FISH CORD**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
- .4 Minimum conduit size for lighting and power circuits: 21 mm.
- .5 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .6 Mechanically bend steel conduit over 21 mm diameter.
- .7 Install fish cord in empty conduits.
- .8 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .9 Dry conduits out before installing wire.

**3.3 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits along structural supports.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

**3.4 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

**3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect panelboards from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 PANELBOARDS**

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
  - .1 Install circuit breakers in panelboards before shipment.
  - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 V panelboards: bus and breakers rated for 10 A (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel.

**2.2 BREAKERS**

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.
- .5 Lock-on devices for fire alarm and emergency circuits.

### **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative 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 Departmental Representative.

#### **3.2 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by panelboards installation.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2 CAN/CSA C22.2 No.42.1-00 (R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3 CSA C22.2 No.55-M1986 (R2012), Special Use Switches.
  - .4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.

- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 SWITCHES**

- .1 20 A, 120 V, single pole, three-way and four-way (as indicated) switches to: CSA C22.2 No.55 and CSA C22.2 No.111.
- .2 Manually-operated general purpose AC switches with following features:
  - .1 Terminal holes approved for No. 10 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine moulding for parts subject to carbon tracking.
  - .4 Suitable for back and side wiring.
  - .5 White decora style.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads and/or heating loads.
- .4 Switches of one manufacturer throughout project.

### **2.2 RECEPTACLES**

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
  - .1 White urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.

### **2.3 COVER PLATES**

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

- .3      Stainless steel, 1 mm thick cover plates cover plates, for wiring devices mounted in flush-mounted outlet box.

- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

## **2.4 SOURCE QUALITY CONTROL**

- .1 Cover plates from one manufacturer throughout project.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical or as indicated.
  - .3 Install GFI type receptacles as indicated.
- .3 Cover plates:
  - .1 Install suitable common cover plates where wiring devices are grouped.
  - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

### **3.2 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.3 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMJ-J-266-ANCE-2010).

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
  - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    - .1 Production certificate of origin must be submitted to Departmental Representative for review.
  - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
  - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
  - .4 Production certificate of origin must contain:
    - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
    - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
    - .3 Contractor's name and address and person responsible for project.
    - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
    - .5 Name and address of building where circuit breakers will be installed:
      - .1 Project title: \_\_\_\_
      - .2 End user's reference number: \_\_\_\_.

.3 List of circuit breakers: \_\_\_\_.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 BREAKERS GENERAL**

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating.

**2.2 MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.



**2.3            OPTIONAL FEATURES**

- .1            On-off locking device.

**Part 3           Execution**

**3.1            INSTALLATION**

- .1            Install circuit breakers as indicated.

**3.2            CLEANING**

- .1            Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1            Leave Work area clean at end of each day.
- .2            Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3            Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1            Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Canadian Standards Association (CSA International).
  - .1        CAN/CSA C22.2 No.4-04 (R2009), Enclosed Switches.
  - .2        CSA C22.2 No.39-M1987 (R2007), Fuseholder Assemblies.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2        Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

- .4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.1 DISCONNECT SWITCHES**

- .1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 size as indicated.
- .2 Provision for padlocking in off switch position by locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .5 Quick-make, quick-break action.
- .6 ON-OFF switch position indication on switch enclosure cover.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE C62.41-2002, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
  - .1 ASTM F1137-11, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
- .5 ICES-005-07, Radio Frequency Lighting Devices.
- .6 Underwriters' Laboratories of Canada (ULC)

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
  - .3 Photometric data to include: spacing criterion.
- .3 Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 Divert unused metal materials from landfill to metal recycling facility.
- .5 Disposal and recycling of fluorescent lamps as per local regulations.
- .6 Disposal of old PCB filled ballasts.

**Part 2 Products**

**2.1 LAMPS**

- .1 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 3500 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80 or as indicated.
- .2 Light Emitting Diodes (LED)
  - .1 LEDs shall meet IESNA LM-79 and LM-80 standards.
  - .2 Colour temperature shall be 3500 deg. K. Lamps shall be binned with no visible colour variance (3300K to 3700K maximum range). Rated life for 1 watt white LED shall be 50,000 hours. Lumen output shall be maximum based on latest technology at time of delivery.
  - .3 All LED luminaires that present signs of failure on site, within the warranty period, shall be replaced at no additional cost. If temporary luminaires are required to replace any failed LED luminaires, during the waiting time for parts (i.e. drivers, boards, heat sinks, etc.), the labour cost including installation, temporary luminaire supply, temporary luminaire removal and reinstallation of the LED fixture shall be provided at no additional cost. Additional electrical costs, associated with higher wattage temporary luminaires, shall be reimbursed with interest by the manufacturer.
  - .4 In case of failure of a LED luminaire complete or part there of the luminaire failure, an independent third party testing laboratory (reviewed by the Departmental Representative) shall be commissioned by the manufacturer or vendor to perform tests on samples taken from the failed luminaires installed on corresponding site. All reporting including the test results shall be submitted to Departmental Representative for evaluation and final review.
  - .5 Any additional time involved by Departmental Representative shall be billed at the Departmental Representative's hourly rates to the manufacturer or vendor.

**2.2 BALLASTS**

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.
  - .1 Rating: voltage as indicated, for use with 2-32W, rapid start lamps.
  - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
  - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
  - .4 Current crest factor: 1.7 maximum.
  - .5 Harmonics: 10% maximum THD.
  - .6 Operating frequency of electronic ballast: 20 kHz minimum.
  - .7 Total circuit power: 58 Watts.
  - .8 Ballast factor: greater than 0.90.
  - .9 Sound rated: Class A.
  - .10 Mounting: integral with luminaire.


**2.3 FINISHES**

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

**2.4 OPTICAL CONTROL DEVICES**

- .1 As indicated in luminaire schedule.

**2.5 LUMINAIRES**

LED	
Type L1	Not Used
Type L2	Not Used
Type L3	Washrooms
	<p>Description 150mm downlight retrofit suitable for wet locations. :</p> <hr/> <p>Lamp: LED 3500K</p> <hr/> <p>Ballast: LED driver</p> <hr/> <p>Voltage: 120V</p>

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.
  - .1 The contractor will provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and other related lighting equipment as specified herein. Lamps for all equipment will be provided and installed by the contractor according to equipment manufacturer's instructions.
  - .2 Locate luminaires in accordance with the Architect's Drawings. Coordinate exact locations on site. Refer to architects drawings for dimensions of coves and valences. . Fluorescent staggered coves must have a minimum of two inches overlap.
  - .3 Install in accordance with Manufacturer's Instructions, Local Codes, Electrical Division Drawings and Specifications.

**3.2 WIRING**

- .1 Connect luminaires to lighting circuits:
  - .1 Install flexible or rigid conduit for luminaires as indicated.

**3.3 LUMINAIRE SUPPORTS**

- .1 For suspended ceiling installations support luminaires independently of ceiling.

**3.4 LUMINAIRE ALIGNMENT**

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

**3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2        Section 26 05 21 - Wires and Cables (0-1000 V).

**1.2                REFERENCES**

- .1        CSA International
  - .1        CSA C22.2 No.141-10, Emergency Lighting Equipment.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                CLOSEOUT SUBMITTALS**

- .1        Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2        Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1        Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2        Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3        Storage and Handling Requirements:
  - .1        Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2        Store and protect emergency lighting from nicks, scratches, and blemishes.
  - .3        Replace defective or damaged materials with new.
- .4        Develop Construction Waste Management Plan related to Work of this Section.
- .5        Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste

Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.6 WARRANTY**

- .1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V, AC.
- .3 Output voltage: 12 V DC.
- .4 Operating time: 30 minutes.
- .5 Battery: sealed, maintenance free.
- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .7 Solid state transfer circuit.
- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: quartz halogen 12 W.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12 Finish: white.
- .13 Auxiliary equipment:
  - .1 Ammeter.
  - .2 Voltmeter.
  - .3 Test switch.
  - .4 Time delay relay.
  - .5 Battery disconnect device.
  - .6 AC input and DC output terminal blocks inside cabinet.

- .7 Shelf.
- .8 Cord and [single twist-lock] plug connection for AC.
- .9 RFI suppressors.

**Part 3 Execution**

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.

**3.2 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.3 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by emergency lighting installation.

**END OF SECTION**