

# **GENERAL SPECIFICATIONS**

## **ISSUED FOR TENDER**

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### **PARKS CANADA AGENCY**

#### **Staff Housing Phase 2**

#### **Waterton Lakes National Park**

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**Contract: 5P420-15-5067**  
**Asset Number: FII 945**

**December 8, 2016**

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**Part 1 General**

**1.1 GEOTECHNICAL REPORT**

- .1 Refer to geotechnical report for guidelines in excavation, foundation and slab design, dewatering, perimeter drainage, paving and damp-proofing.
- .2 Geotechnical report is prepared by Golder Associates, dated December 4, 2015 and titled:
  - .1 Geotechnical Report  
IBI Group Architects Engineers  
Waterton Lake Staff Housing  
Waterton Lakes National Parks, AB
- .3 A copy of the report is appended with this section.

**1.2 PRE-DEMOLITION HAZARDOUS BUILDING MATERIALS ASSESSMENT**

- .1 Refer to pre-demolition hazardous building materials assessments for guidelines including but not limited to: Federal and Provincial regulations, methodology, observations, results and discussions, conclusions and recommendations for hazardous materials.
- .2 Pre-demolition hazardous building materials assessments prepared by Golder Associates, dated January 2016 and titled:
  - .1 Pre-Demolition Hazardous Building Materials Assessment  
Bunk House Compound,  
Waterton, AB
  - .2 Pre-Demolition Hazardous Building Materials Assessment  
Lot 20, 102A & Lot 102B Wind Flower Avenue,  
Waterton, AB
  - .3 Pre-Demolition Hazardous Building Materials Assessment  
Lot 21, 104 Wind Flower Avenue,  
Waterton, AB
- .3 A copy of each report is appended with this section.

**1.3 RELATED INSTRUCTIONS**

- .1 Check field conditions and characteristics before bidding.
- .2 Report any irregularities or changed surface conditions.

**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 WORK COVERED BY CONTRACT DOCUMENTS**

- .1 Work of this Contract comprises general construction of Staff Housing – Waterton National Park – Phase 2, located at: located at 102 & 104 Windflower Avenue, Waterton, AB.
- .2 Work to also include:
  - .1 Hazardous Materials Removals, Demolition to prepare for New Construction: 102 & 104 Windflower Avenue, Waterton Park, AB.
  - .2 Hazardous Materials Removals, Demolition, and Site Remediation: Bunkhouse Compound, 1 Compound Road, Waterton Park, AB.
  - .3 Tree Supply/Planting additional trees offsite within Waterton Park in areas specified by Departmental Representative.

**1.2 CONTRACT METHOD**

- .1 Construct Work under stipulated price contract.

**1.3 WORK BY OTHERS**

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
- .3 Work of Project executed prior to start of Work of this Contract, and which is specifically excluded from this Contract:
  - .1 Upgrade water main in lane of 102 & 104 Windflower to 150 mm. Install new 150 mm sanitary line and new 100 mm water main from lane to property line of 102 & 104 Windflower Avenue, Waterton Park, AB.
- .4 Work of Project during the construction period of the Work of this Contract, and which is specifically excluded from this Contract:
  - .1 Upgrade water main along Fountain Avenue and install a new hydrant on the northeast corner of Fountain Avenue and Windflower Avenue.

**1.4 WORK SEQUENCE**

- .1 Co-ordinate Progress Schedule to ensure the following required milestones are achieved:
  - .1 Enclose exterior of building including building envelope by September 30, 2017.
  - .2 Provide for Occupancy of the building by March 31, 2018.
  - .3 Complete all Work on Existing Bunkhouse site after December 1, 2017 and no later than March 31, 2018.
  - .4 Complete all landscape works including planting of offsite trees no later than May 19, 2018.

**1.5 CONTRACTOR USE OF PREMISES**

- .1 Unrestricted use of site until Substantial Performance.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

**1.6 SUSTAINABLE PROJECT REQUIREMENTS**

- .1 Refer to Section 01 47 15.

**1.7 SITE EXAMINATION**

- .1 Examine the field conditions and determine if any conflicts arise between the Construction Documents and the required construction sequence. Inform the Departmental Representative in writing immediately, should a conflict arise
- .2 Visit the site and compare the drawings and specifications with all existing site conditions including all conditions surrounding the site prior to submitting a Bid. Failure to visit the site in no way relieves the Contractor or Sub-contractor from the necessity of furnishing any material, or performing any work in accordance with drawings and specifications, without additional cost to project.
- .3 Examine the drawings and specifications regarding the performance of the Work. Examine existing conditions and report to the Departmental Representative, in writing any defects, deficiencies or conditions, which may affect the proper performance of the Work. Commencement of the Work implies acceptance of existing conditions and substrates. In the absence of any such report, the Contractor and trades will be held to have waived all claims for damage to or defects in such work. Commencement of the Work implies acceptance of existing conditions and substrates.

**1.8 CO-ORDINATION**

- .1 Coordinate the progress of the Work, progress schedules, submittals, use of the site, temporary utilities, construction facilities and controls.
- .2 Coordinate installation of all utilities, including Electrical, telephone, cable TV, gas, water, sewer, sanitary and the like.
- .3 Check and verify dimensions as the Work proceeds
- .4 The Contractor will co-ordinate work of all trades and Subcontractors to expedite progress and avoid interference. This applies particularly to work of trades which will be installed in close proximity with work of other trades. Requests for extras, as a result of lack of coordination will not be considered.
- .5 Supply all items to be built in including anchors, ties, nailing strips, blocks, bolts, sleeves, and the like, as and when required, together with templates, measurements and shop drawings

**1.9 OWNER FURNISHED ITEMS**

- .1 Owner Responsibilities:
  - .1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
  - .2 Arrange and pay for delivery to site in accordance with Progress Schedule.
  - .3 Inspect deliveries jointly with Contractor.
  - .4 Submit claims for transportation damage.
  - .5 Arrange for replacement of damaged, defective or missing items.
- .2 Contractor Responsibilities:
  - .1 Designate submittals and delivery date for each product in progress schedule.
  - .2 Review shop drawings, product data, samples, and other submittals. Submit to Consultant notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
  - .3 Receive and unload products at site.
  - .4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
  - .5 Handle products at site, including uncrating and storage.
  - .6 Protect products from damage, and from exposure to elements.
  - .7 Assemble, install, connect, adjust, and finish products.
  - .8 Provide installation inspections required by public authorities.
  - .9 Repair or replace items damaged by Contractor or subcontractor on site (under his control).
- .3 Schedule of Owner furnished items:
  - .1 Park / Picnic Benches.

**1.10 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 72 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian or vehicular traffic.
- .3 Provide alternative routes for pedestrian and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

- .7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed and abandoned service lines.
- .10 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**1.11 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.
  - .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Other documents as specified.

**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 CASH ALLOWANCES**

- .1 Include in Contract Price specified cash allowances.
- .2 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation and other authorized expenses incurred in performing Work.
- .3 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .4 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.
- .5 Expenditures are not to be made from the Cash Allowance without an approved Change Order from the Departmental Representative.
- .6 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.
- .7 Include progress payments on accounts of work authorized under cash allowances in monthly certificate for payment.
- .8 Prepare schedule jointly with Departmental Representative to show when items called for under cash allowances must be authorized by Departmental Representative for ordering purposes so that progress of Work will not be delayed.
- .9 Amount of each allowance to be included is as follows:

|    |  |             |
|----|--|-------------|
| .1 | Utility Connections: Electrical, Gas and Phone                                     | \$40,000    |
| .2 | Concrete, Compaction and Asphalt Testing   | \$20,000    |
| .3 | Consultant for Hazardous Materials Air Monitoring, Site Assessment, and Reporting: |             |
| .1 | Bunk House   | \$43,000.00 |
| .2 | Lot 20   | \$13,000.00 |
| .3 | Lot 21   | \$6,000.00  |

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Owner/Contractor Agreement.

**1.2 APPLICATIONS FOR PROGRESS PAYMENT**

- .1 Make applications for payment on account as provided in Agreement monthly as Work progresses.
- .2 Date applications for payment last day of agreed monthly payment period, amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
- .3 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 to satisfaction of Departmental Representative.

**1.3 SCHEDULE OF VALUES**

- .1 Provide schedule of values supported by evidence to satisfaction of Departmental Representative and when accepted by Departmental Representative, be used as basis for applications for payment.
- .2 Breakdown schedule of values based on specification Divisions. Schedule of values to include at a minimum:
  - .1 Division 01 - General Requirements
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  - .2 Aluminum Railing Systems
- .6 Division 06 - Wood and Plastics
  - .1 Rough Carpentry
  - .2 Heavy Timber Construction
  - .3 Roof Trusses
  - .4 Finish Carpentry and Architectural Woodwork
- .7 Division 07 - Thermal and Moisture Protection
  - .1 Bituminous Dampproofing, Drain Board & Board Insulation
  - .2 Blanket Insulation, Sprayed Insulation - Polyurethane Foam
  - .3 Vapour Retarders and Air Barriers - Performance
  - .4 Asphalt Shingles
  - .5 Fibre Cement Siding & Trims
  - .6 Sheet Metal Flashing and Trim, Aluminum Soffit
  - .7 Fire Stopping and Joint Sealants
- .8 Division 08 - Openings
  - .1 Metal Doors and Frames
  - .2 Flush Wood Doors
  - .3 Fibreglass Doors and Vinyl Windows
  - .4 Cabinet and Miscellaneous Hardware and Door Hardware
- .9 Division 09 - Finishes
  - .1 Gypsum Board Assemblies
  - .2 Ceramic Tiling and Resilient Flooring & Floor Base
  - .3 Vinyl-Coated Fabric Wall Coverings and Painting
- .10 Division 10 - Specialities
  - .1 Signage and Traffic Signage
  - .2 Wire Mesh Partitions
  - .3 Wall and Corner Guards and Toilet and Bath Accessories
  - .4 Fire Extinguishers and Safety Blankets
- .11 Division 11 - Equipment
  - .1 Residential Appliances
- .12 Division 12 - Furnishings
  - .1 Horizontal Louver Blinds
- .13 Division 21 - Fire Suppression
- .14 Division 22 – Plumbing
  - .1 Plumbing Rough-Ins
  - .2 Plumbing Fixtures

- .15 Division 23 - Heating, Ventilating and Air Conditioning (HVAC)
  - .1 Sheet Metal/Equipment
  - .2 Controls
  - .3 Commissioning
- .16 Division 26 - Electrical
  - .1 Distribution, Branch Power and Lighting
  - .2 Electrical Rough-Ins
  - .3 Electrical Fixtures
- .17 Division 27 - Communications
- .18 Division 28 - Electronic Safety and Security
- .19 Division 31 - Earthwork
- .20 Division 32 - Exterior Improvements
  - .1 Granular Sub-Base, Aggregate Base Course, and Asphalt Paving For Building Sites
  - .2 Concrete Walks, Curbs and Gutters
  - .3 Pavement Markings
  - .4 Exterior Site Furnishings
  - .5 Exterior Lighting
  - .6 Topsoil Placement and Grading, Mechanical Seeding, Trees, Shrubs, and Ground Cover Planting
- .21 Division 33 - Utilities
- .3 Include statement based on schedule of values with each application for payment.
- .4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Departmental Representative may reasonably require to establish value and delivery of products.

#### **1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS**

- .1 Submit separate schedule of unit price items of Work requested.
- .2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:
  - .1 Cost of material.
  - .2 Delivery and unloading at site.
  - .3 Sales taxes.
  - .4 Installation, overhead and profit.
- .3 Unit prices multiplied by quantities given to equal material cost of that item in Schedule of Values.

#### **1.5 PROGRESS PAYMENT**

- .1 Departmental Representative will, no later than ten days after receipt of an application for payment, issue certificate for payment in amount applied for or in such other amount as



Departmental Representative determines to be due. If Departmental Representative amends application, notification in writing giving reasons for amendment.

**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      Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2      Prepare agenda for meetings.
- .3      Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.
- .4      Provide physical space and make arrangements for meetings.
- .5      Preside at meetings.
- .6      Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7      Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and affected parties not in attendance and Departmental Representative.
- .8      Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

**1.2                PRECONSTRUCTION MEETING**

- .1      Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2      Senior representatives of Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3      Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4      Agenda to include:
  - .1      Appointment of official representative of participants in the Work.
  - .2      Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedules.
  - .3      Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4      Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
  - .5      Delivery schedule of major equipment.
  - .6      Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
  - .7      Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .8      Owner provided products.
  - .9      Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .10     Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

- .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

### **1.3 PROGRESS MEETINGS**

- .1 During course of Work and 3 weeks prior to project completion, schedule progress meetings monthly.
- .2 Contractor, major Subcontractors involved in Work, Departmental Representative Owner are to be in attendance.
- .3 Notify parties minimum 4 days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .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.

### **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 DEFINITIONS**

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by [Departmental Representative] [DCC Representative] [Consultant] to enable monitoring of project work in relation to established milestones.

**1.2 REQUIREMENTS**

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within 5 working days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

**1.4 PROJECT MILESTONES**

- .1 Project milestones form interim targets for Project Schedule.
  - .1 Building closed-in and weatherproofed by September 30, 2017.
  - .2 Interim Certificate (Substantial Completion) within January 31, 2018.

**1.5 MASTER PLAN**

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 3 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

**1.6 PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Award.
  - .2 Shop Drawings, Samples.
  - .3 Permits.
  - .4 Mobilization.
  - .5 Excavation.
  - .6 Backfill.
  - .7 Building footings.
  - .8 Slab on grade.
  - .9 Structural Steel.
  - .10 Siding and Roofing.
  - .11 Interior Architecture (Walls, Floors and Ceiling).
  - .12 Plumbing.
  - .13 Lighting.
  - .14 Electrical.
  - .15 Piping.

- .16 Controls.
- .17 Heating, Ventilating, and Air Conditioning.
- .18 Millwork.
- .19 Fire Systems.
- .20 Testing and Commissioning.
- .21 Supplied equipment long delivery items.
- .22 Engineer supplied equipment required dates.

**1.7 PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

**1.8 PROJECT MEETINGS**

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

**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 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.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
- .3 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.
- .4 Allow 10 working days for Departmental Representative's review of each submission.
- .5 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 before proceeding with Work.

- .6 Make changes in shop drawings as Departmental Representative Consultant may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .8 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.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 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.



- .12 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.
- .13 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.
- .14 Submit electronic copies of manufacturer's 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.
- .15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 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 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

**1.3 SAMPLES**

- .1 Submit for review samples in triplicate 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 before 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 as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations minimum.
  - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly and as directed by Departmental Representative.
  - .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.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Contract Number: 5P420-15-5067**  
**Asset Number: FII 945**

**Section 01 33 00**  
**SUBMITTAL PROCEDURES**  
**Page 5 of 5**

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Alberta
  - .1 Occupational Health and Safety Act, R.S.A. - Updated 2013.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and before commencement of Work. Health and Safety Plan must include:
  - .1 Results of site specific safety hazard assessment.
  - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit two copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 10 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

**1.3 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities before beginning Work.
- .2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

**1.4 SAFETY ASSESSMENT**

- .1 Perform site specific safety hazard assessment related to project.

**1.5 MEETINGS**

- .1 Schedule and administer Health and Safety meeting with Departmental Representative before commencement of Work.

**1.6 REGULATORY REQUIREMENTS**

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

**1.7 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.

**1.8 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.

**1.9 COMPLIANCE REQUIREMENTS**

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, Alberta Reg. and Code.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

**1.10 UNFORSEEN 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 Alberta having jurisdiction and advise Departmental Representative verbally and in writing.

**1.11 HEALTH AND SAFETY CO-ORDINATOR**

- .1 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.
  - .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.
  - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

**1.12 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 Alberta having jurisdiction, and in consultation with Departmental Representative.

**1.13 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

**1.14 BLASTING**

- .1 Blasting or other use of explosives is not permitted.

**1.15 WORK STOPPAGE**

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Definitions:
  - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
  - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
- .2 Reference Reports:
  - .1 Basic Impact Analysis, Staff Housing Design – Waterton Lakes National Park, dated December 2105, prepared by Golder Associates. A copy of the report is appended with this section.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Departmental Representative.
- .3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction. Address plans for all Mitigation Measures identified in the Basic Impact Analysis.
- .4 Address topics at level of detail commensurate with environmental issue and required construction task(s).
- .5 Include in Environmental Protection Plan:
  - .1 Name(s) of person(s) responsible for ensuring adherence to Environmental Protection Plan.
  - .2 Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from site.
  - .3 Name(s) and qualifications of person(s) responsible for training site personnel.
  - .4 Descriptions of environmental protection personnel training program.
  - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
  - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

- .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
  - .1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
- .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
  - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .13 Waste Water Management Plan identifying methods and procedures for management, discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
- .15 Pesticide treatment plan to be included and updated, as required.

### **1.3 FIRES**

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

### **1.4 DRAINAGE**

- .1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.



- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

**1.5 SITE CLEARING AND PLANT PROTECTION**

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
  - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated.

**1.6 WORK ADJACENT TO WATERWAYS**

- .1 Construction equipment to be operated on land only.
- .2 Waterways to be kept free of excavated fill, waste material and debris.
- .3 Design and construct temporary crossings to minimize erosion to waterways.
- .4 Do not skid logs or construction materials across waterways.
- .5 Avoid indicated spawning beds when constructing temporary crossings of waterways.

**1.7 POLLUTION CONTROL**

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
  - .1 Provide temporary enclosures where directed by Departmental Representative
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

**1.8 HISTORICAL/ARCHAEOLOGICAL CONTROL**

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

**1.9 NOTIFICATION**

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
  - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for 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 AND CODES**

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Perform Work in accordance with National Energy Code (NECB 2011).
- .3 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.

**1.2 HAZARDOUS MATERIAL DISCOVERY**

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify 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.

**1.3 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions. This is a non-smoking site.

**1.4 NATIONAL PARKS ACT**

- .1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

**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 INSPECTION**

- .1 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.
- .2 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.
- .3 If Contractor covers or permits to be covered Work that has been designated for tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 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.

**1.2 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 the stated Allowances.
- .2 Allocated costs: to Section 01 21 00 - Allowances.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 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.

**1.3 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.

**1.4 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.

**1.5 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in the 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.

**1.6 REPORTS**

- .1 Submit four 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.

**1.7 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.

**1.8 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 as specified in specific Section and as acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative 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.

**1.9 MILL TESTS**

- .1 Submit mill test certificates as required of specification Sections.

**1.10 EQUIPMENT AND SYSTEMS**

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to specific Section for requirements.

**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 PRECEDENCE**

- .1 For Federal Government Projects, Division 01 Sections take precedence over technical specifications in other Divisions of this Project Manual.

**1.2 REFERENCES**

- .1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE 52.2-12, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.
- .4 Carpet and Rug Institute (CRI)
  - .1 Green Label Program.
  - .2 Green Label Plus Program.
- .5 CSA Group
  - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
  - .2 CAN/CSA-B45.0 Series-02 (R2013), Plumbing Fixtures.
  - .3 CAN/CSA-Z809-08(R2013), Sustainable Forest Management.
- .6 Environmental Choice Program
  - .1 CCD-016-97(R2005), Thermal Insulation Materials.
  - .2 CCD-020-95(R2007), Gypsum Wallboard.
  - .3 CCD-029-96, Water Conserving Products.
  - .4 CCD-045-95, Sealant and Caulking Compounds.
  - .5 CCD-046-95, Adhesives.
  - .6 CCD-127-95, Recycled Plastic Products.
  - .7 CCD-144-2003, Naturally-Derived Phenol Substitutes.
  - .8 CCD-152-2001(R2005), Flooring Products.
- .7 Green Seal Environmental Standards (GS)
  - .1 GS-03-97, Environmental Criteria for Anti-Corrosive Paints.
  - .2 GS-11-11, Standard for Paints and Coatings.

- .8 National Air Duct Cleaners Association (NADCA)
  - .1 NADCA ACR-2013, Assessment Cleaning and Restoration.
  - .2 NADCA Standard 05-1997, Requirements for the Installation of Service Openings in HVAC Systems.
- .9 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2013, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .10 Scientific Certification Systems (SCS)
  - .1 FloorScore Program [2012].
- .11 Sheet Metal and Air Conditioning National Contractors Association (SMACNA)
  - .1 IAQ Guideline for Occupied Buildings Under Construction, 2007.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submittals required:
  - .1 Submit name and experience of Sustainability Coordinator to Departmental Representative for approval.
  - .2 Compliance Report indicating requirement to purchase energy efficient and environmentally benign products.
  - .3 Use Report indicating understanding of requirement to use materials and methods of construction, which improve energy and water efficiency, reduce hazardous by-products, and use recycled materials, or materials, which can be reused.
  - .4 Ensure Energy Report: indicates EnerGuide and/or Energy Star ratings of new equipment and appliances.
- .3 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC emissions, prior to installation or use:
  - .1 Adhesives.
  - .2 Caulking compounds.
  - .3 Sealants.
  - .4 Insulating materials.
  - .5 Fireproofing or fire stopping materials.
  - .6 Paints.
  - .7 Carpets.
  - .8 Floor and wall patching or levelling materials.
  - .9 Lubricants.
  - .10 Clear finishes for wood surfaces.



- .4 IAQ Management Plan:
  - .1 Submit Indoor Air Quality (IAQ) Management Plan for construction and preoccupancy phases of building.

#### **1.4 HAZARDOUS MATERIALS**

- .1 Take measures to ensure chemical spills do not enter drains.
- .2 Provide proper storage and containment of herbicides and indoor pesticides.
  - .1 Design and construction of storage spaces for hazardous materials in accordance with authorities having jurisdiction.
  - .2 Include ventilation of areas, which contain potential sources of air contamination.
    - .1 Comply with standards for storage of flammable, combustible and hazardous materials, explosives, compressed gas cylinders, and reactive, corrosive and oxidizing materials.
  - .3 Storage conditions, ventilation requirements, construction materials storage areas, containers, drums and tanks, compatibility issues, and labelling: in accordance with federal and municipal guidelines supplemented as follows:
    - .1 Confine storage of chemicals and hazardous wastes to designated areas with security of access.
    - .2 Ensure access to hose bib and water for mixing concentrated chemicals.
    - .3 Include containment to prevent spills from entering drains.
    - .4 Include venting to exterior.
    - .5 Keep storage areas under negative pressure, where possible.

#### **1.5 EROSION AND SEDIMENTATION CONTROL**

- .1 Follow methods and procedures specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Establish long-term soil stabilization program as indicated.
- .3 Develop an Erosion and Sedimentation Control Plan to control stormwater runoff and other erosion measures in Accordance with Section 01 35 43 Environmental Procedures.
- .4 Protect stockpiled topsoil.

#### **1.6 REDUCING SITE DISTURBANCES**

- .1 Create traffic patterns that cause minimum site disruptions, as per Departmental Representative's approval.
- .2 Minimize disturbances to watershed using site water management measures to ensure that watersheds and groundwater will be preserved.
- .3 Construct and erect erosion barriers to locations indicated and as directed by Departmental Representative.
- .4 Take measures to avoid soil compaction.
- .5 Re-grade and plant vegetation in accordance with Section 31 22 13 - Rough Grading.

## 1.7 BUILDING ENVELOPE

- .1 Include insulation to optimize reduction of heat losses or heat gains through building envelope.
  - .1 Insulation to levels specified in National Energy Code (NECB 2011).
- .2 Maintain integrity of building envelope using air barriers and vapour retarders and avoid thermal bridging to provide thermal comfort and prevent condensation.
  - .1 Air leakage through air barrier system within roof area: not to exceed 0.15 l/s\*m<sup>2</sup> @ 75 Pa.
  - .2 Air leakage through air barrier system within area of exterior walls (excluding window): not to exceed 0.30 l/s\*m<sup>2</sup> @ 75 Pa.
  - .3 Air leakage through floor: not to exceed 0.10 l/s\*m<sup>2</sup> @ 75 Pa.
  - .4 Air leakage through windows: not to exceed limits specified in AAMA/WDMA/CSA 101/I.S.2/A440-08 (NAFS-08) and CSA A440S1-09 with Update No. 1 (Canadian Supplement to NAFS-08).

## 1.8 GENERAL BUILDING DESIGN

- .1 Green design facilitation is used on this project to support green design integration.
  - .1 Submit name and experience of Sustainability Design Co-ordinator to Departmental Representative for approval.
- .2 Indicate in writing to Departmental Representative.
  - .1 Compliance Report: indicating requirement to purchase energy efficient and reduced environmental impact products.
  - .2 Use Report: indicate understanding of requirement to use materials and methods of construction, which improve energy and water efficiency, reduce hazardous by-products, and use recycled materials, or materials which can be reused.
  - .3 Energy Report: to indicate that new equipment and appliances meet energy efficiency criteria.

## 1.9 INDOOR AIR QUALITY

- .1 IAQ Performance
  - .1 Comply with following minimum indoor air performance requirements. Total volatile organic compounds level requirements include formaldehyde:
    - .1 Product emission rate measured in g/L.
    - .2 4-Phenyl Cyclohexene (4-PC) Emission Rates as per the Carpet and Rug Institutes Green Label program:
      - .1 Product emission rate measured in µg/m<sup>2</sup>hr.
  - .2 Indoor Environmental Quality
    - .1 Reduce quantity of indoor air contaminants that are odorous or potentially irritating to provide installer and occupant health and comfort as indicated.

- .2 Minimize cross-contamination of regularly occupied occupancy areas by chemical pollutants.
  - .1 Include drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs.
- .2 Construction IAQ Management Plan
  - .1 Develop and implement Indoor Air Quality (IAQ) Management Plan for construction and preoccupancy phases of building as follows:
    - .1 During construction: meet or exceed minimum requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.
    - .2 Protect stored on-site or installed absorptive materials from moisture damage.
    - .3 Replace filtration media immediately prior to occupancy.
      - .1 Filtration media: in accordance with ASHRAE 52.2, Minimum Efficiency Reporting Value (MERV) of 8.
    - .4 Conduct minimum 2 week building flush-out with new filtration media at 100% outside air after construction ends and prior to occupancy.
      - .1 Test contaminant levels in building.
    - .5 Adopt IAQ management plan during construction procedures, including:
      - .1 Protection of HVAC system during construction to control pollutant sources, and interrupt pathways for contamination.
      - .2 Sequence installation of materials to allow dissipation of high emissions from finishes that off-gas high quantities of emissions during curing to avoid contamination of absorptive materials.
      - .3 Erect appropriate noise and dust barriers where demolition or construction procedures are to occur adjacent to occupied space.
        - .1 Take necessary steps to minimize interference with occupants in occupied spaces.
      - .4 Permanent HVAC system may be used as approved in writing by Departmental Representative to move both supply and return air during construction process. Meet following conditions:
        - .1 Install and maintain filters with efficiency rating of MERV 8.
        - .2 Do not use permanent diffusers.
        - .3 Do not use plenum type return air system.
        - .4 Seal HVAC duct system to prevent spread of airborne particulate and other contaminants.
        - .5 Vacuum dust systems following building flush out.
          - .1 Use portable HEPA vacuums, certified clean in accordance with NADCA specifications.
  - .3 Environmental Tobacco Smoke (ETS) Control
    - .1 Smoking will not be permitted at site during construction.

- .4 Carbon Dioxide (CO<sub>2</sub>) Monitoring
  - .1 Provide carbon dioxide detectors to assess and monitor air quality and ventilation rates.

## **1.10 GENERAL CONSTRUCTION MATERIALS/PRACTICES**

- .1 Materials and Resources
  - .1 Use uncontaminated demolition materials for fill and hardcore and/or granular base.
  - .2 Incorporate reused building materials as indicated.
  - .3 Use products and services that meet criteria of EcoLogo guidelines.
  - .4 Provide list of non-endorsed products and services, provided the green labelled product or services are capable of meeting specified performance requirements.
- .2 Construction Waste Management
  - .1 Follow recommendations and requirements of this projects construction, renovation and demolition (CRD) waste management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
  - .2 Recycled Content
    - .1 Use materials with post-consumer and post-industrial recycled content.
  - .3 Wood
    - .1 Materials made from composite wood materials or agricultural products: must not contain urea-formaldehyde resins.
  - .4 Insulation
    - .1 Utilize insulation materials meeting following requirements:
      - .1 Board-type thermal insulation materials must contain, when calculated on 12-month rolling basis:
        - .1 Over 35% recycled material by weight of finished product if made from glass fibre.
        - .2 Over 45% recycled material by weight of finished product if made from mineral composition.
      - .2 Loose-fill and spray-on thermal insulation materials must contain, when calculated on 12-month rolling basis:
        - .1 Over 75% recycled material by weight of finished product, if made from cellulose fibre.
        - .2 Over 35% recycled material by weight of finished product if made from glass fibre.
        - .3 Over 50% recycled material by weight of finished product, if made from mineral wool.
    - .3 Use insulation materials manufactured or installed that do not include CFC's.

**1.11 PAINTS, STAINS, AND VARNISHES**

- .1 Use paints and coatings with VOC limits to Green Seal Standard GS-11
- .2 Use clear wood finishes, floor coatings, stains, primers and shellacs to interior elements with VOC limits to SCAQMD Rule 1113.

**1.12 SEALANTS, ADHESIVES AND COMPOUNDS**

- .1 Use adhesives with VOC limits to SCAQMD Rule 1168. Aerosol Adhesives must comply with Green Seal standard for Commercial Adhesives GS-36.
- .2 Use sealant products with VOC limits to SCAQMD Rule 1168.

**1.13 FLOORING**

- .1 Resilient flooring: in compliance with FloorScore.

**1.14 HVAC EQUIPMENT**

- .1 Identify sources of external contamination in writing to Departmental Representative.
- .2 Include filtration system with MERV 13 to ASHRAE 52.2.

**1.15 LIGHTING**

- .1 Integrate lighting controls as specified in common areas.
- .2 Lighting Fixtures
  - .1 Include high efficiency lamps and luminaries with electronic ballasts.

**1.16 PLUMBING FIXTURES**

- .1 Water Efficiency
  - .1 Include showerheads, kitchen and bathroom faucets with low flow models aerators.
  - .2 Include efficient equipment to heat and supply service water to meet water-use target of less than 1.0 m<sup>3</sup>/m<sup>2</sup>/year
- .2 Water Use Reduction
  - .1 Install water metres as indicated.
  - .2 Use low-flow faucet.
  - .3 Include low flow toilets to CAN/CSA-B45.0, maximum 6 Litres/flush.
  - .4 Include water saving showerheads: flow rates 9.5 l/min @ 5.5 kg/cm<sup>2</sup> litres/min.

**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 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.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit erosion and sedimentation control plan for review by Departmental Representative.

**1.3 INSTALLATION AND REMOVAL**

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

**1.4 DEWATERING**

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

**1.5 WATER SUPPLY**

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

**1.6 TEMPORARY HEATING AND VENTILATION**

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect Work and products against dampness and cold.
  - .3 Prevent moisture condensation on surfaces.
  - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

- .5 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
- .7 On completion of Work for which permanent heating system is used, replace filters, as specified in Sections.
- .8 Pay costs for maintaining temporary heat.
- .9 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
  - .1 Conform with applicable codes and standards.
  - .2 Enforce safe practices.
  - .3 Prevent abuse of services.
  - .4 Prevent damage to finishes.
  - .5 Vent direct-fired combustion units to outside.
- .10 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

**1.7 TEMPORARY POWER AND LIGHT**

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 60 amps.
- .2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.



**1.8 TEMPORARY COMMUNICATION FACILITIES**

- .1 Provide and pay for temporary telephone and data hook up lines, and equipment necessary for own use and use of Departmental Representative.

**1.9 FIRE PROTECTION**

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

**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 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.189-2000, Exterior Alkyd Primer for Wood.
  - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-09 (R2014), Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-0121-08 (R2013), Douglas Fir Plywood.
  - .3 CAN/CSA-S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.
  - .4 CAN/CSA-Z321-96 (R2006), Signs and Symbols for the Occupational Environment.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.
- .4 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.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 INSTALLATION AND REMOVAL**

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

**1.4 SCAFFOLDING**

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, platforms, and temporary stairs.

**1.5 HOISTING**

- .1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists cranes to be operated by qualified operator.

**1.6 SITE STORAGE/LOADING**

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

**1.7 CONSTRUCTION PARKING**

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

**1.8 SECURITY**

- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

**1.9 OFFICES**

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

**1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

**1.11 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

**1.12 CONSTRUCTION SIGNAGE**

- .1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Departmental Representative.
- .2 Construction sign minimum 1.2 x 1.2 m, of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter. Wording in both official languages
- .3 Indicate on sign, name of Owner, Consultant, Contractor, of design style as agreed with Departmental Representative.
- .4 No other signs or advertisements, other than warning signs, are permitted on site.

- .5 Direct requests for approval to erect Consultant/Contractor signboard to Departmental Representative. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages.
- .6 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .7 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

**1.13 PROTECTION AND MAINTENANCE OF TRAFFIC**

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .8 Dust control: adequate to ensure safe operation at all times.
- .9 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.
- .10 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .11 Provide snow removal during period of Work.

**1.14 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

**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 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Reference Reports:
  - .1 Basic Impact Analysis, Staff Housing Design – Waterton Lakes National Park, dated December 2105, prepared by Golder Associates, copy provided in Section 01 35 43 – Environmental Procedures.

**1.2 INSTALLATION AND REMOVAL**

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.
- .3 All installations to be designed in context with the Basic Impact Analysis for the project.

**1.3 HOARDING**

- .1 Erect sturdy, temporary site enclosures as required to enclose site and protect any public areas or adjunct properties. Maintain fence in good repair.
- .2 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 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 all 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 Be responsible for damage incurred due to lack of or improper protection.

**1.12 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for 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 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 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.
- .3 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 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 Contractor. 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] [DCC Representative] [Consultant].

**1.15 EXISTING UTILITIES**

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

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

**1.2 QUALIFICATIONS OF SURVEYOR**

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

**1.3 SURVEY REFERENCE POINTS**

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Departmental Representative.
- .4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

**1.4 SURVEY REQUIREMENTS**

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

**1.5 EXISTING SERVICES**

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

**1.6 LOCATION OF EQUIPMENT AND FIXTURES**

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

- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

**1.7 RECORDS**

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

**1.8 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
  - .1 Structural integrity of elements of project.
  - .2 Integrity of weather-exposed or moisture-resistant elements.
  - .3 Efficiency, maintenance, or safety of operational elements.
  - .4 Visual qualities of sight-exposed elements.
  - .5 Work of Owner or separate contractor.
- .3 Include in request:
  - .1 Identification of project.
  - .2 Location and description of affected Work.
  - .3 Statement on necessity for cutting or alteration.
  - .4 Description of proposed Work, and products to be used.
  - .5 Alternatives to cutting and patching.
  - .6 Effect on Work of Owner or separate contractor.
  - .7 Written permission of affected separate contractor.
  - .8 Date and time work will be executed.

**1.2 MATERIALS**

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

**1.3 PREPARATION**

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

**1.4 EXECUTION**

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.

- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for 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 PROJECT CLEANLINESS**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times. 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.

**1.2 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 including that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times. 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, shampoo 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.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for 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 WASTE MANAGEMENT GOALS**

- .1 Before start of Work conduct meeting with Departmental Representative to review and discuss waste management goal and Contractor's proposed Waste Reduction Workplan for Construction Renovation and /or Demolition (CRD) waste to be project generated.
- .2 Waste management goal: to divert a minimum 50 percent of total Project Waste from landfill sites. Before project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced. The overall waste diversion goal for this project is 75 percent.
- .3 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .4 Protect environment and prevent environmental pollution damage.

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
  - .2 Class III: non-hazardous waste - construction renovation and demolition waste.
  - .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
  - .4 Inert Fill: inert waste - exclusively asphalt and concrete.
  - .5 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
  - .6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
  - .7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
  - .8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
  - .9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
    - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
    - .2 Returning reusable items including pallets or unused products to vendors.

- .10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .11 Separate Condition: refers to waste sorted into individual types.
- .12 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .13 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Management Plan (WMP) goals and identifies lessons learned.
- .14 Waste Management Co-ordinator (WMC) : contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .15 Waste Management Plan (WMP): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities.
- .2 Reference Standards:
  - .1 Canada Green Building Council (CaGBC)
    - .1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
  - .2 Canadian Construction Association (CCA)
    - .1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.
  - .3 Public Works and Government Services Canada (PWGSC)
    - .1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.
    - .2 CRD Waste Management Market Research Report (available from PWGSC's Environmental Services).
    - .3 Sustainable Development Strategy 2007-2009: Target 2.1 Environmentally Sustainable Use of Natural Resources.
      - .1 Real Property projects over \$1 million and in communities where industrial recycling is supported, implementation of CRD waste management practices will be completed, with waste materials being reused or recycled.
      - .2 Contractually ensure resources used in construction or maintenance are consumed and recovered in a sustainable manner.

### 1.3 DESCRIPTION OF WORK

- .1 Develop a Waste Management Plan for this Project and submit to the Departmental Representative for review.
- .2 Supervise on-site waste management activities on a daily basis

- .3 Coordinate waste management tasks with subcontractors to ensure timely and orderly progress of the work
- .4 Prepare waste management documentation and submittals to summarize all shipments of waste materials from the project site
- .5 Report waste management progress to the Departmental Representative.

**1.4 DOCUMENTS**

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
  - .1 Waste Management Plan.
  - .2 Proposed Receiving Facilities (Schedule W1).
  - .3 Waste Tracking Worksheet (Schedule W2).
  - .4 Schedules W1 & W2 completed for project.

**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following before project start-up:
  - .1 One copy and one electronic copy of completed Waste Management Plan.
  - .2 One copy and one electronic copy of completed Proposed Receiving Facilities (Schedule W1).
  - .3 One copy and one electronic copy of Waste Tracking Worksheet (Schedule W2).
- .3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by Departmental Representative the following:
  - .1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
  - .2 Updated Waste Tracking Worksheet (Schedule W2).
  - .3 Written monthly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.
- .4 Submit before final payment the following:
  - .1 Waste Diversion Report, indicating final quantities by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials.
  - .2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

**1.6 WASTE MANAGEMENT PLAN**

- .1 Prior to any waste removal submit a Waste Management Plan to the Departmental Representative for review. The Plan should include the following information:
  - .1 Analysis of the proposed job site waste to be generated, including types and quantities.

- .2 Landfill options: The name of the landfill(s) where all waste will be disposed except for items that the Contract Documents indicate as reused in place or relocated and reused as part of the Work.
- .3 Alternatives to Landfill: A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed local market for each material, and the estimated weight.
- .4 Material to be tracked includes but is not limited to cardboard, clean dimensional wood, beverage containers, concrete, bricks, concrete masonry units, asphalt, hot rolled steel & cast iron, metals (from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, steel studs and framing, stainless steel, aluminum, copper, zinc, lead, brass, and bronze), gypsum board, glass, plastic buckets, carpet and carpet pad trim, paint, plastic sheeting and packaging, rigid plastic foam insulation, fibrous insulation, including batt and semi-rigid insulation.
- .5 Provide the names for each Subcontractor who will transport solid, hazardous waste and land clearing debris from the site and the name of the Receiving Facility that will accept waste for disposal.
- .6 Provide a description of the means of transportation of the recyclable materials (whether materials will be site separated and self-hauled to designed centres, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.
- .7 Provide names of receiving facilities that will accept waste for disposal.
- .8 Meetings: A description of the regular meetings to be held to address waste management.
- .9 As the project proceeds, revise and resubmit a Final Plan to reflect any differences between intended disposal methods and those actually employed.

**1.7 PROPOSED RECEIVING FACILITIES – SCHEDULE W1**

- .1 List the proposed receiving facilities for each material.
- .2 Indicate the material(s) that will be accepted by each facility and whether the material(s) will be reused, recycled or sent to landfill.
- .3 Provide supporting letters on the end-use of materials.
- .4 Submit completed schedule to the Departmental Representative prior to any waste removal.

**1.8 WASTE TRACKING WORKSHEET – SCHEDULE W2**

- .1 Retain and provide to Departmental Representative copies of waybills, invoices, letters and other documentation that clearly indicates the receiving facility, end use (reused, recycled or landfill) and quantity of waste for each shipment of waste generated on the project site.
- .2 Record each shipment using the Waste Tracking Worksheet; note that electronic version can be obtained on request.
- .3 Provide the worksheet to Departmental Representative monthly.

- .4 Submit an up-to-date copy of the Waste Tracking Worksheet and waybills, invoices, letters and other documentation to the Departmental Representative on a monthly basis.

**1.9 USE OF SITE AND FACILITIES**

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

**1.10 QUALITY ASSURANCE**

- .1 Waste Management Meeting: Waste Management Co-ordinator is to provide an update on status of waste diversion and management activities at each meeting. Written monthly Waste Diversion Report summary to be provided by Waste Management Coordinator.

**1.11 STORAGE, HANDLING AND PROTECTION**

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect structural components not removed and salvaged materials from movement or damage.
- .4 Protect surface drainage, mechanical and electrical from damage and blockage.
- .5 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .6 Separate and store materials produced during project in designated areas.
- .7 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
  - .1 On-site source separation is recommended.
  - .2 Remove co-mingled materials to off site processing facility for separation.
  - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
  - .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

**1.12 DISPOSAL OF WASTES**

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, and paint thinner into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
  - .1 Number and size of bins.
  - .2 Waste type of each bin.
  - .3 Total tonnage generated.

- .4 Tonnage reused or recycled.
- .5 Reused or recycled waste destination.

- .4 Remove materials on-site as Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

**1.13 SCHEDULING**

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 APPLICATION**

- .1 Do Work in compliance with Waste Management Plan.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .3 Distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, and the Departmental Representative.
- .4 Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties of the appropriate stages of the Project.
- .5 Provide for separation facilities: lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Keep recycling and waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- .6 Separate, store and dispose of hazardous wastes according to local regulations.
- .7 With each Application for Progress Payment submit ongoing spreadsheets of waste materials recycled, salvaged and disposed of by this project in table form.

**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.

**3.3 WASTE DIVERSION REPORT**

- .1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
  - .1 Identify final diversion results and measure success against goals from Waste Management Plan.
  - .2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Management Plan and explain variances.
    - .1 Supporting documentation.
    - .2 Waybills and tracking forms.
    - .3 Description of issues, resolutions and lessons learned.



**SCHEDULE W1 – PROPOSED RECEIVING FACILITIES**

(Submit to the Departmental; Representative Prior to any waste removal)

| Material Type | Proposed Receiving Facility             |  |              |
|---------------|---|--|--------------|
|               | Name                                    | Material End Use   | Phone Number |
| Bricks        | Example Calgary Recycling Facility Inc. | <input checked="" type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill | 123-456-7890 |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |
|               |   | <input type="checkbox"/> Recycled/Reused<br><input type="checkbox"/> Sent to Landfill            |              |

I hereby certify that the information provided is complete and correct:

---

 Signature of Site Superintendent

---

 Date

## SCHEDULE W2 – WASTE TRACKING WORKSHEET

(Submit most recent copy to the Departmental; Representative on a monthly basis)

| Material Type Legend   |                 |                            |
|------------------------|-----------------|----------------------------|
| Land Clearing Debris   | Asphalt         | Concrete / Masonry / Stone |
| Steel and Other Metals | Wood            | Gypsum                     |
| Cardboard              | Plastic         | “Blue Box” Waste           |
| Mixed Waste            | Other (specify) |                            |

[illegible]

I hereby certify that the information provided is complete and correct:

**Signature of Site Superintendent**

Date \_\_\_\_\_

**END OF SECTION**

**Part 1 General**

**1.1 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 in English that 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, balanced and fully operational.
    - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner and Utility companies: submitted.
    - .5 Operation of systems: demonstrated to Owner's personnel.
    - .6 Commissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to Departmental Representative.
    - .7 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 Departmental Representative, complete outstanding items and request re-inspection.

**1.2 FINAL 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] [recycling] in accordance with Section 01 74 21 - Construction/Demolition Waste Management

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-warranty Meeting:
  - .1 Convene meeting [one] week prior to contract completion with contractor's representative and Departmental Representative to:
    - .1 Verify Project requirements.
    - .2 Review warranty requirements and manufacturer's installation instructions.
  - .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, four 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 systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.

- .8 Drawings: provide with reinforced punched binder tab.
  - .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 Consultant and Contractor with name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
  - .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-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, and as required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

**1.7 FINAL SURVEY**

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

**1.8 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 01 91 13 - General Commissioning (Cx) Requirements.
- .15 Additional requirements: as specified in individual specification sections.

## **1.9 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.



**1.10 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.

**1.11 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.

**1.12 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 for review

- .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 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 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.
- .7 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.
- .8 Conduct 12 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 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, commissioned systems, 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 12 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.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.

**1.13 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 three weeks before date of final inspection.
- .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 contract documents.
  - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - 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 50 00 - Heating Plant: 2 hours of instruction.
  - .2 Section 23 73 11 - Cooling and Ventilation System: 2 hours of instruction.
  - .3 Section 23 09 33 - Control System: 3 hours of instruction.
  - .4 Section 22 05 00 - Plumbing System: 2 hours of instruction.
  - .5 Section 26 - Electrical System: 3 hours of instruction.
  - .6 Section 27 – Communications System: 1 hour of instruction.
  - .7 Section 28 – Fire Detection and Access Systems: 4 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 three weeks before 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 SUMMARY**

- .1 Acronyms:
  - .1 BMM - Building Management Manual.
  - .2 Cx - Commissioning.
  - .3 EMCS - Energy Monitoring and Control Systems.
  - .4 O M - Operation and Maintenance.
  - .5 PI - Product Information.
  - .6 PV - Performance Verification.
  - .7 TAB - Testing, Adjusting and Balancing.

**1.2 GENERAL**

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
  - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
  - .2 Ensure appropriate documentation is compiled into the BMM.
  - .3 Effectively train O M staff.
- .2 Contractor conducts Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
  - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
  - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

**1.3 COMMISSIONING OVERVIEW**

- .1 Cx to be a line item of Contractor's cost breakdown.
- .2 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .3 Cx scope for this building includes the following:
  - .1 Mechanical Equipment:
    - .1 Air Handling Systems / Units
    - .2 Exhaust Fans
    - .3 Make-up Air Units
    - .4 Boilers and Pumps
    - .5 Domestic Water Heaters and Pump
    - .6 Sump Pumps

- .2 Electrical Equipment:
  - .1 Main Service Infrastructure
  - .2 Lighting and lighting controls
  - .3 Electrical panels and distribution
  - .4 Power and distribution
  - .5 Communications Systems

#### **1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS**

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during testing, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

#### **1.5 PRE-CX REVIEW**

- .1 Before Construction:
  - .1 Review contract documents, confirm by writing to Departmental Representative.
    - .1 Adequacy of provisions for Cx.
    - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
  - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
  - .1 Have completed Cx Plan up-to-date.
  - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
  - .3 Fully understand Cx requirements and procedures.
  - .4 Have Cx documentation shelf-ready.
  - .5 Understand completely design criteria and intent and special features.
  - .6 Submit complete start-up documentation to Departmental Representative.
  - .7 Have Cx schedules up-to-date.
  - .8 Ensure systems have been cleaned thoroughly.
  - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
  - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

**1.6 CONFLICTS**

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

**1.7 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit no later than four weeks after award of Contract:
    - .1 Name of Contractor's Cx agent.
    - .2 Draft Cx documentation.
    - .3 Preliminary Cx schedule.
  - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least [8] weeks prior to start of Cx.
  - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least eight weeks prior to start of Cx.
  - .4 Provide additional documentation relating to Cx process required by Departmental Representative.

**1.8 COMMISSIONING DOCUMENTATION**

- .1 Departmental Representative to review and approve Cx documentation.
- .2 Provide completed and approved Cx documentation to Departmental Representative.

**1.9 COMMISSIONING SCHEDULE**

- .1 Provide detailed Cx schedule as part of construction schedule. Contractors shall carry start-ups, TAB, functional testing and verification, Operation and Maintenance (OM) manuals submission and Training on construction schedule. Dates shall be coordinated between contractors, and other project stakeholders
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
  - .1 Approval of Cx reports.
  - .2 Verification of reported results.
  - .3 Repairs, retesting, re-commissioning, re-verification.
  - .4 Training.

**1.10 COMMISSIONING MEETINGS**

- .1 Convene Cx meetings following project meetings as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.



- .4 On-site Cx meetings will commence at approximately 50% construction completion. Ensure subcontractors and relevant manufacturer representatives are present.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Contractor, who will record and distribute minutes.

**1.11 STARTING AND TESTING**

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

**1.12 START-UP DOCUMENTATION**

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
  - .1 Factory and on-site test certificates for specified equipment.
  - .2 Pre-start-up inspection reports.
  - .3 Signed installation/start-up check lists.
  - .4 Start-up reports,
  - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

**1.13 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS**

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

**1.14 TEST RESULTS**

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

**1.15 START OF COMMISSIONING**

- .1 Notify Departmental Representative at least 21 days before start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

**1.16 COMMISSIONING PERFORMANCE VERIFICATION**

- .1 Carry out Cx:
  - .1 Under actual or accepted simulated operating conditions, over entire operating range, in all modes.
  - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

**1.17 TESTING, ADJUSTING AND BALANCING**

- .1 TAB contractor shall provide TAB reports to the Departmental Representative for review and record.
- .2 TAB contractor shall return to site after providing the TAB reports to spot-check and confirm to the Departmental Representative approximately 20% of recorded results. TAB contractor shall provide all equipment and qualified personnel for this verification

**1.18 FUNCTIONAL TESTING / VERIFICATION**

- .1 The Controls contractor shall provide to the Departmental Representative proof of calibration of controls and sensors, point-to-point check sheets and screenshots of BAS graphics in advance of functional testing and verification.
- .2 Electrical contractor shall assist the Cx consultant with measurements at electrical panels.
- .3 Controls contractor shall provide qualified personnel to demonstrate to the Cx consultant equipment and systems operation as per design and the approved shop drawings.

**1.19 REPEAT VERIFICATIONS**

- .1 Assume costs incurred by Departmental Representative for subsequent verifications where:
  - .1 Verification of reported results fail to receive Departmental Representative approval.

**1.20 SUNDRY CHECKS AND ADJUSTMENTS**

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

**1.21 DEFICIENCIES, FAULTS, DEFECTS**

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

**1.22 COMPLETION OF COMMISSIONING**

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

**1.23 ACTIVITIES UPON COMPLETION OF COMMISSIONING**

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

**1.24 TRAINING**

- .1 In accordance with Section 0179 00 – Demonstration & Training.

**1.25 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS**

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

**1.26 OCCUPANCY**

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

**1.27 OWNER'S PERFORMANCE TESTING**

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

**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 RELATED REQUIREMENTS**

- .1 Section 02 82 00.01 - Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.02 - Asbestos Abatement – Intermediate Precautions
- .3 Section 02 82 00.03 - Asbestos Abatement – Maximum Precautions
- .4 Section 02 83 19 - Lead-Containing Paint Abatement
- .5 Section 02 84 00 - Removal and Disposal of PCBs
- .6 Section 02 91 19 - Removal and Disposal of ODS
- .7 Section 02 92 19 - Removal and Disposal of Mercury Components
- .8 Section 02 99 00 - Removal and Disposal of Radioactive Components
- .9 Section 31 23 33 - Excavating, Trenching and Backfilling

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
  - .2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
  - .3 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .2 Reference Standards:
  - .1 CSA International
    - .1 CSA S350-[M1980(R2003)], Code of Practice for Safety in Demolition of Structures.
  - .2 Department of Justice Canada (Jus)
    - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
    - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
      - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
      - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
      - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
  - .3 National Fire Protection Association (NFPA)
    - .1 NFPA 241-13, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

- .4 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S660-[08], Standard for Nonmetallic Underground Piping for Flammable and Combustible Liquids.
- .5 U.S. Environmental Protection Agency (EPA)
  - .1 EPA CFR 86.098-10, Emission standards for 1998 and later model year Otto-cycle heavy-duty engines and vehicles.
  - .2 EPA CFR 86.098-11, Emission standards for 1998 and later model year diesel heavy-duty engines and vehicles.
  - .3 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Demolition Meetings:
  - .1 Convene pre-demolition meeting one week before beginning work of this Section, with Contractor's Representative and Departmental Representative to:
    - .1 Verify project requirements.
    - .2 Verify existing site conditions adjacent to demolition work.
    - .3 Co-ordination with other construction subtrades.
  - .2 Key personnel including, but not limited to, site supervisor, project manager, subcontractor representatives, and WMC to attend.
  - .3 WMC must provide written report on status of waste diversion activity.
  - .4 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours before scheduled meeting.
- .2 Scheduling:
  - .1 Meet project time lines without compromising specified minimum rates of material diversion.
    - .1 In event of unforeseen delay notify Departmental Representative in writing.

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

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section 01 74 21 - Construction/Demolition Waste Management Disposal.
- .2 WMC is responsible for fulfilment of reporting requirements.
- .3 Before beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and indicate:
  - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
  - .2 Schedule of selective demolition.
  - .3 Number and location of dumpsters.

- .4 Anticipated frequency of tippage.
- .4 Submit electronic copies of certified weigh bills, bills of lading, and receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of Departmental Representative.
  - .1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in Waste Reduction Workplan.
- .5 Shop Drawings:
  - .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .6 Sustainable Design Submittals:
  - .1 Submittals: in accordance with Section 01 47 15 – Sustainable Requirements: Construction.
  - .2 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with EPA 832/R-92-005, authorities having jurisdiction, and Section 01 47 15 – Sustainable Requirements: Construction.
  - .3 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating percentages of construction wastes were recycled or salvaged.

## **1.5 QUALITY ASSURANCE**

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

## **1.6 SITE CONDITIONS**

- .1 Environmental protection:
  - .1 Work to be done in accordance with Section 01 35 43 - Environmental Procedures.
  - .2 Work must not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
  - .3 Fires and burning of waste or materials is not permitted on site.
  - .4 Selling of materials is not permitted.
  - .5 Do not bury rubbish waste materials.
  - .6 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
    - .1 Proper disposal procedures to be maintained throughout project.
  - .7 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

- .8 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction and as directed by Departmental Representative.
- .9 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .10 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .11 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

## **1.7 EXISTING CONDITIONS**

- .1 If material resembling spray or trowel applied asbestos or other designated substance listed as hazardous are encountered in course of demolition, stop work, take preventative measures, and notify Departmental Representative immediately. Proceed only after receipt of written instructions have been received from Departmental Representative.
- .2 Structures to be demolished are based on their condition on date that tender is accepted.
- .3 Materials to be Retained or Salvaged for Reuse:
  - .1 Protect existing items designated to remain and items for salvage. Should such items be damaged immediately repair to the satisfaction of the Departmental Representative at no cost.
  - .2 Items such as cornerstones, commemorative plaques, and tablets found or indicated remain the property of Departmental Representative. Notify Departmental Representative before removing and obtain approval for method of removal.
  - .3 Deliver and store where directed by Departmental Representative.

## **1.8 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copies of colour digital photography in jpg format, standard resolution as directed by Departmental Representative to demonstrate measures have been taken as specified and directed.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: Four locations.
  - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: as directed by Departmental Representative.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1    Verification of Conditions: verify that conditions are acceptable for structure demolitions.
  - .1    Visually inspect site and structures to be demolished.
  - .2    Verify extent and location of items designated for removal, disposal, alternative disposal, recycling, and items to remain.
  - .3    Inform Departmental Representative of unacceptable or unexpected conditions immediately upon discovery.
    - .1    Stop work in the area immediately.
    - .2    Follow instructions from Departmental Representative.
  - .4    Proceed with demolition only after unacceptable conditions have been remedied.
- .2    Visit and examine the site, become familiar with features and characteristics impacting the work. No allowances will be made by the Departmental Representative for difficulties encountered due to features or peculiarities of the site or existing conditions which exist at the time of examination before submission of bid.
- .3    Inspect the premises to determine the conditions under which the work is to be done and the amount of materials and debris to be removed.
- .4    Provide at least one person who is familiar with the scope and intent of the work, individual to be present during demolition work.

**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 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    Work in accordance with Section 01 35 43 - Environmental Procedures, and Erosion and Sedimentation Control Plan.
  - .2    Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades, and properties.
    - .1    Provide bracing, shoring and underpinning as required.
    - .2    Repair damage caused by demolition as directed by Departmental Representative.



- .3 Support affected structures and, if safety of structure being demolished, adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
- .4 Prevent debris from blocking surface drainage system, mechanical and electrical systems which must remain in operation.
- .5 Do not interfere with use of adjacent buildings to remain in use. Maintain clear and safe passage to and from occupied buildings.
- .3 Surface Preparation:
  - .1 Notify and obtain approval of utility companies before starting demolition.
  - .2 Place markers to indicate location of disconnected services. Identify service lines and capping locations on survey plan.
  - .3 Disconnect, remove back to property line except as indicated, and cap existing electrical and telephone service lines entering buildings to be demolished.
    - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
    - .2 Notwithstanding industry trade scope definitions mechanical demolition to be done by the electrical subcontractor.
  - .4 Disconnect, remove back to property line except as indicated, and cap existing mechanical services.
    - .1 Natural gas supply lines: remove in accordance with gas company requirements.
    - .2 Sewer and water lines: remove in accordance with authority having jurisdiction and as directed by Departmental Representative.
    - .3 Other underground services: remove and dispose.
    - .4 Notwithstanding industry trade scope definitions mechanical demolition to be done by the mechanical subcontractor.
  - .5 Do not disrupt active or energized utilities traversing premises or designated to remain undisturbed.
  - .6 Verify locations of buried utilities by careful soil hydrovac methods.
  - .7 Remove rodent and vermin as required by Departmental Representative.

### **3.3 DEMOLITION**

- .1 Work to be performed in accordance with applicable provincial regulations and with Section 01 56 00 - Temporary Barriers and Enclosures.
- .2 Do not proceed with general demolition in an area until the parties primarily responsible for electrical and mechanical work have signed an authorization to proceed.
- .3 Schedule demolition work with Departmental Representative to cause minimum interference with other portions of the site to remain in use.
- .4 Carry out demolition in an orderly and careful manner using tradesmen qualified to perform demolition and removal work.
- .5 Blasting operations not permitted during demolition.

- .6 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.
- .7 Before start of Work remove contaminated or hazardous materials listed as hazardous, as defined by authorities having jurisdiction, as directed by Departmental Representative from site and dispose of at designated disposal facilities in safe manner and in accordance with Section 02 81 01 - Hazardous Materials.
- .8 Demolish structures to permit construction and as indicated.
- .9 Crush concrete generated due to demolition of foundations to size suitable for recycling.
  - .1 Where possible identify markets which will accept crushed material as aggregate.
  - .2 For further information regarding acceptable uses contact Provincial / Territorial aggregate producers associations and Ministries of Transportation.
- .10 Demolish basement, foundation, walls and footings, and concrete floors below or on grade within areas of new construction.
- .11 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .12 At end of each day's work, leave Work in safe and stable condition.
- .13 Demolish to minimize dusting, keep materials wetted.
- .14 Remove structural framing.
- .15 Contain fibrous materials to minimize release of airborne fibres while being transported within facility.
- .16 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
- .17 Remove materials and equipment as indicated, store, protect, and reinstall in new building, using qualified tradesmen.
- .18 Remove materials and equipment as indicated and store in location designated by Departmental Representative.
- .19 Use natural lighting to do Work where possible.
  - .1 Shut off lighting except those required for security purposes at end of each day.

### **3.4 FILL AND GRADING**

- .1 Examine the site to determine the amounts of fill required including topsoil. Verify existing conditions with adjacent site to make allowances for coordination of fill required.
- .2 Excavated or graded materials existing on site or from previous scopes may be suitable to use as fill for grading if approved by the Departmental Representative. Remove and dispose of surplus and unsuitable material as directed by Departmental Representative.
- .3 Use only material free from frozen lumps, snow, ice, debris, organic material and other deleterious materials. Lumps and material larger than 100 mm must be broken down during placing.

- .4 Areas to be backfilled must be free from debris, snow, ice, and frozen ground.
- .5 Backfill hole where existing foundation has been removed using Fill Type 1, Type 2, or Type 3 and in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- .6 Maintain +3% of optimum moisture content of fill materials to attain required compaction density. Contractor will be held responsible for reinstallation of surface paving, slabs, and the like due to later settlement, including but not limited to settlement due to improper moisture conditioning.

### **3.5 CLEANING**

- .1 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 47 15 – Sustainable Requirements: Construction.
- .2 Waste Management: separate waste materials for 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 Divert excess materials from landfill to site approved by Departmental Representative.
- .4 Designate appropriate security resources / measures to prevent vandalism, damage and theft.
- .5 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.
- .6 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.
  - .1 Label stockpiles, indicating material type and quantity.
- .7 Separate from general waste stream each of following materials. Stockpile materials in neat and orderly fashion in location and as directed by Departmental Representative for alternate disposal. Stockpile materials in accordance with applicable fire and safety regulations.
  - .1 Power source poles deemed unfit for reuse by Departmental Representative.
- .8 Supply separate, clearly marked disposal bins for categories of waste material. Do not remove bins from site until inspected and approved by Departmental Representative. Please notify Departmental Representative before removal of bins from site.
- .9 Remove stockpiled material as directed by Departmental Representative when it interferes with operations of project construction.
- .10 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .11 Transport material designated for alternate disposal using approved haulers, facilities, and receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.
  - .1 Written authorization from Departmental Representative is required to deviate from haulers, facilities, and receiving organizations listed in Waste Reduction Workplan.

- .12 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
  - .1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.
  - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Remove and dispose of the following asbestos-containing materials at Lot 20:
    - .1 Vinyl floor tile beneath non asbestos-containing sheet flooring, located in the back room of the Post Office;
    - .2 Exterior grey window caulking, located on one window of the Residence;
    - .3 Asphalt shingles, located on the roof of the shed;
    - .4 Vinyl floor tile beneath carpet, located in the living room of the Residence;
    - .5 9"x9" vinyl floor tile, located in the basement of the residence; and,
    - .6 White insulation board, located on the floor vents of the Residence.
  - .2 Remove and dispose of the following asbestos-containing materials at Lot 21:
    - .1 Brown vinyl floor tile, located in the bedrooms on main floor of the Residence; and
    - .2 Grey board above the furnace, located in the basement of the Residence.
  - .3 Contractor must retain a qualified Health and Safety Consultant to conduct the required site inspection and air monitoring during asbestos abatement work, as defined in the Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety.
    - .1 Health and Safety Consultant must meet the qualifications defined in the Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety.
    - .2 Health and Safety Consultant must have working experience on projects of similar size and scope, and working experience on this site within the last three years.

**1.2 RELATED REQUIREMENTS**

- .1 Section 02 82 00.02 Asbestos Abatement – Intermediate Precautions
- .2 Section 02 82 00.03 Asbestos Abatement – Maximum Precautions
- .3 Section 02 83 19 Lead-Containing Paint Abatement
- .4 Section 02 84 00 Removal and Disposal of PCBs
- .5 Section 02 91 19 Removal and Disposal of ODS
- .6 Section 02 92 19 Removal and Disposal of Mercury Components
- .7 Section 02 99 00 Removal and Disposal of Radioactive Components

### 1.3 REFERENCE STANDARDS

- .1 The current issue of the following documents shall govern. Where conflict may exist between these requirements and project specifications, the more stringent shall apply.
- .2 Regulations: Comply with current applicable Federal, Provincial, Municipal, and local regulations:
  - .1 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-1.205-94, Sealer for Application to Asbestos-Fibre-Releasing Materials
  - .2 Canadian Standards Association (CSA International)
  - .3 Department of Justice Canada (Jus)
    - .1 Canadian Environmental Protection Act, 1999 (CEPA).
  - .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .5 Alberta Occupational Health and Safety Act, Regulation and Code;
  - .6 Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety;
  - .7 Transport Canada (TC)
    - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
  - .8 Transportation of Dangerous Goods Regulations and/or Waste Management Act Regulations, Alberta/92/96. Waste Control Regulations under the Environmental Protection and Enhancement Act.
  - .9 CAN/CGSB-43.150-97, Performance Packaging's for Transportation of Dangerous Goods
  - .10 Alberta Environmental Protection and Enhancement Act (AEPEA).
    - .1 Waste Control regulation 129/1996, with amendments up to and including Alberta Regulation 31/2012
    - .2 Alberta User Guide for Waste Managers:  
<http://www.environment.gov.ab.ca/info/library/7423.pdf>
  - .11 Guidelines for the Disposal of Asbestos Waste, available from Alberta Environment: <http://www.environment.gov.ab.ca/info/library/7247.pdf>
  - .12 Alberta Building Code.

### 1.4 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Amended Water: water with nonionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.
- .3 Asbestos-Containing Materials (ACMs): materials that contain the provincially regulated 0.1% or more asbestos by dry weight, including fallen materials and settled dust.
- .4 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.

- .5 Authorized Visitors: Engineers, Consultants or designated representatives, and representatives of regulatory agencies.
- .6 Competent worker: in relation to specific work, means a worker who:
  - .1 Is qualified because of knowledge, training and experience to perform the work.
  - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
  - .3 Has knowledge of all potential or actual danger to health or safety in the work.
- .7 DOP Testing: testing method used to determine integrity of negative pressure units and HEPA vacuums using diocetyl phthalate (DOP) HEPA-filter leak test.
- .8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.
- .9 Friable material: means material that:
  - .1 When dry, can be crumbled, pulverized or powdered by hand pressure, or
  - .2 is crumbled, pulverized or powdered.
- .10 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .11 Occupied Area: any area of the building or work site that is outside Asbestos Work Area.
- .12 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
- .13 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.

## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.
- .6 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

- .7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
  - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.
- .8 Submit Worker's Compensation Board status and transcription of insurance.
- .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
  - .1 Encapsulants;
  - .2 Amended water;
  - .3 Slow drying sealer.
- .10 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal and Provincial requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications, more stringent requirement applies. Comply with regulations in effect at time Work is performed.
- .2 Health and Safety:
  - .1 Perform construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
      - .1 Air purifying half-mask respirator with P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an



- operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
- .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.
  - .3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
  - .4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.
  - .5 Ensure workers wash hands and face when leaving Asbestos Work Area.
  - .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
  - .7 Visitor Protection:
    - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
    - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
    - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

## 1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling and reuse in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Remove accumulations of asbestos waste from the work area daily.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .5 Handle, package, transport and dispose of asbestos waste generated by removal activities in accordance with Federal, Provincial, and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mil bags or leak proof drums. Label containers with appropriate warning labels.

- .6 Provide manifests describing and listing waste created. Transport containers in accordance with TDG regulation to a licensed landfill for burial.

## **1.8 EXISTING CONDITIONS**

- .1 Reports and information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this project are bound into this specification.
- .2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

## **1.9 SCHEDULING**

- .1 Before beginning Work on this Project notify the following in writing:
  - .1 Notification of project (NOP) to Alberta Occupational Health and Safety.
  - .2 The licensed landfill the intent to transport and dispose of asbestos waste.
- .2 Inform sub-trades of presence of asbestos-containing materials identified in Existing Conditions.
- .3 Submit to Departmental Representative copy of notifications prior to start of Work.

## **1.10 PERSONNEL TRAINING**

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, following minimum requirements:
  - .1 Fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by a competent, qualified person.
- .4 Supervisory personnel to have completed the Alberta 16-Hour Occupational Health and Safety for the Asbestos Worker.
  - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Drop Sheets:
  - .1 Polyethylene: 0.15 mm thick.

- .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.
- .3 Waste Containers: contain waste in two separate containers.
  - .1 Inner container: 0.15 mm thick sealable polyethylene waste bag.
  - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
  - .3 Labelling requirements: affix pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site. Label containers in accordance with Asbestos Regulations 29 CFR 1910.1001. Label in English.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .5 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .6 Sealer: flame spread and smoke developed rating less than 50.
- .7 Encapsulants: Type 2 surface film forming type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada.

### **Part 3 Execution**

#### **3.1 ASBESTOS REMOVAL**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health and Safety Requirements.
- .2 Before beginning Work, isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.
  - .1 Remove visible dust from surfaces in the work area where dust is likely to be disturbed during course of work.
  - .2 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.
  - .3 Do not use compressed air to clean up or remove dust from any surface.
- .3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
  - .1 Use polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.

- .4 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.
  - .1 Use garden reservoir type low - velocity fine - mist sprayer.
  - .2 Perform Work to reduce dust creation to lowest levels practicable.
  - .3 Work will be subject to visual inspection and air monitoring by the Contractor.
  - .4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .5 Frequently and at regular intervals during Work and immediately on completion of work:
  - .1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and
  - .2 Drop sheets to be wetted and placed in a waste container as soon as practicable.
- .6 Cleanup:
  - .1 Remove asbestos material in small sections. Do not allow saturated asbestos to dry out.
  - .2 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.
  - .3 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.
  - .4 Seal waste bags and remove from site. Dispose of in accordance with requirements of Provincial and Federal Authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that the appropriate guidelines and regulations for asbestos disposal are followed.
  - .5 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.
- .7 From beginning of Work until completion of final cleaning operations, the Contractor is to take air samples on daily basis outside and inside of Asbestos Work Area(s) in accordance with the Provincial Health and Safety regulations.
  - .1 Contractor will be responsible for monitoring in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .8 If air monitoring shows that areas outside Asbestos Work Area enclosure is contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.
- .9 Ensure that respiratory safety factors are not exceeded.

- .10 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, at no cost to the Government of Canada. Health and Safety Consultant must be onsite on a full time basis during abatement activities.

**END OF SECTION**

**1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Remove and dispose of the following asbestos-containing materials at the Bunkhouse:
    - .1 Drywall joint compound, located throughout the Bunkhouse; and,
    - .2 Beige mosaic sheet flooring, located at the entrance of Unit 16 in the Bunkhouse.
  - .2 Remove and dispose of the following asbestos-containing materials at Lot 20:
    - .1 Drywall joint compound, located throughout the entire building.
  - .3 Remove and dispose of the following asbestos-containing materials at Lot 21:
    - .1 Beige patterned sheet flooring, located in the main floor vestibule of the Residence; and
    - .2 Drywall joint compound throughout main floor of the Residence.
  - .4 Contractor must retain a qualified Health and Safety Consultant to conduct the required site inspection and air monitoring during asbestos abatement work, as defined in the Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety.
    - .1 Health and Safety Consultant must meet the qualifications defined in the Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety.
    - .2 Health and Safety Consultant must have working experience on projects of similar size and scope, and working experience on this site within the last three years.

**1.2 RELATED REQUIREMENTS**

- .1 Section 02 82 00.01 Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.03 Asbestos Abatement – Maximum Precautions
- .3 Section 02 83 19 Lead-Containing Paint Abatement
- .4 Section 02 84 00 Removal and Disposal of PCBs
- .5 Section 02 91 19 Removal and Disposal of ODS
- .6 Section 02 92 19 Removal and Disposal of Mercury Components
- .7 Section 02 99 00 Removal and Disposal of Radioactive Components

**1.3 REFERENCE STANDARDS**

- .1 The current issue of the following documents shall govern. Where conflict may exist between these requirements and project specifications, the more stringent shall apply.

- .2 Regulations: Comply with current applicable Federal, Provincial, Municipal, and local regulations:
  - .1 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-1.205-94, Sealer for Application to Asbestos-Fibre-Releasing Materials
  - .2 Canadian Standards Association (CSA International)
  - .3 Department of Justice Canada (Jus)
    - .1 Canadian Environmental Protection Act, 1999 (CEPA).
  - .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .5 Alberta Occupational Health and Safety Act, Regulation and Code;
  - .6 Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety;
  - .7 Transport Canada (TC)
    - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
  - .8 Transportation of Dangerous Goods Regulations and/or Waste Management Act Regulations, Alberta/92/96. Waste Control Regulations under the Environmental Protection and Enhancement Act.
  - .9 CAN/CGSB-43.150-97, Performance Packaging's for Transportation of Dangerous Goods
  - .10 Alberta Environmental Protection and Enhancement Act (AEPEA).
    - .1 Waste Control regulation 129/1996, with amendments up to and including Alberta Regulation 31/2012
    - .2 Alberta User Guide for Waste Managers:  
<http://www.environment.gov.ab.ca/info/library/7423.pdf>
  - .11 Guidelines for the Disposal of Asbestos Waste, available from Alberta Environment: <http://www.environment.gov.ab.ca/info/library/7247.pdf>
  - .12 Alberta Building Code.

#### 1.4 DEFINITIONS

- .1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .2 Asbestos Containing Materials (ACMs): materials that contain the provincially regulated 0.1% or more asbestos by dry weight, including fallen materials and settled dust.
- .3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.
- .4 Authorized Visitors: Visitors: Engineers, Consultants or designated representatives, and representatives of regulatory agencies.
- .5 Competent worker: in relation to specific work, means a worker who:
  - .1 Is qualified because of knowledge, training and experience to perform the work.
  - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
  - .3 Has knowledge of all potential or actual danger to health or safety in the work.

- .6 DOP Testing: testing method used to determine integrity of negative pressure units and HEPA vacuums using dioctyl phthalate (DOP) HEPA-filter leak test.
- .7 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .8 Glove Bag: prefabricated glove bag as follows:
  - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
  - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
  - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
  - .4 Straps for sealing ends around pipe.
- .9 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.
- .10 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .11 Occupied Area: any area of building or work site that is outside Asbestos Work Area.
- .12 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
- .13 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.
- .6 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.



- .7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
  - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.
- .8 Submit Worker's Compensation Board status and transcription of insurance.
- .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
  - .1 Encapsulants;
  - .2 Amended water;
  - .3 Slow drying sealer.
- .10 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal and Provincial requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
      - .1 Air purifying half-mask respirator with P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

- .2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.
- .3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
- .4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.
- .5 Ensure workers wash hands and face when leaving Asbestos Work Area.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .7 Visitor Protection:
  - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
  - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
  - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling and reuse in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Remove accumulations of asbestos waste from the work area daily.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .5 Handle, package, transport and dispose of asbestos waste generated by removal activities in accordance with Federal, Provincial, and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mil bags or leak proof drums. Label containers with appropriate warning labels.
- .6 Provide manifests describing and listing waste created. Transport containers in accordance with TDG regulation to a licensed landfill for burial.

**1.8 EXISTING CONDITIONS**

- .1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.
- .2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

**1.9 SCHEDULING**

- .1 Before beginning Work on this Project notify the following in writing:
  - .1 Notification of project (NOP) to Alberta Occupational Health and Safety.
  - .2 The licensed landfill the intent to transport and dispose of asbestos waste.
- .2 Inform sub-trades of presence of asbestos-containing materials identified in Existing Conditions.
- .3 Submit to Departmental Representative copy of notifications prior to start of Work.

**1.10 PERSONNEL TRAINING**

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
  - .1 Fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to have completed the Alberta 16-Hour Occupational Health and Safety for the Asbestos Worker.
  - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.

**Part 2 Products****2.1 MATERIALS**

- .1 Drop and Enclosure Sheets:
  - .1 Polyethylene: 6mm thick.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.
- .3 Waste Containers: contain waste in two separate containers.
  - .1 Inner container: 6mm thick sealable polyethylene bag

- .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 6mm thick sealable polyethylene bag.
- .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site. Label containers in accordance with Asbestos Regulations 29 CFR 1910.1001. Label in English.
- .4 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .5 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
  - .1 Sealer: flame spread and smoke developed rating less than 50.
- .6 Encapsulant: Type 2 surface film forming type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada.

### **Part 3 Execution**

#### **3.1 SUPERVISION**

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.
  - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.

#### **3.2 PREPARATION**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health and Safety Requirements.
- .2 Work Areas:
  - .1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Seal joints and seams of active return air ducts within Asbestos Work Area.
  - .2 Clean proposed work area using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.
  - .3 The spread of dust from the work area to be prevented by:
    - .1 Using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls.

- .2 Using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.
- .4 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 0.02 inches 5 Pa of water, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior to each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used.
- .5 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
- .6 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use two layers of polyethylene on floors.
- .7 Build airlocks at entrances to and exits from work area so that work area is always closed off by one curtained doorway when workers enter or exit.
- .8 At each access to work area install warning signs in English in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".
- .9 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 6mm thick and treat as contaminated asbestos waste. Remove wall and ceiling - mounted objects such as lights, partitions, shelving other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Departmental Representative. Use Minimum Precautions (Section 02 82 00.02) during fixture removal to reduce fibre dispersal.
- .10 Isolate and disconnect existing electricity. Provide a suitable source of electricity to execute the work. Electricity in the work area must be supplied through Ground Fault Circuit Interrupters (GFCI).
- .3 Worker Decontamination Enclosure System:
  - .1 Worker Decontamination Enclosure System includes Dirty Room and Clean Room, as follows:
    - .1 Dirty Room: build Dirty Room between Clean Room and work area, with two curtained doorways, one to Clean Room and one to work area. Install waste receptor to dispose of protective clothing.
    - .2 Clean Room: build Clean Room between Dirty Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Dirty Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

- .4 Container and Equipment Decontamination Enclosure System:
  - .1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Wash room, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.
    - .1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Wash room. Equip Staging Area with curtained doorway to Washroom.
    - .2 Wash room: build Wash room between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.
    - .3 Holding Room: build Holding Room between Wash room and Unloading Room, with two curtained doorways, one to Wash room and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.
    - .4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.
- .5 Construction of Decontamination Enclosures:
  - .1 Build suitable wood framing for enclosures or use existing building where convenient, and line with polyethylene sheeting sealed with tape. Use two layers of rip-proof polyethylene on floors.
  - .2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
- .6 Maintenance of Enclosures:
  - .1 Maintain enclosures in tidy condition.
  - .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
  - .3 Visually inspect enclosures at beginning of each working period.
  - .4 Use smoke methods to test effectiveness of barriers when directed by the Departmental Representative.
- .7 Do not begin Asbestos Abatement work until:
  - .1 Arrangements have been made for disposal of waste.
  - .2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.
  - .3 Work area and decontamination enclosure are effectively segregated.

- .4 Tools, equipment, and materials waste containers are on hand.
- .5 Arrangements have been made for building security.
- .6 Warning signs are displayed where access to contaminated areas is possible.
- .7 Notifications have been completed and other preparatory steps have been taken.

### **3.3 ASBESTOS REMOVAL**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health and Safety Requirements.
- .2 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.
- .3 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.
  - .1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.
  - .2 Do not use compressed air to clean up or remove dust from any surface.
- .4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
  - .1 Use polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.
  - .2 When removing ceilings and walls, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.
- .5 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.
  - .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
  - .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.
- .6 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .7 Cleanup:
  - .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
  - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

- .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
- .4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.
- .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

### **3.4 FINAL CLEANUP**

- .1 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .2 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .3 Include in clean-up Work areas, Dirty Room, Washroom, and other contaminated enclosures.
- .4 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.
- .5 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.
- .6 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

### **3.5 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS**

- .1 When cleanup is complete:
  - .1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.
  - .2 Re-secure mounted objects removed in course of Work in their former positions.
  - .3 Re-establish mechanical and electrical systems in proper working order. Install new filters.
  - .4 Repair or replace objects damaged in the course of Work, as directed by Departmental Representative.



**3.6 AIR MONITORING**

- .1 From beginning of Work until completion of cleaning operations, the Contractor is to take air samples on daily basis outside and inside Asbestos Work Area(s) in accordance with Provincial Occupational Health and Safety Regulations.
  - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial Occupational Health and Safety Regulations.
- .2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
  - .1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.
  - .2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to Asbestos Work Area
- .3 During course of Work, the Contractor to measure fibre content of air outside work areas by means air samples analyzed by Phase Contrast Microscopy (PCM).
  - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .4 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, the Contractor will perform air monitoring within Asbestos Work Area by aggressive methods.
  - .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
  - .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
  - .3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

**3.7 INSPECTION**

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by DCC Representative may result in Work stoppage, at no cost to the Government of Canada. Health and Safety Consultant must be onsite on a full time basis during abatement activities.
- .2 Health and Safety Consultant will inspect Work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

- .3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur  
Departmental Representative may order Work shutdown, at no cost to the Government of  
Canada.
  - .1 No additional costs will be allowed by Contractor for additional labour or  
materials required to provide specified performance level.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Remove and dispose of the following asbestos-containing materials at Lot 20:
    - .1 Mosaic sheet flooring beneath carpet, located in the bedrooms of the Residence.
  - .2 Remove and dispose of the following asbestos-containing materials at Lot 21:
    - .1 Ceiling texture coat, located in the main floor kitchen of the Residence; and
    - .2 Grey paper duct wrap, located in the basement of the Residence.
  - .3 Contractor must retain a qualified Health and Safety Consultant to conduct the required site inspection and air monitoring during asbestos abatement work, as defined in the Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety.
    - .1 Health and Safety Consultant must meet the qualifications defined in the Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety.
    - .2 Health and Safety Consultant must have working experience on projects of similar size and scope, and working experience on this site within the last three years.

**1.2 RELATED REQUIREMENTS**

- .1 Section 02 82 00.01 Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.02 Asbestos Abatement – Intermediate Precautions
- .3 Section 02 83 19 Lead-Containing Paint Abatement
- .4 Section 02 84 00 Removal and Disposal of PCBs
- .5 Section 02 91 19 Removal and Disposal of ODS
- .6 Section 02 92 19 Removal and Disposal of Mercury Components
- .7 Section 02 99 00 Removal and Disposal of Radioactive Components

**1.3 REFERENCE STANDARDS**

- .1 The current issue of the following documents shall govern. Where conflict may exist between these requirements and project specifications, the more stringent shall apply.
- .2 Regulations: Comply with current applicable Federal, Provincial, Municipal, and local regulations:
  - .1 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-1.205-94, Sealer for Application to Asbestos-Fibre-Releasing Materials
  - .2 Canadian Standards Association (CSA International)

- .3 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .5 Alberta Occupational Health and Safety Act, Regulation and Code;
- .6 Alberta Asbestos Abatement Manual, October, 2012, Alberta Occupational Health and Safety;
- .7 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .8 Transportation of Dangerous Goods Regulations and/or Waste Management Act Regulations, Alberta/92/96. Waste Control Regulations under the Environmental Protection and Enhancement Act.
- .9 CAN/CGSB-43.150-97, Performance Packaging's for Transportation of Dangerous Goods.
- .10 Alberta Environmental Protection and Enhancement Act (AEPEA).
  - .1 Waste Control regulation 129/1996, with amendments up to and including Alberta Regulation 31/2012
  - .2 Alberta User Guide for Waste Managers:  
<http://www.environment.gov.ab.ca/info/library/7423.pdf>
- .11 Guidelines for the Disposal of Asbestos Waste, available from Alberta Environment: <http://www.environment.gov.ab.ca/info/library/7247.pdf>
- .12 Alberta Building Code.

#### 1.4 DEFINITIONS

- .1 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.
- .2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .3 Asbestos-Containing Materials (ACMs): materials that contain the provincially regulated 0.1% or more asbestos by dry weight, including fallen materials and settled dust.
- .4 Asbestos Work Areas: area where work takes place which will, or may disturb ACMs.
- .5 Authorized Visitors: Engineers, Consultants or designated representatives, and representatives of regulatory agencies.
- .6 Competent worker [person]: in relation to specific work, means a worker who:
  - .1 Is qualified because of knowledge, training and experience to perform the work.
  - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
  - .3 Has knowledge of all potential or actual danger to health or safety in the work.

- .7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:
  - .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
  - .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.
  - .3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.
- .8 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) HEPA-filter leak test.
- .9 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .10 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .11 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.
  - .1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.
- .12 Non-Friable Materials: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .13 Occupied Areas: any area of building or work site that is outside Asbestos Work Area.
- .14 Polyethylene sheeting sealed with tape: polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.
- .15 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

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

- .2 Before beginning work:
  - .1 Obtain from appropriate agency and submit to Departmental Representative necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material being dumped, and proper methods of disposal. Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.
  - .2 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person on hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing. Submit proof of attendance in form of certificate.
  - .3 Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.
    - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.
  - .4 Submit layout of proposed enclosures and decontamination facilities to Departmental Representative for review.
  - .5 Submit Provincial requirements for Notice of Project form.
  - .6 Submit proof of Contractor's Asbestos Liability Insurance.
  - .7 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.
  - .8 Submit Worker's Compensation Board status and transcription of insurance.
  - .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:
    - .1 Encapsulants.
    - .2 Amended water.
    - .3 Slow drying sealer.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal and Provincial requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

- .2 Safety Requirements: worker and visitor protection.
  - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
    - .1 Powered air purifying respirator (PAPR) with P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
    - .2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn. Requirements for each worker:
      - .1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
      - .2 Remove gross contamination from clothing before leaving work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated work suits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters

- and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.
- .3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.
  - .4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter work area.
  - .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
  - .3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.
  - .4 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
  - .5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
  - .6 Visitor Protection:
    - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
    - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
    - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

## **1.7 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 accumulations of asbestos waste from the work area daily.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.



- .5 Handle, package, transport and dispose of asbestos waste generated by removal activities in accordance with Federal, Provincial, and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mil bags or leak proof drums. Label containers with appropriate warning labels.
- .6 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

## **1.8 EXISTING CONDITIONS**

- .1 Results of tests of asbestos containing materials to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.
- .2 Notify Departmental Representative of suspect asbestos containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

## **1.9 SCHEDULING**

- .1 Before beginning Work on this Project, notify the following in writing:
  - .1 Notification of project (NOP) to Alberta Occupational Health and Safety.
  - .2 The licensed landfill the intent to transport and dispose of asbestos waste.
- .2 Inform sub-trades of presence of asbestos containing materials identified in Existing Conditions.
- .3 Submit to Departmental Representative copy of notifications prior to start of Work.

## **1.10 PERSONNEL TRAINING**

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
  - .1 Proper fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 All personnel to have completed the Alberta 16-Hour Occupational Health and Safety for the Asbestos Worker.
  - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 FR polyethylene: minimum 0.15 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by [Consultant] [DCC Representative] [Departmental Representative], mixed with water in concentration to provide adequate penetration and wetting of asbestos containing material.
- .5 Waste Containers: contain waste in two separate containers.
  - .1 Inner container: 0.15 mm thick sealable polyethylene bag [or where glove bag method is used, glove bag itself].
  - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
  - .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site. Label containers in accordance with Asbestos Regulations [29 CFR 1910.1001]. Label in both official languages.
- .6 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .7 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .8 Sealer: flame spread and smoke developed rating less than 50 [and be compatible with new fireproofing].
- .9 Encapsulants: Type 2 surface film forming type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
- .2 Work Areas:
  - .1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Seal seams of active return air ducts within Asbestos Work Area.

- .2 The spread of dust from the work area to be prevented by:
  - .1 Using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls.
  - .2 Using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.
- .3 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 0.02 inches of water or 5 Pascals, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used.
- .4 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
- .5 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use two layers of polyethylene on floors. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.
- .6 Build airlocks at entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.
- .7 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".
- .8 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Departmental. Use localized water spraying during fixture removal to reduce fibre dispersal.
- .9 Where application of water is required for wetting asbestos containing materials, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

- .3 Worker Decontamination Enclosure System:
  - .1 Worker Decontamination Enclosure System includes Dirty Room, Shower Room, and Clean Room, as follows:
    - .1 Equipment and Access Room: build Dirty Room between Shower Room and work area, with two curtained doorways, one to Shower Room and one to work area. Install waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work area. Build Dirty Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.
    - .2 Shower Room: build Shower Room between Clean Room and Dirty, with two curtained doorways, one to Clean Room and one to Dirty Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.
    - .3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.
- .4 Container and Equipment Decontamination Enclosure System:
  - .1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.
    - .1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.
    - .2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.
    - .3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.
    - .4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.

- .5 Construction of Decontamination Enclosures:
  - .1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use two layers of polyethylene on floors.
  - .2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
- .6 Maintenance of Enclosures:
  - .1 Maintain enclosures in tidy condition.
  - .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
  - .3 Visually inspect enclosures at beginning of each working period.
- .7 Do not begin Asbestos Abatement work until:
  - .1 Arrangements have been made for disposal of waste.
  - .2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.
  - .3 Work areas and decontamination enclosures area effectively segregated.
  - .4 Tools, equipment, and materials waste containers are on hand.
  - .5 Arrangements have been made for building security.
  - .6 Warning signs are displayed where access to contaminated areas is possible.
  - .7 Notifications have been completed and other preparatory steps have been taken.

### **3.2 SUPERVISION**

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain outside the Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.
  - .1 Supervisor must have working experience on at least five projects of similar size and scope, completed within the last three years.

### **3.3 ASBESTOS REMOVAL**

- .1 Before removing asbestos:
  - .1 Prepare site.
  - .2 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.
- .2 Remove saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.

- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brushed and wet sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.
- .5 Where Department Representative decides complete removal of asbestos containing material is impossible due to obstructions such as structural members or major service elements, and provides written direction, encapsulate material as follows:
  - .1 Apply surface film forming type sealer to provide 0.635mm minimum dry film thickness over sprayed asbestos surfaces]. Apply using airless spray equipment to avoid blowing off fibres.
  - .2 Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces to uniform depth of 25mm minimum. Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces uniformly to substrate.
- .6 After wire brushing and wet sponging to remove visible asbestos, wet clean entire work area including Equipment and Access Room, and equipment used in process. After inspection by Health and Safety Consultant apply continuous coat of slow drying sealer to surfaces of work area. Allow at least 8 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.
- .7 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .8 Cleanup:
  - .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
  - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
  - .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
  - .4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.
  - .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

### **3.4 FINAL CLEANUP**

- .1 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .2 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .3 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.
- .4 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.
- .5 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.
- .6 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

### **3.5 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS**

- .1 When cleanup is complete:
  - .1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.
  - .2 Re-secure mounted objects removed in course of Work in their former positions.
  - .3 Re-establish mechanical and electrical systems in proper working order. Install new filters.
  - .4 Repair or replace objects damaged in the course of Work, as directed by Departmental Representative.

### **3.6 AIR MONITORING**

- .1 From beginning of Work until completion of cleaning operations, the Contractor is to take air samples on daily basis outside and inside Asbestos Work Area(s) in accordance with Provincial Occupational Health and Safety Regulations.
  - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial Occupational Health and Safety Regulations.
- .2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
  - .1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.

- .2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to Asbestos Work Area
- .3 During course of Work, the Contractor to measure fibre content of air outside work areas by means air samples analyzed by Phase Contrast Microscopy (PCM).
  - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .4 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, the Contractor will perform air monitoring within Asbestos Work Area by aggressive methods.
  - .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
  - .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
  - .3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

### **3.7**

#### **INSPECTION**

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by DCC Representative may result in Work stoppage, at no cost to the Government of Canada. Health and Safety Consultant must be onsite on a full time basis during abatement activities.
- .2 Health and Safety Consultant will inspect Work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Departmental Representative may order Work shutdown, at no cost to the Government of Canada.
  - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

**END OF SECTION**



**Part 1 General**

**1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Remove and dispose of the following lead-containing paint in poor condition at the Bunkhouse:
    - .1 Flaking, lead-containing brown paint applied to the wood siding and trim on the exterior.
  - .2 Remove and dispose of the following lead-containing paint in poor condition at Lot 20:
    - .1 Flaking, lead-containing white paint applied to the drywall within the basement of the Residence.
  - .3 Remove and dispose of the following lead-containing paints in poor condition at Lot 21:
    - .1 Flaking, lead-containing white paint applied to the wood deck on the exterior.
    - .2 Flaking, lead-containing grey paint applied to the wood deck on the exterior.
  4. Conduct leachate testing on concentrated lead-based paints waste prior to disposal. Dispose of lead-based paint waste at a licensed landfill in accordance with Alberta User Guide for Waste Managers.

**1.2 RELATED SECTIONS**

- .1 Section 02 82 00.01 Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.02 Asbestos Abatement – Intermediate Precautions
- .3 Section 02 82 00.03 Asbestos Abatement – Maximum Precautions
- .4 Section 02 84 00 Removal and Disposal of PCBs
- .5 Section 02 91 19 Removal and Disposal of ODS
- .6 Section 02 92 19 Removal and Disposal of Mercury Components
- .7 Section 02 99 00 Removal and Disposal of Radioactive Components

**1.3 REFERENCES**

- .1 Department of Justice Canada
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- .3 Human Resources and Social Development Canada (HRSDC)
  - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 Canadian Environmental Assessment Act (2012).
- .6 Canadian Environmental Protection Act (1999).
- .7 Alberta Building Code (2006).
- .8 Occupational Health and Safety Bulletin, Lead at the Work Site (2013).
- .9 Alberta Environmental Protection and Enhancement Act (AEPEA).
  - .1 Waste Control Regulation 129/1996, with amendments up to and including Alberta Regulation 31/2012.
  - .2 Alberta User Guide for Waste Managers.

#### **1.4 DEFINITIONS**

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Authorized Visitors: Departmental Representatives or designated representatives, and representatives of regulatory agencies.
- .3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.
- .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 0.05 micrograms per cubic meter of air (0.05 mg/m<sup>3</sup>) calculated as 8-hour occupational exposure limit (OEL). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic meter of air for removal of lead based paint by methods noted in paragraph 1.1.
- .6 Competent person: Individual capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.
- .7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

#### **1.5 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead-containing paint waste in accordance with requirements of authority having jurisdiction.
- .3 Provide proof of Contractor's General and Environmental Liability Insurance.

- .4 Quality Control:
  - .1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that lead based paint waste has been received and properly disposed.
  - .2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal, Provincial requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers and visitors in work Area include:
      - .1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters to execute the work.
      - .2 Half mask respirator: half-mask particulate respirator with P - series filter, and 99.97 % efficiency could be provided.
    - .2 Eating, drinking, chewing, and smoking are not permitted in work area.
    - .3 Ensure workers wash hands and face with warm water and antibacterial soap when leaving work area. Facilities for washing are required at the work area.
    - .4 Visitor Protection:
      - .1 Provide approved respirators to Authorized Visitors to work areas.
      - .2 Instruct Authorized Visitors procedures to be followed in entering and exiting work area.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Provincial regulations.
- .3 Dispose of lead waste in sealed double thickness 6 mil bags or leak proof drums. Label containers with appropriate warning labels.

- .4 Prepare manifests describing and listing waste being transported from the site. Transport waste in accordance with TDG Regulations. Dispose of waste at a licensed landfill in accordance with Alberta Environment and Parks.

## **1.8 EXISTING CONDITIONS**

- .1 Reports and information pertaining to lead-containing paint to be handled, removed, or otherwise disturbed and disposed of during this Project are available for inspection.
- .2 Notify Departmental Representative of suspect lead-containing paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by the Departmental Representative.

## **1.9 SCHEDULING**

- .1 Before beginning Work on this Project, notify the following in writing:
  - .1 The licensed landfill the intent to transport and dispose of lead-containing paint.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide Departmental Representative a copy of notifications prior to start of Work.

## **1.10 INSTRUCTION AND TRAINING**

- .1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.
- .2 Instruction and training related to respirators includes, at minimum:
  - .1 Proper fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Polyethylene 6 mil thick unless otherwise specified; in sheet size to minimize joints.
- .2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.

- .4 Lead waste containers: metal or fibre type acceptable to landfill operator with tightly fitting covers and 6 mil thickness sealable polyethylene liners.
  - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

### **Part 3 Execution**

#### **3.1 SUPERVISION**

- .1 Supervisor must remain at the worksite during disturbance, removal, or handling of lead based paints.

#### **3.2 PREPARATION**

- .1 Remove and store items from the work area to be salvaged or reused.
- .2 Work Area:
  - .1 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Minimize generation of airborne dust.
  - .2 Seal off building openings with polyethylene sheeting and seal with tape.
  - .3 Protect floor surfaces with rip-proof polyethylene sheeting.
  - .4 Where water application is required for wetting lead containing materials, provide temporary water supply appropriately sized for application of water as required.
- .3 Do not start work until:
  - .1 Arrangements have been made for disposal of waste.
  - .2 Tools, equipment, and materials waste containers are on site.
  - .3 Notifications have been completed and preparatory steps have been taken.

#### **3.3 LEAD ABATEMENT**

- .1 Removal of lead based coatings with non-powered hand tools.
- .2 Remove lead based paint in small sections and pack as it is being removed in sealable 6 mil plastic bags and place in labelled containers for transport.
- .3 Seal filled containers. Clean the external container surfaces thoroughly by wet sponging. Remove from immediate working area to staging area.
- .4 After inspection by Departmental Representative, apply continuous coat of slow drying sealer to surfaces of work area. Do not disturb work area for 8 hours no entry, activity, ventilation, or disturbance during this period.

#### **3.4 INSPECTION**

- .1 Perform inspection to confirm compliance with specification. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Government of Canada.

- .2 Departmental Representative will inspect work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

1. Comply with requirements of this Section when performing the following Work:
  - .1 Remove and dispose of PCB-containing ballasts from applicable light fixtures within the Bunkhouse and Lot 21.

**1.2 RELATED SECTIONS**

- .1 Section 02 82 00.01 Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.02 Asbestos Abatement – Intermediate Precautions
- .3 Section 02 82 00.03 Asbestos Abatement – Maximum Precautions
- .4 Section 02 83 19 Lead-Containing Paint Abatement
- .5 Section 02 91 19 Removal and Disposal of ODS
- .6 Section 02 92 19 Removal and Disposal of Mercury Components
- .7 Section 02 99 00 Removal and Disposal of Radioactive Components

**1.3 REFERENCES**

- .1 Perform work in accordance with the recommendations in the following Environment Canada publications:
  - .1 Handbook on PCBs in Electrical Equipment by Environment Canada.
  - .2 Identification of Fluorescent Lamp Ballasts Containing PCBs, EPS 2/CG/2, April 1986, by Environment Canada.
  - .3 Alberta Environmental Protection and Enhancement Act (AEPEA).
    - .1 Waste Control Regulation 129/1996, with amendments up to and including Alberta Regulation 31/2012.
    - .2 Alberta User Guide for Waste Managers.

**1.4 DEFINITIONS**

- .1 Removal means detachment of PCB-containing ballasts from applicable fixtures and includes preparation for disposal as described in this Section.
- .2 Disposal means transportation to specified disposal facility for permanent disposal, or to an approved site for temporary storage and subsequent transportation to the specified permanent disposal facility.

**1.5 CONTRACTOR QUALIFICATIONS**

- .1 Persons employed for the removal of ballasts shall be trained in the safe work procedures to do so. If man-lifts are used to access the ballasts then the operators must be certified to operate the lifts.
- .2 Where contact with liquid PCB is possible, personnel shall be instructed in handling procedures, safety precautions, use of safety equipment and applicable Alberta and Federal legislation and regulation.

## 1.6 CONTRACTOR QUALIFICATIONS

- .1 Handling and transportation of hazardous wastes shall be performed by a company registered as a carrier with Alberta Environment and Parks.
- .2 Ensure that all persons involved in handling, packing, loading, transportation, unloading, unpacking and disposal of PCB waste are trained in accordance with the Dangerous Goods Transportation and Handling Act.

## 1.7 REGULATORY REQUIREMENTS

- .1 Comply with the following:
  - .1 Canadian Environmental Protection Act (Canada);
  - .2 Environmental Contaminants Act (Canada);
  - .3 Environmental Protection and Enhancement Act (Alberta);
  - .4 Ozone Depleting Substances and Halocarbon Regulation (Alberta);
  - .5 Transportation of Dangerous Goods Act, 1992 (Canada);
  - .6 Dangerous Goods Transportation and Handling Act and Regulations (Alberta);
  - .7 Occupational Health and Safety Act, Regulation and Code (Alberta); and
  - .8 Other legislation and regulations which apply to the performance of the work of this section.

## 1.8 HANDLING AND WORKER PROTECTION

- .1 Require workers to wear PCB resistant gloves in addition to normal work clothing where exposure risk is low.
- .2 Provide workers with additional protective clothing and equipment where contact with liquid PCBs may occur. Provide clothing and equipment appropriate for the potential level of exposure.

## Part 2 Products

### 2.1 MATERIALS

- .1 Absorbent Material: PCB absorbent material which will create a quasi-solid product which can be swept or shoveled. Acceptable materials include:

|                       |                  |                 |
|-----------------------|------------------|-----------------|
| .1 Sawdust            | .5 Inbiber Beads | .9 Oil-Dry      |
| .2 Vermiculite        | .6 Hy-Dry        | .10 Conwed      |
| .3 Activated Charcoal | .7 Diasorb       | .11 3-M matting |
| .4 Oclansorb          | .8 Stay-Dry      | .12 Graboil     |
- .2 Disposal Drums: to CAN/CGSB-43.150-97, steel drum (1A2), 205 litre capacity, minimum 1.2 mm thick sheet steel, fitted with removable steel lids, with lid gaskets made of PCB resistant materials and meeting Transportation of Dangerous Goods Regulations and applicable provincial requirements.
- .3 Plastic Bags: to CAN/CGSB-43.150-97, minimum 150 micrometer thick sheet polyethylene. Bag seams shall be sufficiently strong to resist pressure and shocks that



occur under normal conditions of transport. Designed and manufactured to contain a maximum net mass of 50kg.

### **Part 3 Execution**

#### **3.1 IDENTIFICATION**

- .1 Inspect luminaries to identify ballasts containing PCBs. Take care to accurately identify capacitors and ballasts as PCB type or non-PCB type.
- .2 Following separation, request the Departmental Representative review the luminaries to document accuracy and quantity.

#### **3.2 REMOVAL OF LUMINARY CAPACITORS**

- .1 Remove all PCB containing capacitors and ballasts as follows:
  - .1 Light Fixtures: Remove ballast or capacitor. If capacitor or ballast is leaking (i.e. black residue) also dispose of the light fixture and any other possibly contaminated components of the light fixture.
- .2 Dispose of non-PCB containing capacitors and ballasts as construction waste.

#### **3.3 PREPARATION FOR DISPOSAL**

- .1 Place contaminated materials into plastic bags. Close bags securely using ties. Handle bags containing material to prevent bag puncture.
- .2 Place minimum 75 mm of absorbent material in bottom of drum.
- .3 Place plastic bags containing contaminated material into disposal drum.
- .4 Place capacitors and ballasts into drum with terminals facing up.
- .5 Package PCB contaminated gloves, work clothes and rags in plastic bags and place in drums.
- .6 Seal drums and store in a designated storage area pending transportation and disposal.
- .7 Label drums containing liquid PCB, contaminated material and equipment, with a Number 4 - Severe Hazard label.
- .8 Each container must be marked in accordance with the Dangerous Goods Transportation and Handling Act, showing the shipping name (polychlorinated biphenyl), the product identification number (UN2315) and a Class 9 label.

#### **3.4 TRANSPORTATION AND PERMANENT DISPOSAL**

- .1 Transport waste PCBs in accordance with the Alberta and Federal legislation and regulations.
- .2 Ensure that all materials are properly packaged and labeled prior to transportation.
- .3 Transport hazardous waste materials in properly placarded vehicles equipped with a rain and windproof box.
- .4 Each load shall be accompanied by a properly completed Transportation of Dangerous Goods Regulation (TDGR) Waste Manifest. Prepare manifests describing and listing

waste being transported from the site. Provide the owner with a copy of each waste manifest.

- .5 Arrange and pay for permanent disposal of PCBs and PCB contaminated material in an environmentally safe manner at the Alberta Special Waste Treatment Centre, in accordance with Alberta legislation and regulations.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Remove and dispose of equipment containing ozone-depleting substances (ODS) from within the Bunkhouse, Lot 20 and 21.

**1.2 RELATED SECTIONS**

- .1 Section 02 82 00.01 Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.02 Asbestos Abatement – Intermediate Precautions
- .3 Section 02 82 00.03 Asbestos Abatement – Maximum Precautions
- .4 Section 02 83 19 Lead-Containing Paint Abatement
- .5 Section 02 84 00 Removal and Disposal of PCBs
- .6 Section 02 92 19 Removal and Disposal of Mercury Components
- .7 Section 02 99 00 Removal and Disposal of Radioactive Components

**1.3 REFERENCES**

- .1 Comply with the following:
  - .1 Canadian Environmental Protection Act (Canada);
  - .2 Environmental Contaminants Act (Canada);
  - .3 Environmental Protection and Enhancement Act (Alberta);
  - .4 Ozone Depleting Substances and Halocarbon Regulation (Alberta);
  - .5 Transportation of Dangerous Goods Act, 1992 (Canada);
  - .6 Dangerous Goods Transportation and Handling Act and Regulations (Alberta);
  - .7 Occupational Health and Safety Act, Regulation and Code (Alberta); and
  - .8 Other legislation and regulations which apply to the performance of the work of this section.

**1.4 DEFINITIONS**

- .1 Removal means draining of all ODS/Halocarbon-containing refrigerants and includes preparation for disposal/recycling as described in this section.
- .2 Disposal/recycling means transportation to a specified disposal/recycling facility for permanent disposal, or to an approved site for temporary storage and subsequent transportation to the specified disposal/recycling facility.

**1.5 GENERAL NOTES**

- .1 The Contractor must remove all ODS and Halocarbon containing refrigerants from throughout the facility for identification and disposal. This is to include all refrigerants containing ODS or Halocarbons including but not limited to Chlorofluorocarbons (CFC's), Halons, Chlorocarbons, Hydrochlorofluorocarbons (HCFCs), Hydrofluorocarbons (HCFCs), and Perfluorocarbons (PFCs).

- .2 Quantities of all ODS and Halocarbon-containing refrigerants must be verified on site by all bidders prior to submission of tender. The Contractor shall be responsible to obtain all quantifications in areas detailed in this specification for estimating purposes at this site.
- .3 Submit waste shipping documents confirming that all ODS/Halocarbon-containing waste will be transported and disposed/recycled in accordance with Alberta Environment and TDG requirements to the Departmental Representative prior to the removal of each individual load of ODS/Halocarbon-containing waste from the site and complete shipping and disposal/recycle documents of ODS/Halocarbon-containing waste upon completion of the project.

#### **1.6 SCOPE OF WORK**

- .1 The scope of work may be generally described as removal and disposal/recycling of all ODS/Halocarbon-containing refrigerants from throughout the Bunkhouse and the Residences at Lots 20 and 21. The Contractor shall be responsible for the removal of all ODS/Halocarbon-containing refrigerants throughout the work the site. Quantities of all ODS/Halocarbon-containing refrigerants must be verified on site by all bidders prior to submission of tender.

#### **1.7 CONTRACTOR QUALIFICATIONS**

- .1 Use a qualified refrigeration specialist for removal and disposal/recycle of ODS/Halocarbon-containing refrigerants. Prior to collection and removal of ODS/Halocarbon-containing refrigerants from site, supply the Departmental Representative with the refrigeration specialist name and contact information.
- .2 All refrigerants shall be disposed of by the refrigeration specialist.

#### **1.8 DISPOSAL CONTRACTOR QUALIFICATIONS**

- .1 Handling and transportation of ODS/Halocarbon-containing refrigerants must be performed by a hazardous waste company registered as a carrier with Alberta Environment and Parks.
- .2 Carrier of hazardous wastes must have successfully completed a Transportation of Dangerous Goods course, acceptable to the Departmental Representative, within the past three years.
- .3 Submit detailed disposal/recycling procedures including emergency procedures in the event of a spill, and provide the name of the waste carrier and ODS/Halocarbon-containing refrigerants waste disposal/recycling facility to the Departmental Representative 72 hours prior to the waste being removed from site.

#### **1.9 RELATED WORK**

- .1 The Contractor must co-ordinate all electrical lockouts and shutdowns/isolations as required by this contract with the Departmental Representative

**1.10 HANDLING AND WORKER PROTECTION**

- .1 Require workers to wear chemical resistant gloves when removing ODS/Halocarbon-containing refrigerant where exposure risk is low.
- .2 Provide workers with additional protective clothing and respiratory equipment where contact with ODS/Halocarbon-containing refrigerant may occur. Provide clothing and equipment appropriate for the potential level of exposure. Equipment may include chemical resistant gloves, coveralls, safety glasses with side shields, and respirator approved by NIOSH.

**Part 2 Products (Not Used)**

**Part 3 Execution**

**3.1 OZONE DEPLETING SUBSTANCES AND HALOCARBON CONTAINING REFRIGERANT**

- .1 Locate all units with ODS/Halocarbon-containing refrigerants.
- .2 Refrigerant specialists shall remove all ODS/Halocarbon-containing refrigerants from the system it is used in, and recycle or dispose of properly.
- .3 Absorb all spills with absorptive material and immediately ventilate area.
- .4 Dispose/recycle all ODS/Halocarbon-containing refrigerants components by making disposal/recycle arrangements with a licensed disposal facility.
- .5 Contact the selected ODS/Halocarbon-containing refrigerants disposal/recycle facility to obtain their instructions for packaging, labelling and shipping of the ODS/Halocarbon-containing refrigerants components.
- .6 Provide a copy of the instructions for packaging, labelling and shipping of the ODS/Halocarbon-containing refrigerants components to the Departmental Representative prior to the waste being removed from site.
- .7 Package, label and ship ODS/Halocarbon-containing refrigerants in accordance with the waste disposal/recycling facility's instructions and in accordance with Alberta and Federal legislation and regulations governing the handling, transportation and disposal/recycling of ODS/Halocarbon-containing refrigerants.
- .8 Each load shall be accompanied by a properly completed Transportation of Dangerous Goods Regulation (TDGR) Waste Manifest. Provide the Departmental Representative with a copy of each waste manifest.
- .9 Arrange and pay for disposal/recycling of ODS/Halocarbon-containing refrigerants in an environmentally safe manner.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Remove and dispose of mercury-containing fluorescent light tubes throughout the Bunkhouse, and Lots 21 and 22.
  - .2 Remove and dispose of mercury-containing capsules in thermostats in the Residences at Lots 21 and 22.

**1.2 RELATED SECTIONS**

- .1 Section 02 82 00.01 Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.02 Asbestos Abatement – Intermediate Precautions
- .3 Section 02 82 00.03 Asbestos Abatement – Maximum Precautions
- .4 Section 02 83 19 Lead-Containing Paint Abatement
- .5 Section 02 84 00 Removal and Disposal of PCBs
- .6 Section 02 91 19 Removal and Disposal of ODS
- .7 Section 02 99 00 Removal and Disposal of Radioactive Components

**1.3 REFERENCES**

- .1 Comply with the following:
- .2 Canadian Environmental Protection Act (Canada);
- .3 Environmental Contaminants Act (Canada);
- .4 Environmental Protection and Enhancement Act (Alberta);
- .5 Ozone Depleting Substances and Halocarbon Regulation (Alberta);
- .6 Transportation of Dangerous Goods Act, 1992 (Canada);
- .7 Dangerous Goods Transportation and Handling Act and Regulations (Alberta);
- .8 Occupational Health and Safety Act, Regulation and Code (Alberta); and
- .9 Other legislation and regulations which apply to the performance of the work of this section.

**1.4 DEFINITIONS**

- .1 Removal means detachment of light tubes and thermostat capsules from applicable fixtures and includes preparation for recycling as described in this section.
- .2 Recycle means transportation to a specified recycling facility.

**1.5 GENERAL NOTES**

- .1 The Contractor must remove all mercury vapour-containing fluorescent light tubes and thermostat capsules from throughout the Bunkhouse and Residences for identification and recycling.

- .2 Provide to the Departmental Representative copies of MSDS sheets of absorbent materials.
- .3 Submit shipping documents confirming that all mercury vapour-containing fluorescent light tubes and thermostat capsules will be transported in accordance with Alberta Environment and Parks and TDG requirements to the Departmental Representative prior to the removal of each individual load of mercury vapour-containing fluorescent light tubes and thermostat capsules from the site and complete shipping documents of mercury vapour-containing fluorescent light tubes and thermostat capsules upon completion of the project.
- .4 At least 72 hours prior to commencing hazardous materials removal, the Contractor shall submit a detailed schedule for review Departmental Representative prior to the start of work.

#### **1.6 SCOPE OF WORK**

- .1 The scope of work may be generally described as the removal and transportation of all mercury vapour-containing fluorescent light tubes and thermostat capsules from throughout the Bunkhouse and Residences to a designated recycling facility. The Contractor shall be responsible for the removal of all mercury vapour-containing fluorescent light tubes and thermostat capsules throughout the sites. Quantities of all mercury vapour-containing fluorescent light tubes and thermostat capsules must be verified on site by all bidders prior to submission of tender.

#### **1.7 REMOVAL CONTRACTOR QUALIFICATIONS**

- .1 Use a qualified electrician to fully isolate all fluorescent lights and thermostats prior to conducting removal, packaging, and making transportation arrangements for recycling of mercury vapour-containing fluorescent light tubes and thermostat capsules.

#### **1.8 RECYCLING CONTRACTOR QUALIFICATIONS**

- .1 Handling and transportation of mercury components must be performed by a hazardous waste company registered as a carrier with Alberta Environment and Parks.
- .2 Carrier of hazardous wastes must have successfully completed a Transportation of Dangerous Goods course, acceptable to the Departmental Representative, within the past three years. 72 hours prior to removal of mercury waste from site, supply the Departmental Representative with the carrier's name and contact information.
- .3 Submit detailed recycling procedures including emergency procedures in the event of a spill, and provide the name of the waste carrier and recycling facility to the Departmental Representative prior to the waste being removed from site.

#### **1.9 RELATED WORK**

- .1 The Contractor must co-ordinate all electrical lockouts and shutdowns/isolations as required by this contract with the Departmental Representative.

#### **1.10 HANDLING AND WORKER PROTECTION**

- .1 Require workers to wear normal work clothing (exposure risk is low).

- .2 Provide workers with half-mask respirators equipped with mercury vapour cartridges as an added protection factor in case the tubes or capsules are accidentally broken.

**Part 2 Products**

- .1 Absorbent Material: Mercury absorbent material which may include calcium poly-sulphide or Sulphur based absorbent materials.

**Part 3 Execution**

**3.1 Mercury-Containing Equipment**

- .1 Locate and remove all mercury vapour-containing light tubes and thermostat capsules to be recycled.
- .2 Place all mercury vapour-containing light tubes and capsules into an impervious container packed with absorptive material.

**3.2 TRANSPORTATION AND RECYCLING**

- .1 Transport waste mercury components in accordance with the Alberta and Federal legislation and regulations.
- .2 Ensure that all materials are properly packaged and labelled prior to transportation.
- .3 Recycle mercury vapour-containing light tubes and capsules by making recycling arrangements with a licensed mercury recycling facility.
- .4 Contact the selected mercury recycling facility to obtain their instructions for packaging, labelling, and shipping of the mercury vapour-containing light tubes and capsules.
- .5 Provide a copy of instructions for packaging, labelling, and shipping of the mercury vapour-containing light tubes and capsules to the Departmental Representative prior to the waste being removed from site.
- .6 Package, label, and ship mercury vapour-containing light tubes and capsules in accordance with the waste recycling facility's instructions and in accordance with Alberta and Federal legislation and regulations governing the handling, transportation and recycling of mercury vapour-containing light tubes and capsules.
- .7 Transport hazardous waste materials in properly placarded vehicles.
- .8 Each load shall be accompanied by a properly completed Transportation of Dangerous Goods Regulation (TDGR) Waste Manifest. Provide the Departmental Representative with a copy of each waste manifest.
- .9 Use an approved hazardous waste company to transport and recycle mercury-vapour-containing light tubes and capsules.
- .10 Arrange and pay for recycling of mercury vapour-containing light tubes and capsules in an environmentally safe manner.

**END OF SECTION**



**Part 1 General**

**1.1 SUMMARY**

1. Comply with requirements of this Section when performing the following Work:
  - .1 Remove and dispose of smoke detectors with radioactive components within the Bunkhouse, Lot 20 and Lot 21.

**1.2 RELATED SECTIONS**

- .1 Section 02 82 00.01 Asbestos Abatement – Minimum Precautions
- .2 Section 02 82 00.02 Asbestos Abatement – Intermediate Precautions
- .3 Section 02 82 00.03 Asbestos Abatement – Maximum Precautions
- .4 Section 02 83 19 Lead-Containing Paint Abatement
- .5 Section 02 84 00 Removal and Disposal of PCBs
- .6 Section 02 91 19 Removal and Disposal of ODS
- .7 Section 02 92 19 Removal and Disposal of Mercury Components

**1.3 REFERENCES**

- .1 Comply with the following (current editions):
  - .1 Canadian Environmental Protection Act (Canada);
  - .2 Environmental Contaminants Act (Canada);
  - .3 Environmental Protection and Enhancement Act (Alberta);
  - .4 Ozone Depleting Substances and Halocarbon Regulation (Alberta);
  - .5 Transportation of Dangerous Goods Act, 1992 (Canada);
  - .6 Dangerous Goods Transportation and Handling Act and Regulations (Alberta);
  - .7 Occupational Health and Safety Act, Regulation and Code (Alberta); and
  - .8 Other legislation and regulations which apply to the performance of the work of this section.

**1.4 DEFINITIONS**

- .1 Removal means detachment of radioactive components from applicable smoke detectors and includes preparation for disposal as described in this section.

**1.5 GENERAL NOTES**

- .1 The Contractor must remove all smoke detectors scheduled to be impacted by the demolition and renovation activities from the work areas for disposal.
- .2 All submittals are to be forwarded to the Departmental Representative a minimum of 72 hours prior to commencing the project.
- .3 Quantities of all radioactive building components must be verified on site by all bidders prior to submission of tender. The Contractor shall be responsible to obtain all quantifications throughout the site.

- .4 Submit waste shipping documents confirming that all radioactive building components will be transported and disposed/recycled in accordance with Alberta Environment and Parks and TDG requirements to the Environmental Consultant prior to the removal of each individual load of radioactive building components from the site and complete shipping and disposal/recycle documents of radioactive building components upon completion of the project.
- .5 At least 72 hours prior to commencing hazardous materials removal, the Contractor shall submit a detailed schedule for review by Departmental Representative prior to the start of work.

## **1.6 SCOPE OF WORK**

- .1 The scope of work may be generally described as the removal and disposal of all smoke detectors with radioactive substances from throughout the Bunkhouse, Lot 20 and Lot 21. The Contractor shall be responsible for the removal of all radioactive building materials throughout the site. Quantities of all radioactive building materials must be verified on site by all bidders prior to submission of tender.

## **1.7 CONTRACTOR QUALIFICATIONS**

- .1 Use a qualified electrician to fully isolate all smoke detectors prior to conducting removal, packaging, and transportation for disposal of each smoke detector with radioactive components.

## **1.8 RELATED WORK**

- .1 The Contractor must co-ordinate all electrical lockouts and shutdowns/isolations as required by this contract with the Owner.

## **1.9 HANDLING AND WORKER PROTECTION**

- .1 Require workers to wear normal work clothing (exposure risk is low).

## **Part 2 Products (Not Used)**

## **Part 3 Execution**

### **3.1 SMOKE DETECTOR REMOVAL**

- .1 Disconnect smoke detectors from electrical supply using a qualified electrician.
- .2 Remove radioactive components from smoke detector and identify type and quantity of radioactive component.
- .3 Dispose of remaining smoke detector shell as normal construction waste.
- .4 Dispose of all radioactive smoke detector components as radioactive waste when, smoke detectors:
  - .1 contain 5 microcuries (185 kilobecquerels) or more of Americium-241 or any amount of Radium; and

- .2 containing less than 5 microcuries (185 kilobecquerels) of Americium-241 are disposed of in quantities of ten or more.

### **3.2 TRANSPORTATION AND RECYCLING**

- .1 Dispose/recycle waste radioactive building components by making disposal/recycle arrangement with one of the following radioactive waste disposal facilities:
  - .1 Original equipment manufacturer.
  - .2 Waste Operations Branch  
Atomic Energy of Canada Ltd.  
Chalk River, Ontario K0J 1J0  
Contact: (613) 584-3311 for further details.
  - .3 Atomic Energy of Canada licensed waste disposal facility.
- .2 Contact the selected disposal/recycle facility to obtain their instructions for packaging, labelling, and shipping of the waste radioactive building components.
- .3 Provide a copy of the instructions for packaging, labelling, and shipping of the waste materials to the Departmental Representative prior to the waste being removed from site.
- .4 Transport waste materials in accordance with the Alberta and Federal legislation and regulations.
- .5 Package, label, and ship waste materials in accordance with the waste disposal/recycling facility's instructions and in accordance with Alberta and Federal legislation and regulations governing the handling, transportation and disposal/recycling of radioactive building components.
- .6 Transport hazardous materials in properly placarded vehicles equipped with a rain and windproof box.
- .7 Each load shall be accompanied by a properly completed Transportation of Dangerous Goods Regulation (TDRG) Waste Manifest.
- .8 Arrange and pay for disposal/recycle of radioactive building components in an environmentally safe manner.
- .9 Provide copies of the disposal or recycle confirmation information to the Departmental Representative

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 20 00 - Concrete Reinforcing
- .2 Section 03 30 00 - Cast-In-Place Concrete

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-O86-14, Engineering Design in Wood.
  - .3 CSA O121-08 (R2013), Douglas Fir Plywood.
  - .4 CSA O151-09, Canadian Softwood Plywood.
  - .5 CSA O153-13, Poplar Plywood.
  - .6 CAN/CSA-O325.07 (R2003), Construction Sheathing.
  - .7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
  - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
  - .9 CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada
- .2 COFI (Council of Forest Industries of British Columbia)
  - .1 Exterior Plywood for Concrete Formwork
- .3 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Where there are differences between the specifications and drawings and the codes, standards or acts, the most stringent shall govern.
- .2 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submit shop drawings for formwork and falsework.
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada for foundation wall and stair wall formwork.
- .4 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .5 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
- .6 Indicate method and schedule of construction, stripping, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

- .7 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .8 All embedded items, openings, sleeves, chases are not necessarily shown on the structural drawings nor are their sizes or locations shown. Refer to architectural, mechanical and electrical drawings and specifications and the detailed shop drawings prepared by the appropriate Trade Contractors for openings and sleeving requirements not shown, located and dimensioned on the structural drawings.

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

- .1 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for 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.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86 and CSA – 0325.
  - .2 Rigid insulation board: to CAN/ULC-S701.
- .3 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.
  - .1 Spiral pattern to show in hardened concrete.
- .4 Exposed surfaces: form materials for concrete surfaces which will be exposed to interior view, or which require smooth and uniform surfaces for applied finished or other purposes, shall be formed with square panels of plywood. The panels shall be square and made in a true plane, clean, free of holes, surface markings and defects.
- .5 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
  - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .6 Form release agent: shall be a proprietary material which will not stain the concrete or impair the natural bonding or colour characteristics of coating intended for use on the concrete.
- .7 Sealant: to Section 07 92 00 - Joint Sealants.

**Part 3 Execution**

**3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Perform forming operations and place hardware so that finished concrete will be within the tolerances set out in CSA A23.1. These tolerances are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.
- .3 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .4 Hand trim sides and bottoms and remove loose earth and water from earth forms before placing concrete.
- .5 Concrete surfaces which will be exposed to interior view shall be cleaned and grinded as required to ensue no sharp edges or rated joint lines.
- .6 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .7 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9 Form chases, slots, openings, drips, recesses, and control joints as indicated.
- .10 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .11 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

**3.2 FORMWORK REMOVAL**

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 1 to 2 days for walls.
  - .2 1 day for footings.
- .2 Re-use formwork subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 30 00 - Cast-In-Place Concrete.

**1.2 PRICE AND PAYMENT PROCEDURES**

- .1 Measurement and Payment:
  - .1 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.

**1.3 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.
- .3 CSA International
  - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3-14, 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.

**1.4 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 SP-66.

- .3 Shop Drawings:
  - .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 the 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.
    - .1 Provide tension lap Class B where indicated unless otherwise indicated.

## **1.5 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 2 weeks prior to beginning reinforcing work.
  - .2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

## **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 400, 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 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.
- .9 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .10 Mechanical splices: subject to approval Departmental Representative.

## **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with 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.

## **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 the 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 in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

**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 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 03 10 00 – Concrete Forming and Accessories.
- .2 Section 02 20 00 – Concrete Reinforcing.

**1.2 REFERENCES**

- .1 Reference Standards:
  - .1 ASTM International
    - .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
    - .2 ASTM C494/C494M-10a, Standard Specification for Chemical Admixtures for Concrete.
    - .3 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
    - .4 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .2 CSA International
    - .1 CSA A23.1/A23.2-14, 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 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation Meetings: Convene pre-installation meeting one week prior to beginning concrete works.
  - .1 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor - finishing, forming, concrete producer, testing laboratories attend. Teleconference is preferable.
    - .1 Verify project requirements.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.
- .3 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.

**1.5 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Departmental Representative, minimum 4 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.
  - .7 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.
- .5 Sustainability Standards Certification:
  - .1 Construction Waste Management: provide copy of plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.6 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.

**2.2 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.

**2.3 MATERIALS**

- .1 Portland Cement: to CSA A3001, Type GU.
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.
- .4 Admixtures:
  - .1 Air entraining admixture: to ASTM C260.
  - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

**2.4 MIXES**

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental 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 Refer to structural drawings for mix types.
  - .3 Provide quality management plan to ensure verification of concrete quality to specified performance.
  - .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

**2.5 SEALING COMPOUNDS**

- .1 Surface Sealer: Water-based, clear colour, maximum VOC limit of 250 g/L

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete.
  - .1 Provide 48 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 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 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 Sleeves and inserts:
  - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through footings and foundation walls by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
  - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
  - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor rods:
  - .1 Set anchor rods to templates in co-ordination with appropriate trade prior to placing concrete.
  - .2 Grout anchor rods in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
    - .1 Drilled holes: to manufacturers' recommendations.
  - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
  - .4 Set bolts and fill holes with epoxy grout per manufacturers' specifications.
- .4 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Finish concrete floor to CSA A23.1/A23.2. Class N-CF
  - .3 Provide troweled finish unless otherwise indicated.
  - .4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
  - .5 Seal all slabs on grade with a surface sealer. Sealer to be installed in accordance with manufacturer's written instructions. Clean over-spray and all sealant from adjacent surfaces. Sealant shall not be applied prior to 28 days curing time.

- .5 Toppings:
  - .1 Topping mixture to meet minimum requirements as follows: Monolithic, mm thick: 38, density: 70kg/m<sup>2</sup>.
  - .2 Place monolithic topping to CSA A23.1/A23.2 and topping manufacturer's recommendations.
- .6 Use bond breaker to separate slabs-on-grade from vertical surfaces.

### **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 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .5 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 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 06 10 00 - Rough Carpentry
- .2 Section 07 21 13 - Board Insulation
- .3 Section 07 21 16 - Blanket Insulation
- .4 Section 07 27 00 - Air Barriers - Performance
- .5 Section 07 62 00 - Metal Flashing and Trim
- .6 Section 07 92 00 - Joint Sealants

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C39/C39M-15a - Compressive Strength of Cylindrical Concrete Specimens.
  - .2 ASTM C67-12 - Sampling and Testing Brick and Structural Clay Tile.
  - .3 ASTM C177-10 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - .4 ASTM C192/C192M-15 - Making and Curing Concrete Test Specimens in the Laboratory.
  - .5 ASTM C482-02 (2014) - Bond Strength of Ceramic Tile to Portland Cement Paste.
  - .6 ASTM E84-15b - Surface Burning Characteristics of Building Materials.
  - .7 ASTM c847-14a – Standard Specification for Metal Lath
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.32-M77 - Sheathing, Membrane, Breather Type.
- .3 CSA International
  - .1 CAN/CSA A179-04 (R2014) - Mortar and Grout for Unit Masonry.
  - .2 CAN/CSA A371-04 (R2014) - Masonry Construction for Buildings.
  - .3 CSA A23.1-09/A23.2-09 (R2014) - Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
  - .4 CSA A3000-13 - Cementitious Materials Compendium.
  - .5 CSA S304.1-04 (R2010) – Design of Masonry Structures.
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 ULC/CAN4 S114-M80 (R1997) – Standard Method of Test for Determination of Non-Combustibility in Building Materials.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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



- .2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit product literature indicating manufactured masonry and application materials including mortar colour charts, rainscreen material, and weather resistant barrier.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Masonry Units: Show sizes, profiles, spacing, details, and locations of special shapes.
  - .2 Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
- .4 Provide samples: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit 300 x 300 mm panel containing samples of specified manufactured masonry showing full range of colours and textures and complete with specified mortar.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports:
    - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

#### **1.4 CLOSEOUT SUBMITTALS**

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

#### **1.5 QUALITY ASSURANCE**

- .1 Certifications: 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 1200 x 1200 mm mock-up of manufactured masonry veneer showing colours and textures, use of reinforcement, mesh, rainscreen drainage, termination details, coursing, mortar, and workmanship.
  - .3 Mock-up will be used:
    - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
  - .4 Locate where directed.
  - .5 Coordinate construction of mock-up with regular site meetings for inspection of mock-up before proceeding with work.

- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work.
- .7 Approved mock-up may 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 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Store moisture-sensitive materials in weather protected enclosures.

**1.7 PROJECT/SITE CONDITIONS**

- .1 Environmental Requirements: Maintain materials and ambient temperature in area of installation at minimum 4°C (40°F) prior to, during, and for 48 hours following installation.
- .2 Comply with requirements of CSA A371 for hot and cold weather requirements for installation of manufactured masonry.
- .3 Replace defective or damaged materials with new.

**1.8 WARRANTY**

- .1 Product Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing for a period of fifty (50) years following date of Final Acceptance.

**Part 2 Products**

**2.1 MANUFACTURED MASONRY MATERIALS**

- .1 Acceptable Products
  - .1 Cultured Stone by Boral Stone Products
  - .2 Coronado Stone Products
  - .3 OR Pre-approved Alternate
- .2 Accessories
  - .1 Corners - preformed
- .3 Single Texture Manufactured Stone Veneer:
  - .1 Thin Brick Veneer: Spring
  - .2 Size: 75mm(3") to 254mm(10") nominal
  - .3 Thickness:
    - .1 Standard - Varies from 19mm(0.75") near edge up to 64mm(2.5") at center section.
    - .2 Skippers – 25mm-50mm(1"-2") in height and up to 150mm(6") in length.

- .4 Architectural Trim:
  - .1 Pier Capstones:
    - .1 Texture: Flagstone
    - .2 Color: Grey, to match Trimstones/Wall Capstones/Sills
    - .3 Size: As shown on Drawings
    - .4 Provide sloped top surface and drip edge.
  - .2 Trimstones/Wall Capstones/Sills:
    - .1 Color: Grey
    - .2 Size: As shown on Drawings
    - .3 Provide sloped top surface and drip edge.
- .5 Manufactured Masonry Physical Properties:
  - .1 Compressive Strength: ASTM C192 and ASTM C39, 12.4 MPa (1800 psi), five (5) specimen average, 10.3 MPa (1500 psi) minimum for individual unit.
  - .2 Bond Between Stone Unit, Type S Mortar, and Backing: ASTM C482, 345 kPa (50 psi).
  - .3 Thermal Resistance: ASTM C177, R-factor, 0.355 per 25.4 mm (1 inch) of thickness.
  - .4 Freeze/Thaw: ASTM C67, no disintegration and less than 3 percent weight loss.
  - .5 Combustibility: ULC/CAN4 S114-M80, passes.
  - .6 Fire Hazard Test: to Underwriters Laboratories listing, flame spread/smoke developed 0/0.
  - .7 Fire Hazard Test: ASTM E84, Class A (Class I).
  - .8 Maximum Veneer Unit Weight: 73 kg/m<sup>2</sup> (15 psf).

## **2.2 RELATED MATERIALS**

- .1 Asphalt Impregnated Building Paper: CAN/CGSB-51.32, heavy duty asphalt-saturated kraft paper, minimum 3.5 lb/100 ft<sup>2</sup> water resistance rating 30-45 minutes.
- .2 Metal Lath: 1.3 mm (18 gauge) woven wire mesh.
- .3 Flashing: As specified in Section 07 62 00.
- .4 Fasteners:
  - .1 Into Wood Studs: Minimum 3 mm (0.120 inch) shank diameter galvanized nails or staples of sufficient length to penetrate 35 mm (1-3/8 inches) minimum into the stud.
  - .2 Into Metal Studs: Minimum 11.1 mm (7/16 inch) head diameter, corrosion-resistant, self-drilling, self-tapping, pancake head screws of sufficient length to penetrate 10 mm (3/8 inch) minimum into the stud.
- .5 Mortar: Premixed Type N or mortar mixed using components and proportions following manufactured masonry manufacturer's installation instructions. Comply with CAN/CSA A179.
- .6 Mortar Colour: Iron oxide pigments, Dark Grey

- .7 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .8 Weep Screed as required for installation over framed construction.

**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 asphalt shingles installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .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 PREPARATION**

- .1 Protection: Prevent work from occurring on the opposite of walls to which manufactured masonry is applied during and for 48 hours following installation of the manufactured masonry.
- .2 Surface Preparation: Follow manufacturer's instructions designated below for the appropriate type of manufactured masonry and substrate.
- .3 Clean surfaces thoroughly and allow to dry prior to installation.

**3.3 FLASHINGS**

- .1 Install flashings as specified in Section 07 62 00 and as indicated.

**3.4 INSTALLATION**

- .1 Install manufactured masonry products in accordance with manufacturer's installation instructions using grouted joints.
- .2 Blend the stone on the wall from several different boxes to ensure proper colour and size variations
- .3 Install architectural trim products in accordance with manufacturer's installation instructions.]
- .4 Install/Apply Related Materials specified above in accordance with type of substrate and manufactured masonry manufacturer's installation instructions.

**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 Clean manufactured masonry in accordance with manufacturer's installation instructions.
- .4 Waste Management: separate waste materials for 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.

**3.6 PROTECTION**

- .1 Protect finished work from rain during and for 48 hours following installation.
- .2 Protect finished work from damage during remainder of construction period.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00 – Cast In Place Concrete.
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 06 17 53 – Shop Fabricated Wood Trusses

**1.2 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.
  - .2 ASTM A193/A193M-08, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
  - .3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .4 ASTM A325M-[08], Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength[Metric].
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-85.10-[99], Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
  - .1 Handbook of the Canadian Institute of Steel Construction.
  - .2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-S16-14, Limit States Design of Steel Structures.
  - .3 CSA W47.1-14, Certification of Companies for Fusion Welding of Steel.
  - .4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .5 CSA W55.3-1965(R2003), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .6 CSA W59-14, Welded Steel Construction (Metal Arc Welding).
  - .7 NACE No. 3/SSPC SP-6-06, Commercial Blast Cleaning.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Alberta, Canada.

- .3 Erection drawings:
  - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
    - .1 Description of methods.
    - .2 Sequence of erection.
    - .3 Type of equipment used in erection.
    - .4 Temporary bracings.
- .4 Fabrication drawings:
  - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Alberta, Canada.
- .5 Source Quality Control Submittals:
  - .1 Submit 1 copy of mill test reports 4 weeks prior to fabrication of structural steel.
    - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
    - .2 Provide mill test reports certified by metallurgists qualified to practice in the Province of Alberta, Canada.
- .6 Fabricator Reports:
  - .1 Provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.
- .3 Packaging Waste Management in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 DESIGN REQUIREMENTS**

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 to resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
  - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.

- .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in the Province of Alberta, Canada for non standard connections.

## **2.2 MATERIALS**

- .1 Structural steel: to CSA-G40.20/G40.21 Grade as indicated 300W.
- .2 Anchor bolts: to CSA-G40.20/G40.21, Grade 300W.
- .3 Bolts, nuts and washers: to ASTM A307 and ASTM A325.
- .4 Welding materials: to CSA W48 Series and CSA W59 and certified by Canadian Welding Bureau.
- .5 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, grey.
- .6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m<sup>2</sup>.

## **2.3 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.

## **2.4 SHOP PAINTING**

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.
- .3 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .4 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .5 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

## **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 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.



- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

### **3.3 CONNECTION TO EXISTING WORK**

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

### **3.4 MARKING**

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

### **3.5 ERECTION**

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Departmental Representative.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

### **3.6 FIELD QUALITY CONTROL**

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.
- .3 Submit test reports to Departmental Representative within 1 weeks of completion of inspection.

### **3.7 FIELD PAINTING**

- .1 Paint in accordance with Section 09 91 23 - Interior Painting.
  - .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

### **3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials 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 03 30 00 - Cast in Place Concrete
- .2 Section 06 10 00 - Rough Carpentry

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A307-14: Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2 ASTM A325/A325M-14: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .3 ASTM B209/B209M-14: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - .4 ASTM B210/B210M-12: Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
  - .1 ASTM B221M-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
  - .2 ASTM B241/B241M-12e1, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
  - .3 ASTM B483/B483M-13e1, Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes For General Purpose Applications.
  - .4 ASTM E935-13e1, Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
- .2 CSA International
  - .1 CAN/CSA-S157-05/S157.1-05 (R2015) Strength Design in Aluminum / Commentary on CSA-S157.1-05 Strength Design In Aluminum
  - .2 CSA Standard W47.2-M1987(R2015): Certification of Companies for Fusion Welding of Aluminum
  - .3 CSA W55.3-08: Certification of companies for resistance welding of steel and aluminum.
  - .4 CSA W59-03 (R2008): Welded Steel Construction (Metal-Arc Welding).
  - .5 CSA W59.2-M1991(R2013): Welded Aluminum Construction.

**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 handrails 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 Alberta, Canada.
    - .1 Indicate profiles, colours, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
    - .2 Indicate compliance with all Alberta Building Code 2006 requirements
    - .3 Include erection drawings, elevations and details where applicable

#### **1.4 QUALITY ASSURANCE**

- .1 Perform welding to CSA W59.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 from[nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 DESIGN CRITERIA**

- .1 Design all handrails, guard rails and railing assemblies, to withstand all superimposed loading, including all Alberta Building Code 2006 loading requirements. Test in accordance with ASTM A935.

#### **2.2 ALUMINUM RAILING**

- .1 Rails: 38 mm diameter, extruded tubing. Equip all changes in direction of the top handrail (ie. At corners, returns and the like) with a prefabricated sleeve to splice the sections of the top handrail together. Mitering of adjacent sections of the handrail will not be accepted.
- .2 End Posts: square profile, size to suit.
- .3 Line Posts: square profile, size to suit.
- .4 Fittings: elbows, T-shapes, wall brackets, escutcheons; as required.
- .5 All aluminum extrusions and shapes to be alloy 6006 T6.
- .6 Aluminum sheets: alloy 3000 series
- .7 All other aluminum structural shapes are alloy 6351-T6

- .8 Anchor Bolts: For concrete slab and walls - expansion anchoring system are to be used. For other wall connection - sleeve expansion anchors are to be used.
- .9 Wall mounted railings: manufacturer's standard brackets for mounting rails to walls to meet all Alberta Building Code requirements.
- .10 Exposed Fasteners: corrosion resistant flush countersunk screws or bolts; consistent with design of railing.
- .11 All bolts and lag screws are grade 304 stainless steel and conform to ASTM A307.
- .12 Screws, clips, fasteners and accessories: manufacturer's standard components as required to meet all code requirements
- .13 Finish coatings to AAMA 2603-02. Colour from standard colour range.
- .14 Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

### **2.3 FABRICATION**

- .1 Fit and shop assemble components in largest practical sizes for delivery to site.
- .2 Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- .3 Provide anchors, plates, angles required for connecting railings to structure.
- .4 Exposed Mechanical Fastenings: flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
  - .1 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
  - .2 Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
  - .3 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
  - .4 Accurately assemble components to each other and to building structure.
  - .5 Accommodate for expansion and contraction of members and building movement without damage to connections or members.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for handrail installation in accordance with manufacturer's written instructions.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Install aluminum handrails in accordance with manufacturer's instructions and reviewed shop drawings and to the layout indicated on the drawings.
- .2 Take site measurements to ensure that railings are fabricated to fit surrounding construction, around obstructions and projections in place, as shown on the drawings, and to suit service locations.
- .3 Install components plumb and level.
- .4 Anchor railings to structure with anchors.
- .5 Back prime with bituminous paint all aluminum surfaces in contact with concrete or masonry
- .6 Field weld anchors as indicate:
  - .1 Grind welds smooth.
  - .2 Touch-up welds with primer.
- .7 Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- .8 Assemble with spigots and sleeves to accommodate tight inconspicuous joints and secure installation.
- .9 Use corrosion resistant fasteners for all locations
- .10 Replace items damaged in course of installation

### **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.

### **3.4 PROTECTION**

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

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1     Section 05 12 23 - Structural Steel for Buildings.
- .2     Section 06 13 00 - Heavy Timber Construction
- .3     Section 06 17 53 - Shop Fabricated Wood Trusses.
- .4     Section 06 20 00 - Finish Carpentry
- .5     Section 06 40 00 - Architectural Woodwork
- .6     Section 09 21 16 - Gypsum Board Assemblies
- .7     Section 10 28 10 - Toilet and Bath Accessories

**1.2               REFERENCES**

- .1     ASTM International
  - .1     ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2     ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvaneal) by the Hot-Dip Process.
  - .3     ASTM C1396/C1396M-11, Standard Specification for Gypsum Board.
  - .4     ASTM D1761-06, Standard Test Methods for Mechanical Fasteners in Wood.
  - .5     ASTM D5055-11, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
  - .6     ASTM D5456-11, Standard Specification for Evaluation of Structural Composite Lumber Products.
- .2     Canadian General Standards Board (CGSB)
  - .1     CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .2     CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.
  - .3     CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .3     CSA International
  - .1     CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
  - .2     CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
  - .3     CSA O121-08, Douglas Fir Plywood.
  - .4     CAN/CSA O122-06(R2011), Structural Glued-Laminated Timber.
  - .5     CSA O141-05(R2009), Softwood Lumber.
  - .6     CSA O151-09, Canadian Softwood Plywood.
  - .7     CSA O153-M1980(R2008), Poplar Plywood.
  - .8     CSA O325-07, Construction Sheathing.
  - .9     CAN/CSA-Z809-08, Sustainable Forest Management.

- .4 The Truss Plate Institute of Canada
  - .1 Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses 2007.

**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 wood products and 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 the Province of Alberta, Canada.

**1.4 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.
- .3 Sustainable Standards Certification:
  - .1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

**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 Store and protect wood from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

**Part 2 Products**

**2.1 FRAMING STRUCTURAL AND PANEL MATERIALS**

- .1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Glulam in accordance with Structural Glued-Laminated Timber CAN/CSA-O122.
- .3 Wood I-joists in accordance with Prefabricated Wood I-Joists ASTM D5055.
- .4 Light-frame trusses in accordance with "Truss Design and Procedures for Light Metal Connected Wood Trusses", The Truss Plate Institute of Canada.
- .5 Structural Composite Lumber (SCL) in accordance with ASTM D5456.
- .6 Framing and board lumber: in accordance with NBC.
- .7 Furring, blocking, nailing strips, grounds, rough bucks, 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.
- .8 Plywood, OSB and wood based composite panels: to CSA O325.
- .9 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .10 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .11 Poplar plywood (PP): to CSA O153, standard construction.
- .12 Gypsum sheathing: to ASTM C1396/C1396M.

**2.2 ACCESSORIES**

- .1 Air seal: closed cell polyurethane or polyethylene.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .3 Nails, spikes and staples: to CSA B111.
- .4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, engineered wood screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .6 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.
- .7 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy type approved by Departmental Representative.



- .8 Fastener Finishes:
  - .1 Stainless steel: use stainless steel 304 alloy for exterior exposed entrance canopy framing.
- .9 Steel columns: in accordance with 05 12 23 Structural Steel for Buildings:
  - .1 Provide all connection forces to steel fabricator.
  - .2 Coordinate geometry of all wood to steel connections.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 PREPARATION**

- .1 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .2 Treat material as indicated.

#### **3.3 MATERIAL USAGE**

- .1 Refer to structural drawings for roof sheathing, exterior wall sheathing, and subflooring.

#### **3.4 INSTALLATION**

- .1 Install members true to line, levels and elevations, square and plumb.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.
- .4 Select exposed framing for appearance. Install lumber materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .5 Install subflooring with panel end-joints located on solid bearing, staggered at least 800 mm.
  - .1 In addition to mechanical fasteners, floor panels secure floor subflooring to floor joists using glue and screws. Place continuous adhesive bead in accordance with manufacturer's instructions, single-bead on each joist and double-bead on joists where panel ends butt.

- .6 Install roof sheathing in accordance with requirements of NBC.
- .7 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.
- .8 Install blocking for future barrier free grab bars and fixtures as indicated on drawings.
- .9 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .10 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .11 Install sleepers as indicated.
- .12 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- .13 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .14 Countersink bolts where necessary to provide clearance for other work.
- .15 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.
- .16 Coordinate structural steel column detailing, fabrication, and installation.
- .17 Provide loads and connection geometry to steel fabricator.

### **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 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.

### **3.6 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00 - Cast-in-Place Concrete

**1.2 REFERENCES**

- .1 CSA O86 Consolidation-14, Engineering Design in Wood.

**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 wood species and include product characteristics, performance criteria, mechanical properties, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Alberta., Canada.
  - .2 Include on drawings:
    - .1 Each shop drawing submission showing connection details indicating connector types, screw length and diameter, screw finish, location, and design values for bearing elements and truss members.
    - .2 Instructions: submit manufacturer's installation instructions.
- .4 Construction Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.4 QUALIFICATIONS ASSURANCE**

- .1 Qualifications:
  - .1 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.
  - .2 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

**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 Use padded, non-marring slings for handling heavy timber members
  - .2 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. Block off ground and stack with spacers so air may circulate around all faces of members.
  - .3 Cover heavy timber units with opaque, waterproof membrane if stored outside.
  - .4 Make adequate provision for delivery and handling stresses.
  - .5 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 DESIGN REQUIREMENTS**

- .1 Design all connections between heavy timber members and between heavy timber members and their supports.
- .2 Allow for effects of wood shrinkage in design of connections.
- .3 Coordinate connection of heavy timber framing with light timber framing at the exterior wall of the building.
- .4 Retain a professional engineer to design all connections.

### **2.2 MATERIALS**

- .1 All materials to conform to CSA O86.1
- .2 Heavy Timber: Cedar, Select Structural, 4S4, with a maximum moisture content of 19% at time of fabrication and conforming to NLGA Standard Grading Rules.
- .3 Sealer for heavy timber: penetrating type, clear, non-yellowing liquid.
- .4 Fastenings:
  - .1 Split ring connections: hot rolled carbon steel, SAE 1010, meeting requirements of SAE handbook.
  - .2 Shear plate connections: Pressed steel type: hot rolled carbon steel, SAE 1010, meeting requirements of SAE handbook. Malleable iron type: to ASTM A47M, grade 22010.
  - .3 Lag screws: to ANSI/ASME B18.2.1
  - .4 Bolts: to ASTM A307
  - .5 Glulam rivets: to CAN/CSA G40.21
  - .6 Nails and spikes: to CSA B111
  - .7 Drift Pins: round, smooth bars to CAN/CSA-G40.21, Grade 300W
  - .8 Self-tapping screws (STS): SWG ASSY VG Plus and SWG ASSY 3.0 Self-Tapping Wood Screws or similar per Evaluation Report CCMC 13677\_R in compliance with the National Building Code 2010.

- .5 Structural steel rods and plates: to CAN/CSA G40.21, Grade 300W.
- .6 Turnbuckles, eye bolts and sockets: by Crosby Canada Ltd.
- .7 Galvanizing: to CAN/CSA-G164

### **2.3 FABRICATION**

- .1 Fabricate members to accurate length, angle and size to assure tight joints.
- .2 Preassemble to ensure fit on site.
- .3 Mark heavy timber members for identification during erection. Marks not to be visible in final assembly.
- .4 No splicing and jointing allowed except as shown on the drawings.
- .5 Apply sealer to all surfaces except those to receive stained finish. Double treat end grain surfaces.
- .6 Wrap members with a moisture resistant wrapping prior to leaving plant.
- .7 Prime paint all other connections.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 MANUFACTURER'S INSTRUCTIONS**

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

### **3.3 ERECTION**

- .1 Ensure protective sealer is not damaged before erection. If damaged, touch up on site before erection.
- .2 Conform to reviewed erection drawings.
- .3 Brace and anchor members until permanently secured by structure.
- .4 Make adequate provisions for erection stresses.
- .5 Splice and join only as indicated on reviewed erection drawings.

- .6 Do not field cut or alter members without Consultant's approval. If approved, treat all cut ends with sealer.
- .7 Remove chemical and other surface deposits on treated wood, in preparation for applied finishes.
- .8 Revisit site and retighten connections which may have come loose due to shrinkage of wood. Allow for retightening all such connections at one year after erection.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract. Written reports must be stamped by a professional engineer registered in the Province of Alberta.
  - .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 at 50% complete.
    - .3 Upon completion of work after cleaning is carried out.
- .2 Obtain reports within three days of review and submit immediately to Departmental Representative.

### **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: 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 05 12 23 – Structural Steel For Buildings.
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 06 18 00 – Glue Laminated Construction

**1.2 REFERENCES**

- .1 CSA International
  - .1 CAN/CSA O80 Series-08, Wood Preservation.
  - .2 CSA O86 Consolidation-14, Engineering Design in Wood.
  - .3 CSA O141-05(R2009), Softwood Lumber.
  - .4 CSA S307-M1980(R2001), Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
  - .5 CSA S347-99(R2009), Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
  - .6 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel.
- .2 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2010.
- .3 National Research Council (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
  - .1 CCMC-on-line edition, Registry of Product Evaluations.
- .4 Truss Plate Institute of Canada (TPIC)
  - .1 TPIC - 2007, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).

**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 wood trusses 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 Alberta., Canada.
  - .2 Include on drawings:
    - .1 Each shop drawing submission showing connection details.
    - .2 Indicate special structural application and specification as according to local authorities having jurisdiction.

- .3 Indicate TPIC Truss Design Procedure and CSA O86 Engineering Design in Wood and specific CCMC Product Registry number of the truss plates
- .4 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.
- .5 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.
- .6 Provide certification that trusses meet requirements of CSA S307 and CSA S347. Do load testing on representative trusses selected by the Departmental Representative.
- .7 Indicate arrangement of webs or other members to accommodate ducts and other specialties.
- .8 Show location of lateral bracing for compression members.
- .9 Test reports: submit certified test reports for prefabricated wood trusses from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .10 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .11 Instructions: submit manufacturer's installation instructions.
- .3 Construction Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.
  - .2 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

#### **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 Store and protect wood trusses from nicks, scratches, and blemishes.



- .3 Replace defective or damaged materials with new.
- .4 Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.
- .4 Develop Construction Waste Management Plan related to Work of this Section in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 DESIGN REQUIREMENTS**

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

### **2.2 MATERIALS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Lumber: Spruce-Pine-Fir (SPF) species, No. 2 or better grade, softwood, with maximum moisture content of 19% at time of fabrication and to following standards:
  - .1 CSA O141.
  - .2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.
  - .3 CAN/CSA-Z809 or FSC or SFI certified.
- .3 Fastenings: to CSA O86.

### **2.3 FABRICATION**

- .1 Fabricate wood trusses in accordance with reviewed shop drawings.
- .2 Provide for design camber and roof slopes when positioning truss members.
- .3 Connect members using bolts and nuts and metal connector plates.

## **2.4 SOURCE QUALITY CONTROL**

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 MANUFACTURER'S INSTRUCTIONS**

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

### **3.3 ERECTION**

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

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with

Contract. Written reports must be stamped by a professional engineer registered in the Province of Alberta.

- .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 Twice during progress of work at 33% and 66% complete.
- .2 Upon completion of work forward signed and sealed letter indicating conformance with shop drawings to Engineer of Record, after cleaning is carried out.
- .3 Obtain reports within three days of review and submit immediately to Departmental Representative.

### **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: 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 06 10 00 - Rough Carpentry
- .2 Section 07 92 00 - Joint Sealants
- .3 Section 09 21 16 - Gypsum Board Assemblies.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI A208.2-09, Medium Density Fibreboard (MDF) for Interior Applications.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Quality Standards, 1st edition, [2009].
- .3 ASTM International
  - .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .4 CSA International
  - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
  - .2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames.

**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 MDF and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
  - .2 Indicate materials, thicknesses, finishes and hardware.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Submit duplicate 300 mm long samples of each unit.

**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 Storage and Handling Requirements:
  - .1 Store and protect wood products from nicks, scratches, and blemishes.
  - .2 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Medium density fibreboard (MDF): to ANSI A208.2, density 640-800 kg/m<sup>3</sup>. Profile as indicated on drawings.

### **2.2 ACCESSORIES**

- .1 Nails and staples: to CSA B111; galvanized to ASTM A123/A123M for interior humid areas and for treated lumber; plain elsewhere.
- .2 Splines: wood.
- .3 Adhesive and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood products installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .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 Do finish carpentry to Quality Standards of (AWMAC).
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .3 Form joints to conceal shrinkage.

### **3.3 CONSTRUCTION**

- .1 Fastening:
  - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
  - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

- .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
- .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Standing and running trim:
  - .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
  - .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
  - .3 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.
  - .4 Install door and window trim in single lengths without splicing.
- .3 Interior and exterior frames:
  - .1 Set frames with plumb sides, level heads and sills and secure.

### **3.4 INSTALLATION OF TRIM**

- .1 Standing and running trim:
  - .1 Interior:
    - .1 MDF, profiles as indicated.

### **3.5 INSTALLATION OF FRAMES**

- .1 Interior:
  - .1 MDF, profiles as indicated.

### **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 recycling] in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.7 PROTECTION**

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

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 01 33 00 - Submittal Procedures
- .2    Section 06 10 00 - Rough Carpentry
- .3    Section 06 20 00 - Finish Carpentry
- .4    Section 07 92 00 - Joint Sealants
- .5    Section 08 70 05 - Cabinet and Miscellaneous Hardware
- .6    Section 09 21 16 - Gypsum Board Assemblies.
- .7    Section 09 91 99 - Painting for Minor Works

**1.2            REFERENCES**

- .1    American National Standards Institute (ANSI)
  - .1    ANSI A208.2-2009, Medium Density Fiberboard (MDF) for Interior Applications.
  - .2    ANSI/HPVA HP-1-2009, Standard for Hardwood and Decorative Plywood.
- .2    ASTM International
  - .1    ASTM E1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
  - .2    ASTM D2832-92(R2011), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
  - .3    ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
- .3    Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1    Architectural Woodwork Standards Manual (AWS, Latest Edition).
- .4    CSA International
  - .1    CSA O112.10-08 (R2013), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
  - .2    CSA O121-08 (R2013), Douglas Fir Plywood.
  - .3    CSA O141-05 (R2014), Softwood Lumber.
  - .4    CSA O151-09 (R2014), Canadian Softwood Plywood.
  - .5    CSA O153-13, Poplar Plywood.
- .5    Green Seal Environmental Standards (GS)
  - .1    GS-11-15, Paints and Coatings.
  - .2    GS-36-13, Commercial Adhesives.
- .6    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1    Material Safety Data Sheets (MSDS).

- .7 National Electrical Manufacturers Association (NEMA)
  - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).
- .8 National Hardwood Lumber Association (NHLA)
  - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011.
- .9 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2010.
- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2011, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

### **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 architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
    - .1 Scales: profiles full size, details half full size.
  - .2 Indicate materials, thicknesses, finishes and hardware.
  - .3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Submit duplicate samples: sample size 300 x 300mm casework material of each type of solid or plywood to receive stain or natural finish
  - .3 Submit duplicate samples of laminated plastic for colour selection.
  - .4 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

### **1.4 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, and wood based composite panels to CSA and ANSI standards.
- .3 Materials and workmanship shall meet or exceed recommendations and requirements of "AWS 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.
  - .1 Protect millwork against dampness and damage during and after delivery.
  - .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.
- .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 architectural woodwork from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Softwood lumber: unless specified otherwise, S4S, average moisture content of 6% and maximum of 9% for interior work in accordance with the following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 AWMAC custom grade, moisture content as specified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: moisture content 9 % or less in accordance with following standards:
  - .1 National Hardwood Lumber Association (NHLA).
  - .2 AWMAC custom grade, moisture content as specified.
- .4 Douglas fir plywood (DFP): to CSA O121, standard construction.
  - .1 Plywood resin to contain no added urea-formaldehyde.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction.
  - .1 Plywood resin to contain no added urea-formaldehyde.
- .6 Hardwood plywood: to ANSI/HPVA HP-1.
  - .1 Plywood resin to contain no added urea-formaldehyde.
- .7 Birch plywood: to AWMAC, Select White.
  - .1 Plywood resin to contain no added urea-formaldehyde.
- .8 MDF (medium density fibreboard) core: to ANSI A208.2, thickness as indicated, density 769 kg/m<sup>2</sup>, CAN/CSA-Z809 or FSC or SFI certified.
  - .1 Medium density fibreboard performance requirements to: ANSI A208.2.
  - .2 MDF resin to contain no added urea-formaldehyde.

- .9 Laminated plastic for flatwork: to NEMA LD3, General Purpose, Type 107, 1.22 mm thick; based on printed pattern colour range with matt finish.
- .10 Nails and staples: steel, plain, type and size to suit application.
- .11 Wood screws: stainless steel, steel, plain, type and size to suit application.
- .12 Splines: wood
- .13 Sealant: in accordance with Section 07 92 00 - Joint Sealants, silicone one part, mildew resistant.
  - .1 Sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .14 Laminated plastic adhesive:
  - .1 Adhesive: contact adhesive to CAN/CGSB-71.20, resorcinol resin adhesive to CSA O112.10, polyvinyl adhesive to CSA O112.10, two component epoxy thermosetting adhesive, as per manufacturers recommendations.
  - .2 Adhesives: VOC limit 30 g/L maximum to SCAQMD Rule 1168
  - .3 Clear Wood Finishes: VOC limit 275 g/L maximum to SCAQMD Rule 1113
  - .4 Paints: VOC limit 50g/L maximum to SCAQMD Rule 1113
- .15 Core material for laminated plastic for flatwork: Softwood Plywood;
- .16 Hardware: Supply and install in accordance with Section 08 70 05 - Cabinet and Miscellaneous Hardware.

## **2.2 MANUFACTURED UNITS**

- .1 Casework:
  - .1 Fabricate caseworks to AWMAC custom quality grade.
  - .2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
    - .1 Board sizes: "standard" or better grade.
    - .2 Dimension sizes: "standard" light framing or better grade.
    - .3 Urea-formaldehyde free.
  - .3 Framing pine or spruce species, NLGA grade.
  - .4 Case bodies (ends, divisions and bottoms), Backs, Shelving:
    - .1 Softwood plywood:
      - .1 Thickness: 19 mm.
      - .2 Number of plies: 7.
      - .3 Face/back veneer to surfaces exposed to interior of cabinet or exterior: Birch species, Architectural grade, rotary cut
      - .4 Bond: Type II.
      - .5 Sanding: regular sanding.
      - .6 Grain direction: vertical.
    - .2 Edge banding: To all exposed edges, matching colour in 3 mm PVC
    - .3 Toe kick: G1S veneer: Softwood plywood, Birch species, Architectural grade, rotary cut.

- .2 Drawers
  - .1 Fabricate drawers to AWMAC custom grade supplemented as follows:
  - .2 Sides and Backs.
    - .1 Hardwood plywood:
      - .1 Thickness: 12 mm.
      - .2 Number of plies: 9.
      - .3 Face/Back/Core veneer: Birch species, Architectural grade, rotary cut
      - .4 Bond: Type II.
      - .5 Sanding: regular sanding
  - .3 Bottoms:
    - .1 Hardwood plywood:
      - .1 Thickness: 6 mm.
      - .2 Number of plies: 5.
      - .3 Face/Back/Core veneer: Birch species, Architectural grade, rotary cut
      - .4 Bond: Type II.
      - .5 Sanding: regular sanding
  - .4 Construction: Dadoed into perimeter, captured on 3 sides, screwed to back of drawer with a minimum of 4 screws.
- .3 Casework Doors and Drawer fronts
  - .1 Fabricate doors and drawer fronts to AWMAC-custom grade supplemented as follows:
  - .2 Softwood plywood:
    - .1 Style: Flat Panel;
    - .2 Thickness: 19 mm.
    - .3 Number of plies: 7.
    - .4 Face/back veneer: Birch species, Architectural grade, rotary cut
    - .5 Bond: Type II.
    - .6 Sanding: regular sanding.
    - .7 Grain direction: vertical.
  - .3 Edge banding: To all exposed edges, matching colour in 3 mm PVC.

## **2.3 FABRICATION**

- .1 Set nails and countersink screws apply plain, stainable-wood filler to indentations, sand smooth and leave ready to receive finish. Conceal fasteners where exposed when possible using applied gable ends and concealed joints construction.
- .2 Shop install cabinet hardware for doors, shelves and drawers.
- .3 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .9 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

#### **2.4 FINISHING**

- .1 All exposed plywood for Case bodies, doors, drawer fronts, shelving and drawer boxes to be Clear lacquer Satin finish.
- .2 Finish in accordance with Section 09 91 99 – Painting for Minor Works.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate.
  - .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 Do architectural woodwork to meet or exceed Quality Standards of AWMAC.
- .2 Materials for interior installation shall be installed only in areas with a constant and minimum temperature of 15°C, with interior relative humidity conditions within design values.
- .3 Install prefinished millwork at locations shown on drawings.
  - .1 Position accurately, level, plumb straight.
- .4 Fasten and anchor millwork securely.
  - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .5 Use draw bolts in countertop joints.

- .6 Provide silicon rubber kitchen cabinet door and drawer front bumper stop damper cushions
- .7 Provide self adhesive screw cover caps to exposed screws in cabinets to match interior cabinet finish
- .8 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .9 At junction of plastic laminate counter, back splash, casework to adjacent wall finish, apply small bead of paintable sealant in accordance with Section 07 92 00 - Joint Sealants.
- .10 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

### **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.
  - .1 Clean millwork, cabinet work, outside surfaces, inside cupboards, and drawers.
  - .2 Remove excess glue from surfaces.
- .3 Waste Management: separate waste materials for 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 millwork and cabinet work from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00 – Cast-In-Place Concrete.

**1.2 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB-37.3-M89, Application of Emulsified Asphalts for Dampproofing or Waterproofing.
  - .3 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
  - .4 CGSB 37-GP-6Ma-83, Asphalt, Cutback, Unfilled, for Dampproofing.
  - .5 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
  - .6 CGSB 37-GP-11M-76(R1984), Application of Cutback Asphalt Plastic Cement.
  - .7 CGSB 37-GP-12Ma-84, Application of Unfilled Cutback Asphalt for Dampproofing.
  - .8 CGSB 37-GP-15M-76(R1984), Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
  - .9 CAN/CGSB-37.16-M89, Filled, Cutback, Asphalt for Dampproofing and Waterproofing.
  - .10 CAN/CGSB-37.28-M89, Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and for Waterproofing.
  - .11 CGSB 37-GP-36M-76, Application of Filled Cutback Asphalts for Dampproofing and Waterproofing.
  - .12 CGSB 37-GP-37M-77, Application of Hot Asphalt for Dampproofing or Waterproofing.
- .2 CSA International
  - .1 CAN/CSA-A123.4-04 (R2013), Asphalt for Construction of Built-Up Roof Coverings and Waterproofing Systems.
- .3 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).

**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 bituminous dampproofing application 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.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .4 Sustainable Design Submittals:
  - .1 Low-Emitting Materials:
    - .1 Submit listing of coatings, sealers used in building, showing compliance with VOC and chemical component limits or restriction requirements.

#### **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 Store and protect dampproofing materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

#### **1.5 SITE CONDITIONS**

- .1 Ambient Conditions: temperature, relative humidity, moisture content.
  - .1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
  - .3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
  - .4 Do not apply dampproofing in wet weather.
- .2 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.

### **Part 2 Products**

#### **2.1 COMPATIBILITY**

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

## 2.2 MATERIALS

- .1 Asphalt:
  - .1 For application and curing at temperatures above 5 degrees C: to CAN/CGSB-37.16.
    - .1 Asphalt dampproof primer conforming to the requirements of CAN/CGSB 37.9.
    - .2 Premium grade fibrated asphalt coating for horizontal and vertical foundation wall applications conforming to the requirements of CAN/CGSB-37.16.
    - .3 Package label or bill of lading for bulk hot liquid asphalt must indicate type, flash point, equiviscous temperature range and final blowing temperature.
  - .2 For application and curing at temperatures above 0 degrees C but below 5 degrees C: to CAN/CGSB-37.2.
    - .1 Dampproof asphalt emulsion primer conforming to the requirements of CAN/CGSB-37.2.
    - .2 Asphalt emulsion dampproofing conforming to the requirements of CAN/CGSB-37.2.
    - .3 Package label or bill of lading for bulk hot liquid asphalt must indicate type, flash point, equiviscous temperature range and final blowing temperature.
- .2 Sealing compound: plastic cutback asphalt cement to CAN/CGSB-37.5.

## 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 bituminous dampproofing application installation in accordance with manufacturer's written instructions.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### 3.2 WORKMANSHIP

- .1 Keep hot asphalt:
  - .1 Below its flash point.
  - .2 At or below its final blowing temperature.
  - .3 Within its equiviscous temperature range at place of application.



### 3.3 PREPARATION

- .1 Before applying dampproofing:
  - .1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.

### 3.4 APPLICATION

- .1 Do dampproofing in accordance with CAN/CGSB-37.3 and CGSB 37-GP-37M.
- .2 Do sealing work in accordance with CGSB 37-GP-11M.
- .3 Do priming of surface in accordance with CGSB 37-GP-15M.
- .4 Apply primer to CGSB primer standard.
- .5 Apply dampproofing in accordance with applicable CGSB application standard.

| Material       | Application |                |
|----------------|-------------|----------------|
| CAN/CGSB-37.2  | use         | CAN/CGSB-37.3  |
| CAN/CGSB-37.16 | use         | CGSB 37-GP-36M |

### 3.5 SCHEDULE

- .1 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.
- .2 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

### 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 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 dampproofing application.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00 - Cast-In-Place Concrete
- .2 Section 04 05 00 - Common Work Results for Masonry
- .3 Section 06 10 00 - Rough Carpentry
- .4 Section 07 27 00 - Air Barriers - Performance
- .5 Section 07 44 56 - Mineral Fibre Reinforced Cementitious Panels

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C208-12, Specification for Cellulosic Fiber Insulating Board.
  - .2 ASTM C518-15, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
  - .3 ASTM C591-15, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  - .4 ASTM C612-14 Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
  - .5 ASTM C726-12, Standard Specification for Mineral Fiber Roof Insulation Board.
  - .6 ASTM C1289-14a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  - .7 ASTM E96/E96M-15, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian Gas Association (CGA)
  - .1 CAN/CGA-B149.1-10, Natural Gas and Propane Installation Code Handbook.
  - .2 CAN/CGA-B149.2-10, Propane Storage and Handling Code.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S604-M91, Standard for Type A Chimneys.
  - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
  - .3 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
  - .4 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### 1.3 ACTION AND INFORMATIONAL 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 35 29.06 - Health and Safety Requirements. Indicate VOC's insulation products and adhesives.
- .2 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

### 1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Pre-Installation Meetings: coordinate pre-installation meeting with regular site meetings before beginning work of this Section, with contractor's representative and Departmental Representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordinate with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### 1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for 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.

## Part 2 Products

### 2.1 INSULATION

- .1 Extruded polystyrene (XPS): to CAN/ULC-S701.
  - .1 Unfaced and faced as indicated on drawings.
  - .2 Insulation:
    - .1 Type: 4.
    - .2 Thermal resistance: RSI 0.88 per 25.4 mm (R 5 per inch), ASTM C518.
    - .3 Compressive strength: 240 kPa in accordance with ASTM D1621.
    - .4 Water absorption: ASTM D2842: <0.7 % by volume.
    - .5 Water vapour permeance: 0.8 perms in accordance with ASTM E96.
    - .6 Thickness: as indicated on drawings.

- .7 Size: 610 mm x 1220 mm.
- .8 Edges: Tongue and groove along longitudinal foam edges, butt joints on lateral edges.
- .3 Facing:
  - .1 Concrete: Latex modified concrete mix, 8 mm thick, with control joint score at mid-length.
  - .2 Surface finish: Textured broom finish; grey colour, may be coated.
  - .3 Corners: fabricated in one continuous piece.
- .2 Rigid Cellular Polyisocyanurate:
  - .1 Faced: to ASTM C1289 & CAN/ULC C-S704.
    - .1 Polyisocyanurate foam core: fibre reinforced, made from minimum 25% recycled materials by weight.
    - .2 Surfaces: organic felt or kraft paper
    - .3 Thermal resistance: RSI 1.0 per 25.4 mm (R 5.7 per inch), ASTM C518.
    - .4 Shape: flat
    - .5 Thickness: 75 mm.
    - .6 Size: 1220 mm x 1220 mm.
- .3 Mineral fibre board: to CAN/ULC-S702, and ASTM C612
  - .1 Type: 1, made from natural basalt rock and minimum 40% recycled content.
  - .2 Density: 128 kg/m<sup>3</sup> in accordance with ASTM C612
  - .3 Thermal resistance: RSI 0.70 per 25.4 mm (R 4 per inch), ASTM C518.
  - .4 Surfaces: unsurfaced.
  - .5 Thickness: as indicated on drawings.
  - .6 Size: 610 mm x 1220 mm.

## 2.2 ACCESSORIES

- .1 Screwed fasteners: 6.4 mm diameter, drilled self tapping galvanized or stainless steel "tapcon" screw anchors complete with PVC or galvanized steel discs approximately 38 mm diameter. Screws to be long enough to penetrate through insulation, air/vapour barrier and gypsum board into stud framing and into concrete back-up minimum 32 mm to securely anchor system into place and to withstand all super-imposed loads..
- .2 Insulation Adhesive for vertical surfaces: conforming to CGSB 71-GP-24M, Type 1, Class A, adhesive must not contain solvents and must be compatible with hot rubberized asphalt waterproofing and insulation.

## 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 WORKMANSHIP**

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys CAN/CGA-B149.1 and CAN/CGA-B149.2 type B and L vents.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

### **3.3 EXAMINATION**

- .1 Examine substrates and immediately inform Departmental Representative in writing of defects.
- .2 Prior to commencement of work ensure:
  - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.
  - .2 For unfaced and faced XPS boards, if the lowest substrate surface is not level to receive panels, create a level surface with a galvanized steel ledger angle, and secure level.

### **3.4 WORKMANSHIP**

- .1 Follow the instructions for use of materials of insulation and accessory manufacturers.
- .2 Install insulation to maintain continuous and complete thermal protection for building spaces and elements.
- .3 Ensure all surfaces which are to receive insulation are clean, free from deleterious matter and are sufficiently level to allow the proper installation of insulation.
- .4 Use insulation free from broken or chipped edges.
- .5 Butt ends and edges of boards tightly together to form a complete thermal barrier. Install tightly against dry substrate.
- .6 Cut and trim insulation to fit spaces around corners and penetrations. Take care to prevent cutting sheet membrane air and vapour seal. Cut and fit insulation tight around all cladding anchors and supports, against mechanical, electrical and other items which protrude through the plane of insulation.
- .7 Use largest possible dimensions to reduce the number of joints.
- .8 Offset both vertical and horizontal joints in multiple layer applications.

- .9 Where insulation is installed between Z girt framing, install to fit tightly between framing members. Mechanically fasten insulation between Z girt framing as specified herein.
- .10 Press insulation tightly in place so that it abutts the air/vapour barrier membrane or waterproofing

### **3.5 FASTENER INSTALLATION**

- .1 Install insulation to all locations above grade, including between framing members using screw-on type fasteners using minimum 6 fasteners per board and not less than 75 mm from all ends and edges.
- .2 Ensure fasteners are installed into studs or solid backing.

### **3.6 PERIMETER FOUNDATION INSULATION**

- .1 Exterior application: extend faced XPS boards from underside of exterior finish to minimum 300 mm below finished grade and extend unfaced to top of footing. Install on exterior face of perimeter foundation wall in accordance with manufactures recommendations.
- .2 Ensure snug fit between panel tongue and grooves, and lateral butt joints.
- .3 Fasten concrete faced insulated panels to structural supports; aligned level and plumb.
- .4 Stagger all vertical joints on insulation except free ends or line of expansion/control joints.
- .5 Use manufacturer's fasteners. Maintain neat appearance.
- .6 Cover exposed insulation at corners and top of perimeter insulation with prefinished flashing as specified in Section 07 62 00.
- .7 Where concrete flatwork or asphalt is to be laid adjacent to faced XPS boards, provide an isolation joint to protect mortar surface from differential movement.
- .8 Ensure that polystyrene can be covered reasonably promptly after installing it.

### **3.7 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 26 00 - Vapour Retarders
- .3 Section 07 84 00 - Fire Stopping
- .4 Section 07 92 - Joint Sealants
- .5 Section 09 21 16 - Gypsum Board Assemblies

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C553-13, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 ASTM C665-12, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .3 ASTM C1320-10, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Canadian Gas Association (CGA)
  - .1 CAN/CGA-B149.1-10 (R2015, Natural Gas and Propane Installation Code Handbook.
  - .2 CAN/CGA-B149.2-10(R2015), Propane Storage and Handling Code.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials
  - .2 CAN/ULC-S604-M91, Type A Chimneys.
  - .3 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

**1.3 ACTION AND INFORMATIONAL 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 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: coordinate pre-installation meeting with regular site meetings before beginning work of this Section, with contractor's representative and Departmental Representative to:
  - .1 Verify project requirements.
  - .2 Review installation [and substrate] conditions.
  - .3 Co-ordinate with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for 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.

## **Part 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section [01 47 15 - Sustainable Requirements: Construction].
  - .1 Recycled content

### **2.2 INSULATION**

- .1 Thermal Batt and blanket mineral fibre: to CAN/ULC S702.
  - .1 Batt insulation for exterior stud walls, attics and ceilings: to CAN/ULC S702, Type 1.
    - .1 Fire performance:
      - .1 Non-combustibility: to CAN/ULC S114.
      - .2 Surface Burning Characteristics: to CAN/ULC S102.
        - .1 Flame spread: 0.
        - .2 Smoke developed: 0.
    - .2 Density: 32 kg/m<sup>3</sup> to ASTM C167.
    - .3 Recycled content: 40 % minimum.
    - .4 Thermal resistance: RSI 0.70 per 25.4 mm (R 4 per inch), ASTM C518
    - .5 Thickness: as indicated on drawings.



- .2 Firestopping installations:
  - .1 Batt insulation for firestopping installations to ASTM C612, Type IVA.
    - .1 Fire performance:
      - .1 Non-combustibility: to CAN/ULC-S114 and ASTM E136.
      - .2 Firestopping: to ASTM E 814.
      - .3 Surface Burning Characteristics: to CAN/ULC-S102 and ASTM E84.
        - .1 Flame spread: 0.
        - .2 Smoke developed: 0.
    - .2 Moisture sorption: 0.04 % to ASTM C1104/C1104M.
    - .3 Thermal resistance: to ASTM C518.
    - .4 Corrosive resistance: to ASTM C665, Corrosive to steel - Pass.
    - .5 Stainless steel stress corrosion: to ASTM C795.
    - .6 Density: to ASTM C667, 72 kg/m<sup>3</sup>.
    - .7 Recycled content: 40 % minimum.
    - .8 Thickness: as indicated on drawings.
- .3 Acoustical installations:
  - .1 Acoustical batt insulation for walls and floors to CAN/ULC-S702, Type 1, ASTM C655, Type 1 and ASTM C553.
    - .1 Fire performance:
      - .1 Non-combustibility: to CAN/ULC-S114 and ASTM E136.
      - .2 Surface Burning Characteristics: to ASTM E84.
        - .1 Flame spread: 0.
        - .2 Smoke developed: 0.
    - .2 Acoustical performance:
      - .1 Airborne sound transmission loss: to ASTM E90.
      - .2 Rating sound insulation: to ASTM E413.
      - .3 Sound absorption co-efficients: to ASTM E423.
      - .4 Impedence and absorption of acoustic materials: To ASTM E1050.
    - .3 Air erosion velocity: 5.08 m/s maximum to UL 181.
    - .4 Thermal resistance: to ASTM C518.
    - .5 Corrosive resistance: to ASTM C665, Corrosive to steel - Pass.
    - .6 Stainless steel stress corrosion: to ASTM C795.
    - .7 Density: to ASTM C612, 72 kg/m<sup>3</sup>.
    - .8 Thickness: as indicated on drawings.

## **2.3 ACCESSORIES**

- .1 Fasteners: Mechanical fasteners in accordance with insulation manufacturers written recommendations.

- .2 Insulation clips:
  - .1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .3 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.

**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 INSULATION INSTALLATION**

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.
- .2 Coordinate installation of firestopping with Section 07 84 00 - FireStopping.
- .3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .4 Do not compress insulation to fit into spaces.
- .5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B and L vents.
- .6 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

**3.3 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 27 00 - Air Barriers – Performance

**1.2 REFERENCES**

- .1 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)
- .2 Green Seal Environmental Standards
  - .1 GS-03-97, Environmental Criteria for Anti-Corrosive Paints.
  - .2 GS-11-11, Standard for Paints and Coatings.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-[06], Volatile Organic Compounds.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S101-07, Fire Endurance Tests of Building Construction and Materials.
  - .2 CAN/ULC-S102.2-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .3 CAN/ULC-S705.1-01, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.
  - .4 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

**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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets.
- .3 Provide submittals indicating how following requirements will be met.
  - .1 Indoor Environmental Quality Credit EQc4.1 Low-Emitting Materials: Adhesives & Sealants: submit product data ensuring that chemical composition and VOC in g/L, is calculated in accordance with SCAQMD Rule 1168.

- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports: submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
  - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

#### **1.4 QUALITY ASSURANCE**

- .1 Applicators to conform to CUFCA Quality Assurance Program.
- .2 Qualifications:
  - .1 Installer: person specializing in sprayed insulation installations approved by manufacturer.
  - .2 Manufacturer: company with minimum 5 years experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.
- .3 Health and Safety Requirements: worker protection:
  - .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
  - .2 Workers must wear gloves, respirators, dust masks, long sleeved clothing, eye protection, and protective clothing as recommended by manufacturer when applying foam insulation.
  - .3 Workers must not eat, drink or smoke while applying foam insulation.

#### **1.5 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 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.6 SITE CONDITIONS**

- .1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.

- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Insulation: spray polyurethane to CAN/ULC-S705.1.
- .2 Material to have a five year aged R-value of no more than 1.02 m2, c/w.
- .3 Primers: in accordance with manufacturer's recommendations for surface conditions.
  - .1 Maximum VOC limit 50 g/l to SCAQMD Rule 1168.

**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 APPLICATION**

- .1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.
- .2 Use primer where recommended by manufacturer.
- .3 Apply sprayed foam insulation in thickness as indicated, minimum 50 mm.

**3.3 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 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 21 16 - Blanket Insulation
- .3 Section 07 92 00 - Joint Sealants
- .4 Section 09 21 16 - Gypsum Board Assemblies

**1.2 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

**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, specifications and datasheet and include:
    - .1 Product characteristics.
    - .2 Performance criteria.
    - .3 Limitations.
- .3 Quality assurance submittals:
  - .1 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**1.4 QUALITY ASSURANCE**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Mock-Ups:
  - .1 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
  - .2 Mock-up will be used to judge workmanship, substrate preparation, and material application.
  - .3 Locate where directed.
  - .4 Coordinate construction of mock-up with regular site meetings 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.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Remove only in quantities required for same day use.
  - .3 Store and protect from nicks, scratches, and blemishes.
  - .4 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 SHEET VAPOUR BARRIER**

- .1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

**2.2 ACCESSORIES**

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealants.
- .3 Staples: minimum 6 mm leg.
- .4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Ensure services are installed and inspected before installation of retarder.
- .2 Install sheet vapour barrier below all slab-on-grade concrete.
  - .1 Continue sheet vapour barrier up mechanical and electrical penetrations and seal with tape.
- .3 Install sheet vapour retarder on warm side of exterior wall and ceiling assemblies before installation of gypsum board to form continuous retarder.
- .4 Use sheets of largest practical size to minimize joints.
- .5 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

### **3.2 BETWEEN DOUBLE TOP PLATES BELOW ROOF JOISTS AND TRUSSES**

- .1 Seal sheet vapour barrier at top of walls as follows:
  - .1 Apply continuous bead of sealant to substrate of first (lower) top plate.
  - .2 Lap 480 mm wide sheet over sealant with 150 mm flap on the interior side and 150 mm flap on the exterior side of wall and press into sealant bead.
  - .3 Install second (upper) top plate securing the sheet vapour barrier in-between.
  - .4 After the exterior wall sheet vapour barrier is installed drape down the 150 mm flap on the interior side of the wall and lap over the adjacent sheet. Continuously seal in place to maintain the continuity of the vapour retarder.

### **3.3 EXTERIOR SURFACE OPENINGS**

- .1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

### **3.4 PERIMETER SEALS**

- .1 Seal perimeter of sheet vapour barrier as follows:
  - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
  - .2 Lap sheet over sealant and press into sealant bead.
  - .3 Install staples through lapped sheets at sealant bead into wood substrate.
  - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

### **3.5 LAP JOINT SEALS**

- .1 Seal lap joints of sheet vapour barrier as follows:
  - .1 Attach first sheet to substrate.
  - .2 Apply continuous bead of sealant over solid backing at joint.
  - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
  - .4 Install staples through lapped sheets at sealant bead into wood substrate.
  - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

### **3.6 ELECTRICAL BOXES**

- .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
  - .1 Install moulded box vapour barrier.
  - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

### **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 RELATED REQUIREMENTS**

- .1 Section 03 30 00 – Cast in Place Concrete
- .2 Section 04 05 00 - Common Work Results for Masonry
- .3 Section 06 10 00 - Rough Carpentry
- .4 Section 07 31 13 - Asphalt Shingles
- .5 Section 07 44 56 - Mineral Fibre Reinforced Cementitious Panels
- .6 Section 31 23 19 - Excavating, Trenching and Backfilling

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM D4541-09e1, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
  - .2 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .3 ASTM E283-04 (2012), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - .4 ASTM E783-02(2010), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
  - .5 ASTM E1186-03(2009), Standard Practices for Air Leakage Site Detection in Building Envelope and Air Retarder Systems.
- .2 Canadian General Standards Board
  - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for use in Building Construction
- .3 Underwriters Laboratories of Canada
  - .1 CAN/ULC-S741-08, Standard for Air Barrier Materials – Specification

**1.3 PERFORMANCE REQUIREMENTS**

- .1 Select and install wall and roof components and assemblies to resist air leakage caused by static air pressure across exterior wall, soffits-and roof assemblies, including windows, glass, doors, roof hatches and other interruptions to integrity of wall and roof systems; to maximum air leakage rate of 0.20 L/s.m<sup>2</sup>—when subjected to pressure differential of 75 Pa as measured in accordance with ASTM E283.
- .2 Provide continuity of air/vapour barrier materials and assemblies in conjunction with materials described in 03 30 00 - Cast-in-Place Concrete, Section 07 21 13 - Board Insulation and 07 92 00 - Joint Sealants.
- .3 Provide continuity of air barrier under floors-on-ground.

**1.4 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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 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, and cleaning procedures.

**1.5 MOCK-UP**

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct typical exterior wall panel; incorporating window openings with frame and sill installed, insulation, building corner condition, junction with roof system; illustrating materials interface and seals.
- .3 Locate where directed by Departmental Representative.
- .4 Mock-up may remain as part of Work.
- .5 Coordinate construction of mock-up with regular site meetings for inspection of mock-up before proceeding with 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 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Avoid spillage, immediately notify Departmental Representative if spillage occurs and start clean up procedures.
- .4 Clean spills and leave area as it was prior to spill.

**1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for 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.

**1.8 SEQUENCING**

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

**1.9 WARRANTY**

- .1 For sealant and sheet materials the 12 months warranty period prescribed is extended to 24 months.
- .2 Warranty: include coverage of installed sealant and sheet materials which:
  - .1 Fail to achieve air tight and watertight seal.
  - .2 Exhibit loss of adhesion or cohesion.
  - .3 Do not cure.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Materials: as required to achieve specified performance criteria; functionally compatible with adjacent materials and components.

**2.2 SHEET MATERIALS**

- .1 Sheet Seal: pliable, self-adhesive, cold applied composite sheet membrane of high strength, high density cross-laminated to high-density polyethylene film, nominal total thickness of 1.02 mm.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 GENERAL**

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for installation.
- .2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program] and requirements for installation,
- .3 Perform Work in accordance with Canadian Urethane Foam Contractor's Association - Professional Contractor Quality Assurance Program and requirements for installation.

**3.3 PREPARATION**

- .1 Prepare substrate surfaces in accordance with air/vapour barrier material manufacturer's instructions.

**3.4 INSTALLATION**

- .1 Install air/vapour barrier materials in accordance with manufacturer's instructions.
- .2 Install sealant materials in accordance with manufacturer's instructions.

- .3 Apply sealants within recommended application temperature ranges.
- .4 Install materials to ensure complete installation and to withstand wind loads (positive and negative) based on 1/100 year wind loads as outlined in the National Building Code 2010 for the Waterton Area.

**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.

**3.6 PROTECTION OF FINISHED WORK**

- .1 Protect finished work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1      Section 06 10 00 - Rough Carpentry
- .2      Section 06 17 53 - Shop - Fabricated Wood Trusses
- .3      Section 07 62 00 - Sheet Metal Flashings and Trim
- .4      Section 23 37 20 - Louvers, Intakes and Vents

**1.2               REFERENCES**

- .1      Canadian General Standards Board (CGSB)
  - .1      CAN/CGSB-37.4-M89, Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing.
  - .2      CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
  - .3      CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .4      CAN/CGSB-51.34-M86, Vapour Barrier Polyethylene Sheet, for Use in Building Construction.
- .2      Canadian Roofing Contractors' Association (CRCA)
  - .1      CRCA Roofing Specification Manual - 2012.
- .3      CSA International
  - .1      CSA A123.1-05/A123.5-05(R2015), Asphalt Shingles Made From Organic Felt and Surfaced With Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules.
  - .2      CAN/CSA-A123.2-03 (R2013), Asphalt-Coated Roofing Sheets.
  - .3      CSA A123.3-05 (R2015), Asphalt Saturated Organic Roofing Felt.
  - .4      CAN3-A123.51-14, Asphalt Shingle Application on Roof Slopes 1:6 and Steeper.
  - .5      CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- .4      Factory Mutual Global
  - .1      FM4473-05, Specification Test Standard for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls.
- .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-2015, Registry of Product Evaluations.
- .7      Underwriters' Laboratories (UL)
  - .1      UL 2218, Standard for Impact Resistance of Prepared Roof Covering Materials.

**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 asphalt shingles and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit proof of manufacturer's CCMC listing and listing number.
  - .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
  - .4 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Samples:
  - .1 Submit duplicate samples of full size specified shingles.

**1.4 QUALITY ASSURANCE**

- .1 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct 3000 x 3000 mm mock-up including components as follows: eave protection, flashing, underlayment, roof vents, and asphalt shingles.
  - .3 Mock-up will be used:
    - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
  - .4 Locate where directed.
  - .5 Coordinate construction of mock-up with regular site meetings for inspection of mock-up before proceeding with work.
  - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work.
  - .7 Approved mock-up may remain as part of finished Work.

**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 Remove only in quantities required for same day use.
  - .3 Store and protect asphalt shingles from nicks, scratches, and blemishes.
  - .4 Replace defective or damaged materials with new.

**1.6 EXTRA STOCK MATERIALS**

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 All unused shingles remain property of Parks Canada Agency.

**1.7 PROJECT/SITE ENVIRONMENTAL REQUIREMENT**

- .1 Ambient Conditions:
  - .1 Temperature, relative humidity, moisture content:
    - .1 Apply products only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
    - .2 Do not install asphalt shingles when moisture content of roof sheathing exceeds 19%.

**1.8 WARRANTY**

- .1 For the Work of this Section 07 31 13 – Asphalt Shingles the 12 months warranty period is extended to 60 months against leakage and any other failure due to faulty workmanship or materials. Allow for High Wind Warranty upgrade and provide products accordingly.
- .2 Provide the manufacturer's lifetime materials warranty.

**Part 2 Products**

**2.1 DESIGN REQUIREMENTS**

- .1 Provide products acceptable for use in high wind conditions exceeding 200 kph.
- .2 Design shingle installation to allow for high wind conditions exceeding 200 kph.

**2.2 MATERIALS**

- .1 Asphalt shingles: to CSA A123.1/A123.5 and FM4473, heavyweight, laminated shingle composed of non-woven glass fibre mat, impregnated with stabilized waterproofing membrane.
  - .1 Type: architectural, strip, self-seal, pattern rectangular.
  - .2 Mass: minimum 2 kg/m<sup>2</sup> for all types.
  - .3 Colour: with a solar reflective index (SRI) of 29 or above, brown, final colour as selected from manufacturer's standard range by Departmental Representative.
- .2 Underlayment / Roofing felt: to CSA A123.3 organic felt No. 15.
- .3 Eave Edge, Valley, and Ice Dam Protection: to CCMC12413-R as recommended by asphalt shingle manufacturer.
- .4 Asphaltic Cement:
  - .1 Plastic cement: to CAN/CGSB-37.5.
  - .2 Lap cement: to CAN/CGSB-37.4.
- .5 Flashing including drip edge: 0.5 mm base thickness galvanized steel sheet, colour to be dark brown.

- .6 Nails: to CSA B111, of galvanized steel, sufficient length to penetrate 19 mm into deck.
- .7 Staples: chisel point galvanized steel 25 mm crown 1.5 mm thick, sufficient length to penetrate 20 mm into deck tube lock nails for soffit substrates.
- .8 Roof Vents: locations as indicated on the drawings.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt shingles installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .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 APPLICATION**

- .1 Do asphalt shingle work to CAN3-A123.51, CRCA Specification, and in accordance with manufacturer's written instructions.
- .2 Install drip edge along eaves, overhanging 12 mm, with minimum 100 mm flange extending onto roof decking.
  - .1 Lap joints 50 mm and seal with cement.
  - .2 Nail to deck at 400 mm on centre.
- .3 Install eave protection up 915 mm from edge of roof (measured along the slope), extending 305 mm (measured horizontally) beyond the inside face of stud walls, and in accordance with manufactures recommendations.
- .4 Install valley protection 915 mm centred on the valley.
- .5 Provide ice dam protection membrane on roofs minimum 900 mm adjacent vertical surfaces and return up vertical surfaces minimum 450 mm.
- .6 Install underlayment over entire deck area and in accordance with manufactures recommendations.
- .7 Install bottom step flashing (soaker base flashing) interleaved between shingles at vertical junctions, with minimum 80 mm head lap, minimum 100 mm up the wall behind the wall cladding and moisture barrier.
- .8 Install roof vents in accordance with manufacturer's recommendations.
- .9 Install asphalt shingles on roof slopes 1:3 and steeper in accordance with CAN3-A123.51 supplemented as follows:
  - .1 Project from edge of eave flashing 12 mm.



- .10 Cap hips and ridges using strip shingles cut into individual units or individual shingles manufactured for this purpose. Apply capping without exposed nails, 125 mm to the weather and in the opposite direction to the prevailing winds.

### **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 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 asphalt shingles installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 31 13 - Asphalt Shingles
- .3 Section 07 44 56 - Mineral Fiber Reinforced Cementitious Panels
- .4 Section 07 62 00 - Sheet Metal Flashing & Trim

**1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B18.6.3-2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .2 ASTM International
  - .1 ASTM D2369-10(2015)e1, Test Method for Volatile Content of Coatings.
  - .2 ASTM D2832-92(2011), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
  - .3 ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .2 CAN/CGSB-93.2-M91, Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use.
  - .3 CAN/CGSB-93.3-M91, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.
  - .4 CAN/CGSB-93.4-92, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.
  - .5 CAN/CGSB-93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.
- .4 CSA International
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .5 Environmental Choice Program (ECP)
  - .1 CCD-045-95, Sealants and Caulking Compounds.
- .6 Green Seal Environmental Standards (GS)
  - .1 GS-36-2013, Standard for Commercial Adhesives.
- .7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .8 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

### 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 [metal siding] and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit [2] copies of WHMIS MSDS in accordance with Section [01 35 29.06 - Health and Safety Requirements] [01 35 43 - Environmental Procedures].
    - .1 Indicate VOC's for caulking materials during application [and curing].
- .3 Shop Drawings:
  - .1 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, [soffits], [fascia], [metal furring], and related work.
- .4 Samples:
  - .1 Submit duplicate 50 x 50 mm samples of siding material, of colour and profile specified.

### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements
- .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 from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## Part 2 Products

### 2.1 ALUMINUM CLADDING COMPONENTS

- .1 Soffit: to CAN/CGSB-93.2.
  - .1 Colour: beige colour selected by Departmental Representative.
  - .2 Gloss: medium
  - .3 Profile: flat sheet 'V' crimped for stiffness, preformed with elongated slits and small perforations vented 0.09 m<sup>2</sup> per square metre of soffit.
    - .1 Pattern: plain surface.
    - .2 Thickness: 0.40 mm base metal thickness.
- .4 Fascia and exposed trim: to CAN/CGSB-93.2, Type C, Class 1.
  - .1 Colour: beige colour selected by Departmental Representative.
  - .2 Gloss: medium

- .3 Profile: ribbed.
- .4 Thickness: 0.50 mm base metal thickness.

## **2.2 FASTENERS**

- .1 Nails: CSA B111. Screws: ASME B18.6.3. Purpose made aluminum alloy, as recommended by the manufacturer. Use prefinished nails to exposed locations.

## **2.3 CAULKING**

- .1 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Adhesives and sealants: VOC limit 30 g/L maximum to SCAQMD Rule 1168.

## **2.4 ACCESSORIES**

- .1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour and gloss as cladding, with fastener holes pre-punched.

# **Part 3 Execution**

## **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

## **3.2 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.

## **3.3 INSTALLATION**

- .1 Install cladding in accordance with CGSB 93.5, and manufacturer's written instructions.
- .2 Install soffit and fascia cladding as indicated.
- .3 Soffit Installation
  - .1 Install soffit cladding perpendicular to the wall. Fasten in place using nails as recommended by the manufacturer for a secure installation. Exposed nails to have coloured heads to match soffit cladding.
  - .2 Install J-trim wherever soffit cladding meets another material.
  - .3 Use full length pieces of trim and soffit wherever possible.

**.4 Fascia and Trim Installation**

- .1 Install fascias and trim in accordance with the manufacturer's instructions. Nail all trim in place so that it will not be exposed in the finished product.
  - .2 Install fascias and trim over sub fascia and wood backing, in maximum lengths with as few joints as possible
  - .3 Use full length pieces of trim and fascia wherever possible.
  - .4 Over lap end joints minimum 50 mm and cut short leg of fascia and trim as required to accommodate expansion and contraction in accordance with manufacturer's recommendations.
  - .5 Install sill trim along top of fascia and trim, level and even with underside of overhang of roof.
  - .6 Do not use exposed fasteners for fascias and trim.
  - .7 Terminate exposed ends of fascia neatly in accordance with manufacturer's directions
- .5 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .6 Attach components in manner not restricting thermal movement.
- .7 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

**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 preformed metal siding installation.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 06 10 00 - Rough Carpentry
- .2    Section 06 13 00 - Heavy Timber Construction
- .3    Section 06 20 00 - Finish Carpentry

**1.2            REFERENCES**

- .1    ASTM International
  - .1    ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
  - .2    ASTM F1667-15, Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .2    National Lumber Grading Authority (NLGA)
  - .1    NLGA Standard Grading Rules for Canadian Lumber 2010.

**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 wood products and include product characteristics, performance criteria, physical size, finish and limitations.
- .3    Samples:
  - .1    Submit duplicate 300 x 300 mm size profile specified.

**1.4            DELIVERY, STORAGE AND HANDLING**

- .1    Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements] [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 wood siding from nicks, scratches, and blemishes.
  - .3    Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Lumber siding / soffit: to NLGA Standard Grading Rules for Canadian Lumber.
  - .1 Knotty bevel siding: western red cedar NLGA paragraph 204, select grade, smooth finish, tongue and groove joints, 140 mm width.
- .2 Fasteners: nails to ASTM F1667, hot galvanized steel, sized as required, smooth shank type with finishing head.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 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.

**3.3 INSTALLATION**

- .1 Install wood starter strips.
- .2 Fasten wood siding in straight, aligned lengths to framing and blocking or furring at 610 mm on centre maximum using two nails at each fixing location. Stagger butt joints not less than 800 mm and distribute evenly over surfaces. Seal cut 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 wood siding installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 21 13 - Board Insulation
- .3 Section 07 21 16 - Blanket Insulation
- .4 Section 07 92 00 - Joint Sealants
- .5 Section 08 11 00 - Metal Doors & Frames
- .6 Section 08 16 13 - Fibreglass Doors
- .7 Section 08 53 13 - Vinyl Windows

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM E96/E96M-15, Standard Test Methods for Water Vapor Transmission of Materials.
  - .2 ASTM C1186-08(2012), Standard Specification for Flat Fiber-Cement Sheets
  - .3 ASTM E136-16 Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750°C.
  - .4 ASTM C666/C666M-15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
  - .5 ASTM F1667 Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
  - .6 ASTM E84-15b, Standard Test Method for Surface Burning Characteristics of Building Materials
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 41-GP-6M-[83], Sheets, Thermosetting Polyester Plastics, Glass Fibre Reinforced.
- .3 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999 R2013
- .4 Green Seal Environmental Standards (GS)
  - .1 GS-11-15, Standard for Paints and Coatings.
  - .2 GS-36-13, Standard for Commercial Adhesives.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2013, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.



- .7 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.
    - .1 MPI EXT 5.1C.
- .8 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992.
- .9 Underwriters Laboratories' of Canada (ULC)
  - .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre for Buildings.
  - .3 CAN/ULC-S704-2011, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
  - .4 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

### **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 cementitious materials 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. Indicate VOC's for cementitious materials.
- .3 Shop Drawings:
  - .1 Indicate dimensions, wall openings, head, jamb, sill and mullion detail, materials and finish, anchor details, compliance with design criteria and requirements of related work.
- .4 Samples:
  - .1 Submit duplicate 150 x 150 mm samples of wall system and duplicate 300mm long pieces of trim and other accessories representative of materials, finishes and colours.
- .5 Sustainable Design Submittals:
  - .1 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants, paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

### **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 Store fibre cement siding and trim stacked on edge or laid flat on smooth level raised platform surfaces. Protect edges and corners from chipping or damage.
  - .3 Replace defective or damaged materials with new.
  - .4 Store materials on site to prevent deterioration, loss or impairment of structural or other essential properties. Cover with tarpaulins or polyethylene sheets. If material becomes wet, allow to dry thoroughly prior to installation.

## 1.5 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 Labour Canada.

## Part 2 Products

### 2.1 MATERIALS

- .1 Fibre Cement Siding: conforming to ASTM 1186, Grade II, type A. Siding to have the following nominal physical or mechanical properties:
  - .1 Density average: 1453.5 kg/m<sup>3</sup>
  - .2 Water Absorption (%) (by Mass): 27.41%
  - .3 Dimensional Change (at 50 - 90% RH): MD: 0.10%  
XD: 0.19%
  - .4 Flexural Strength (MPa): MD: 21.62%  
XD: 12.53%
  - .5 Fastener Pull Resistance: 1482 N
  - .6 Freeze/Thaw Cycling (100 cycles  
As per ASTM C666, method B): Passed  
MD: 40%  
XD: 30%
  - .7 Watertightness: No formation of drops of  
water on underside - passed.
  - .8 Warm Water Resistance: Passed  
MD: 27% (loss)  
XD: 30% (gain)
  - .9 Rain Penetration Resistance: Prevent water entry into the  
innermost face of wall - passed.
- .2 Fibre Cement siding to be non-combustible when tested in accordance with ASTM method E136
- .3 Surface burning characteristics when tested in accordance with ASTM E84:
  - .1 Class A (1) Flame Spread: 0
  - .3 Smoke Developed: 5
- .4 Thickness: 8 mm thick.

- .5 Types:
- .1 Fibre Cement Panel Siding: prefinished vertical panel siding, smooth faced, 1220 mm wide x heights to suit installation, complete with 64 mm battens. Location as indicated on drawing elevations. Colours as selected by the Departmental Representative from the manufacturer's standard colour range.
  - .2 Fibre Cement Lap Siding: prefinished lap siding, cedar-textured grain, 159 mm (6.25") wide providing 125 mm (5") exposure by 3657 mm (12') lengths to suit installation. Location as indicated on drawing elevations. Colours as selected by the Departmental Representative from the manufacturer's standard colour range.
  - .3 Fibre Cement Trims: prefinished trim, smooth faces, 5/4 boards of sizes and profiles as indicated on the drawings. Provide manufacturer's standard one piece outside corner trim as indicated. Provide manufacturer's standard corner trims as detailed on the drawings. Location as indicated on drawing elevations. Colours as selected by the Departmental Representative from the manufacturer's standard colour range.
  - .4 Fibre Cement Shake: prefinished, cedar-textured grain, 11 mm thick, random square staggered edge profile, cut between shingles, 178 mm (7") exposure, 406 mm (16") wide by 1219 mm (48") long. Location as indicated on drawing elevations. Colours as selected by the Departmental Representative from the manufacturer's standard colour range.
  - .5
  - .6 Length: 3.66 m
  - .7 Trim, Flashing and Accessories: manufacturer's standard trim, flashing and accessories as required to complete the work of this Section. Use manufacturer's standard profiles where ever possible. Where required due to job conditions, provide custom profiles to suit.
  - .8 Nails (to wood framing): Hot dipped galvanized 6d common or 32 mm long roofing nails conforming to ASTM F1667.
  - .9 Vinyl accessories for electrical outlets and light fixtures: manufacturer's standard to suit application.

## **2.2 FINISH**

- .1 Siding: Factory Prefinished, premium colour, 100% acrylic latex coating, over machine applied sealant, with 12 year limited coating warranty; colours as selected by the Departmental Representative from the manufacturer's standard range
- .2 Trim: standard prefinished top coat, factory applied over machine applied sealant; with 25 year limited coating warranty; colours as selected by the Departmental Representative from the manufacturer's standard range

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate.
- .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 Install all fibre cement siding and trim in strict accordance with manufacturer's recommendations. Locate fasteners to provide complete installation and to withstand wind loads (positive and negative) based on 1/100 year wind loads as outlined in the National Building Code 2010 for the Waterton Area
- .2 Install all fibre cement siding and trim in strict accordance with manufacturer's recommendations.
- .3 Install panel siding as follows:
  - .1 Ensure that wood framing occurs on all edges of panel siding.
  - .2 Install fasteners no closer than 10 mm from panel edges and 50 mm from panel corners.
  - .3 Maintain clearance between siding and adjacent grade as indicated. Install battens vertically, evenly spaced as indicated or as otherwise directed by the Consultant.
  - .4 Install as indicated on the drawings.
  - .5 Take care not to damage factory finish. Touch up minor scratches on site, to render damaged areas undetectable.
  - .6 Install all trim, flashing and accessories in strict accordance with manufacturer's recommendations, neatly and accurately installed, using as few joints as possible. Install flashing, trim and accessories as required to provide a weather tight installation.
- .4 Install fibre cement shakes in strict accordance with manufacturer's recommendations.

### **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 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 07 27 00 - Air Barrier Performance
- .2 Section 07 31 13 - Asphalt Shingles
- .3 Section 08 11 00 - Metal Doors & Frames
- .4 Section 08 16 13 - Fibreglass Doors
- .5 Section 08 53 13 - Vinyl Windows

**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 A606-15, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
  - .2 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3 ASTM A792/A792M-10 (2013), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .4 ASTM B32-08(2014), Standard Specification for Solder Metal.
  - .5 ASTM D523-14, Standard Test Method for Specular Gloss.
  - .6 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian Roofing Contractors Association (CRCA)
  - .1 Roofing Specifications Manual 2012.
- .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(R2010), Asphalt Saturated Organic Roofing Felt.
  - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.
  - .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .6 Green Seal Environmental Standards
  - .1 Standard GS-03-97, Anti-Corrosive Paints.
  - .2 Standard GS-11-15, Architectural Paints.
  - .3 Standard GS-36-13, Commercial Adhesives.

- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .8 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule #1113-[04], Architectural Coatings.
  - .2 SCAQMD Rule #1168-[05], Adhesives and Sealants.

### **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 35 29.06 - Health and Safety Requirements.
- .3 Samples:
  - .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colours.

### **1.4 QUALITY ASSURANCE**

- .1 Pre-Installation Meetings: coordinate pre-installation meeting with regular site meetings before beginning work of this Section, with contractor's representative and Departmental Representative 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.

## **Part 2 Products**

### **2.1 SHEET METAL MATERIALS**

- .1 Zinc coated steel sheet (to unexposed locations): 0.61 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

### **2.2 PREFINISHED STEEL SHEET**

- .1 Prefinished steel with factory applied silicone modified polyester.
  - .1 Colour selected by Departmental Representative from manufacturer's extended range.

- .2 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.
- .3 Coating thickness: not less than 25 micrometres.
- .4 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.
- .2 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32 with No. 15 perforated asphalt felt to CSA A123.3.
- .3 Sealants: in accordance with Section 07 92 00.
  - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168] [to GSES GS-36.
- .4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .5 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.
- .6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .7 Touch-up paint: as recommended by prefinished material manufacturer.
  - .1 Maximum VOC limit 50 g/L to Standard GS-11.

## 2.3 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.
- .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 of 0.61 mm thick prefinished steel.
- .2 Form all flashing components in 2400 mm maximum length
- .3 Form sections square, true and accurate to size, free from distortions and other defects detrimental to appearance or performance

**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 AAI-Aluminum Sheet Metal Work in Building Construction, ARCA and SMACNA recommended practice
- .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        Fit flashings together so that one end of each section is free to move in the joint. Do not use any caulking or other sealant at joints.
- .6        Caulk flashing at reglet with sealant.
- .7        Install pans, around items projecting through roof membrane.

**3.3                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 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 92 00 - Joint Sealants

**1.2 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 ULC-S-101-14, Standard Method of Fire Endurance Tests of Building Construction and Materials
  - .2 ULC-S-102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  - .3 ULC-S115-11, Fire Tests of Fire stop Systems.

**1.3 DEFINITIONS**

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
  - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

**1.4 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, specifications and datasheet 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.

- .3 Shop Drawings:
  - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
  - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
  - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
    - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

## **1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: company specializing in fire stopping installations approved by manufacturer.
- .2 Pre-Installation Meetings: coordinate pre-installation meeting with regular site meetings before beginning work of this Section, with contractor's representative and Departmental Representative 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.

## **1.6 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 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

- .2 Storage and Protection:
  - .1 Store materials indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.7 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Proceed with installation of fire stopping when ambient conditions only when:
    - .1 Ambient and substrate conditions are within manufacturer's recommended temperatures, relative humidity and substrate moisture content for application and curing of fire stops and smoke seals.
    - .2 Where fire stopping and smoke seal is installed before the building envelope is closed in and made weather tight, protect fire stopping from water, freezing, or other elements which are detrimental to the fire stopping and smoke seal materials.

## **Part 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

### **2.2 MATERIALS**

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
  - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
  - .2 Fire stop system rating:
    - .1 All materials to provide a flame rating (F) to penetrations equal to the rating of the Fire Separation. A flame and temperature rating (FT) is required on all penetration in fire walls and assemblies. All construction joint firestopping systems must provide a rating equal to the rating of the surrounding assemblies.
    - .2 Penetrating items must be rigidly supported in accordance with ULC and ULI guidelines.

- .3 Fire stopping materials and systems must be intumescent where the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials may occur.
- .4 Notify the Departmental Representative whenever the fire stopping system or assembly cannot meet this specification.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

### **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 PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
- .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

### **3.3 INSTALLATION**

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

### **3.4 SPECIAL REQUIREMENTS**

- .1 Where two outlet boxes must be located on opposite sides of a fire rated partition within the same stud cavity, apply firestop putty pad to back of each outlet to restore fire and sound ratings.

### **3.5 SEQUENCES OF OPERATION**

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
  - .1 Ensure pipe insulation installation precedes fire stopping.

### **3.6 FIELD QUALITY CONTROL**

- .1 Inspections: notify Departmental Representative when ready for inspection and before concealing or enclosing fire stopping materials and service penetration assemblies.
- .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.

**3.7 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

**3.8 SCHEDULE**

- .1 Fire stop and smoke seal at:
  - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
  - .2 Edge of floor slabs at curtain wall and precast concrete panels.
  - .3 Top of fire-resistance rated masonry and gypsum board partitions.
  - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
  - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
  - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
  - .7 Openings and sleeves installed for future use through fire separations.
  - .8 Around mechanical and electrical assemblies penetrating fire separations.
  - .9 Rigid ducts: greater than 129 cm<sup>2</sup> : fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 04 05 23 - Masonry Accessories
- .2 Section 06 10 00 - Rough Carpentry
- .3 Section 06 40 00 - Architectural Woodwork
- .4 Section 07 26 00 - Vapour Retarders
- .5 Section 07 84 00 - Fire Stopping
- .6 Section 08 11 00 - Metal Doors and Frames
- .7 Section 09 21 16 - Gypsum Board Assemblies
- .8 Section 09 30 13 - Ceramic Tiling
- .9 Section 09 91 99 - Painting For Minor Works
- .10 Section 10 28 10 - Toilet and Bath Accessories

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
  - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
  - .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
  - .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168-[A2005], Adhesives and Sealants Applications

**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 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 35 29.06 - 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.

#### **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 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 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.

#### **1.6 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, 24 hours before, during application, and until sealants have cured.
    - .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.

## **1.7 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.

## **Part 2 Products**

### **2.1 SEALANT MATERIALS**

- .1 All sealants to have matte finish; high gloss finish will not be acceptable.
- .2 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .3 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.
- .4 Where sealants are qualified with primers use only these primers.

### **2.2 SEALANT MATERIAL DESIGNATIONS**

- .1 Urethanes two part:
  - .1 Self-levelling: to CAN/CGSB-19.24, Type 1, Class B, colour as selected by Departmental Representative from manufacturers standard colour range.
- .2 Urethanes two part:
  - .1 Non-sag: to CAN/CGSB-19.24, Type 2, Class B, colour as selected by Departmental Representative from manufacturers standard colour range.
- .3 Urethanes one part:
  - .1 Non-sag: to CAN/CGSB-19.13, Type 2, MCG-2-25, colour as selected by Departmental Representative from manufacturers standard colour range.

- .4 Silicones one part: to CAN/CGSB-19.13.
- .5 Acrylic latex one part: to CAN/CGSB-19.17.
- .6 Acoustical sealant: to ASTM C919.
- .7 Ensure that back-up materials are compatible with selected sealant and of type recommended by manufacturer. Preformed compressible and non-compressible back-up materials:
  - .1 Polyethylene, urethane, neoprene or vinyl foam:
    - .1 Extruded closed cell foam backer rod.
    - .2 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: urethane two part.
- .2 Coping joints and coping-to facade joints: sealant type: urethane two part.
- .3 Seal interior perimeters of exterior openings as detailed on drawings: sealant type: urethane one part.
- .4 Control and expansion joints on the interior of exterior poured-in place concrete walls: sealant type: urethane two part.
- .5 Interior control and expansion joints in floor surfaces: sealant type: urethane two part self leveling.
- .6 Perimeters of interior frames, as detailed and itemized: sealant type: acrylic latex.
- .7 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): sealant type: silicone one part, mildew resistant.
- .8 Exposed interior control joints in drywall: sealant type: acrylic latex.
- .9 Acoustic rated partitions and separations with STC ratings 50 and above: acoustic sealant as indicated on the drawings and at all penetrations or interior piping.

## **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 Inform Departmental Representative Consultant of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from 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.
  - .2 Clean adjacent surfaces immediately.
  - .3 Remove excess and droppings, using recommended cleaners as work progresses.
  - .4 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.

### **3.8 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 06 10 00 - Rough Carpentry
- .2      Section 07 26 00 - Vapour Retarders
- .3      Section 07 62 00 - Sheet Metal Flashing and Trim
- .4      Section 07 84 00 - Fire Stopping
- .5      Section 07 92 00 - Joint Sealants
- .6      Section 08 14 16 - Flush Wood Doors
- .7      Section 08 50 00 - Windows
- .8      Section 08 71 00 - Door Hardware
- .9      Section 08 80 50 - Glazing

**1.2                REFERENCES**

- .1      American Society for Testing and Materials International (ASTM)
  - .1      ASTM A653/A653M-15, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2      ASTM B29-14, Standard Specification for Refined Lead.
  - .3      ASTM B749-14, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2      Canadian General Standards Board (CGSB)
  - .1      CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  - .2      CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3      Canadian Standards Association (CSA International)
  - .1      CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2      CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .4      Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1      CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
  - .2      CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5      National Fire Protection Association (NFPA)
  - .1      NFPA 80-2016, Standard for Fire Doors and Fire Windows.
  - .2      NFPA 252-2012, Standard Methods of Fire Tests of Door Assemblies.
- .6      ITS/Warnock Hersey Professional Services Ltd. (WHI):
  - .1      Fire Rating Services, Building Materials and Equipment, Listings (ITS/WH).

- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
  - .3 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
  - .4 CAN4-S104-M80(R1985), Standard Method for Fire Tests of Door Assemblies.
  - .5 CAN4-S105-M85(R1992), Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

### **1.3 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
  - .2 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 (NFPA 252) for ratings specified or indicated.
  - .3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E152, NFPA 252, and listed by nationally recognized agency having factory inspection services.

### **1.4 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.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware, fire rating, and finishes.
  - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.
  - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

### **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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

**2.2 DOOR CORE MATERIALS**

- .1 Honeycomb construction:
  - .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m<sup>3</sup> minimum sanded to required thickness.
- .2 Stiffened: face sheets laminated to honeycomb or insulated core.
  - .1 Fibreglass: to CAN/ULC-S702, semi-rigid, density 24 kg/m<sup>3</sup>.
    - .1 Expanded polystyrene: CAN/ULC-S701, density 16 to 32 kg/m<sup>3</sup>. laminated under pressure to surface sheets
- .3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 30 to 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

**2.3 ADHESIVES**

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
  - .1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

**2.4 PRIMER**

- .1 Touch-up prime CAN/CGSB-1.181.
  - .1 Maximum VOC limit 50 g/L to GC-03.

**2.5 PAINT**

- .1 Field paint steel doors and frames in accordance with Section 09 90 00Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
  - .1 Maximum VOC emission level 50 g/L to GS-11

**2.6 ACCESSORIES**

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Shims: Use silicone/plastic shims to all exterior hollow metal frames
- .3 Exterior, interior, top caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .4 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .5 Door bottom seal: Fixed.
- .6 Metallic paste filler: to manufacturer's standard.
- .7 Fire labels: metal rivited.
- .8 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .9 Glazing: in accordance with 08 80 50 - Glazing.
- .10 Make provisions for glazing as indicated and provide necessary glazing stops.
  - .1 Provide removable stainless steel glazing beads for dry glazing of snap-on type.
  - .2 Design exterior glazing stops to be tamperproof.

**2.7 FRAMES FABRICATION GENERAL**

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm welded, thermally broken type construction.
- .4 Interior frames: 1.6 mm welded type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .7 Manufacturer's nameplates on frames and screens are not permitted.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .10 Insulate exterior frame components with polyurethane insulation.

**2.8 FRAME ANCHORAGE**

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.



- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

**2.9 FRAMES: WELDED TYPE**

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

**2.10 DOOR FABRICATION GENERAL**

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: insulated construction. Interior doors: honeycomb construction.
- .3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish].
- .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E330
- .5 Blank, reinforce, drill doors and tap for mortised, templated hardware, and electronic hardware.
- .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .7 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104, ASTM E152, NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .10 Manufacturer's nameplates on doors are not permitted.

**2.11 DOORS: HONEYCOMB CORE CONSTRUCTION**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with polystyrene core laminated under pressure to face sheets.
- .2 Form face sheets for interior doors from 1.6 mm sheet steel with, honeycomb, temperature rise rated core laminated under pressure to face sheets.

**2.12 HOLLOW STEEL CONSTRUCTION**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel.
- .2 Form face sheets for interior doors from 1.6 sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with polystyrene core.
- .5 Fill voids between stiffeners of interior doors with honeycomb, temperature rise rated core.

**2.13 THERMALLY BROKEN DOORS AND FRAMES**

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

**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 GENERAL**

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

**3.3 FRAME INSTALLATION**

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.

- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and vapour retarder.

### **3.4 DOOR INSTALLATION**

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Finished floor, top of carpet: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

### **3.5 FINISH REPAIRS**

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

### **3.6 GLAZING**

- .1 Install glazing for doors in accordance with Section 08 80 50 - Glazing.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 08 71 00 - Door Hardware

**1.2 REFERENCES**

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
  - .1 Quality Standards for Architectural Woodwork 1998.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
  - .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 Canadian Standards Association (CSA International).
  - .1 CSA O115-M1982(R2001), Hardwood and Decorative Plywood.
  - .2 CAN/CSA O132.2 Series-90(R2003), Wood Flush Doors.
  - .3 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.
  - .4 CSA Certification Program for Windows and Doors [00].
- .4 Environmental Choice Program (ECP).
  - .1 CCD-045-2016, Sealants and Caulking Compounds.
  - .2 CCD-046-2012, Adhesives.
- .5 National Fire Protection Association (NFPA).
  - .1 NFPA 80-1999, Standard for Fire Doors and Fire Windows.
  - .2 NFPA 252-1999, Standard Method of Fire Tests of Door Assemblies.
- .6 ITS/Warnock Hersey Professional Services Ltd. (WHI):
  - .1 Fire Rating Services, Building Materials and Equipment, Listings (ITS/WH).
- .7 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN-4S104M-80(R1985), Fire Tests of Door Assemblies.
  - .2 CAN4-S105M-85 (R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104.

**1.3 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.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware, fire rating, and finishes.

- .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.
- .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

#### **1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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

- .1 Storage and Protection:
  - .1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
  - .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
  - .3 Protect doors from scratches, handling marks and other damage. Wrap doors.
  - .4 Store doors away from direct sunlight.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 FIRE RATED WOOD DOORS**

- .1 Wood doors: tested in accordance with CAN4-S104 to achieve rating as scheduled.
- .2 Solid core: to CAN/CSA-O132.2.1.
  - .1 Construction:
    - .1 Solid particleboard core: stile and rail frame bonded to particleboard core with wood lock blocks, 3-ply construction.
  - .2 Face Panels:
    - .1 Hardboard: moulded face, as per drawings.
  - .3 Adhesive: Type II (water resistant) for interior doors.

#### **2.2 WOOD FLUSH DOORS**

- .1 Hollow core: to CAN/CSA-O132.2.2.
  - .1 Construction: mesh or cellular core with lock blocks, 3-ply construction.

- .2 Face Panels:
  - .1 Hardboard face panels: moulded face, as per drawings
- .3 Adhesive: Type I (waterproof) for interior doors.

## **2.3 FABRICATION**

- .1 Vertical edge strips to match face veneer.
- .2 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
- .3 Prepare doors to receive hardware, using templates provided. Factory prepare doors to receive hardware, using proper tools, equipment and drill jigs, to ensure proper fit of hardware, for smooth operation.
- .4 Fabricate doors with reinforced door edge and blocking system for hardware. Use 125 mm deep top rail blocking for all doors with closers. Provide center blocking at strike edge for doors with locksets, latchsets and the like.
- .5 Undercut doors as required to suit floor finish, to a maximum of 6 mm above finish floor.

## **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 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.
- .2 Install labelled fire rated doors to NFPA 80.
- .3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.
- .4 Adjust hardware for correct function.

### **3.3 ADJUSTMENT**

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

### **3.4 CLEANING**

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking; clean doors and frames.
- .3 Clean glass and glazing materials with approved non-abrasive cleaner.
- .4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 21 16 Blanket Insulation
- .3 Section 08 71 00 - Door Hardware
- .4 Section 28 13 00 - Access Control

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E283-04 (2012); Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - .2 ASTM E331-00 (2009); Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  - .3 ASTM E547-00 (2009); Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
  - .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 Environmental Choice Program (ECP).
  - .1 CCD-045-92, Sealants and Caulking Compounds.
  - .2 CCD-046-92, Adhesives.

**1.3 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.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware, fire rating, and finishes.
  - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.
  - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Storage and Protection:
  - .1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
  - .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
  - .3 Protect doors from scratches, handling marks and other damage. Wrap doors.
  - .4 Store doors away from direct sunlight.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Fiberglass Skins: 0.25 mm thick, fibreglass reinforced thermoset composite, textured to duplicate hardwood surface, stainable.
- .2 Stiles and Rails: Engineered wood
- .3 Hardware Blocking: provide wood blocking to support hardware required by hardware schedule.
- .4 Door edges: machinable kiln-dried hardwood, flush and square with door faces, lock edge reinforced
- .5 Door bottom edge: moisture- and decay-resistant composite
- .6 Core: foamed-in-place polyurethane, density 1.9 pcf minimum
- .7 Wiring: 2-No.18 Gauge copper insulated wires inside the door for electrical hardware where required by hardware schedule.

**2.2 PRE-HUNG COMPOSITE DOORS**

- .1 Face Panels: Raised panel, wood grain texture.
- .2 Casing:
  - .1 Exterior: Brick mould, 50 mm.
  - .2 Interior: as per drawings
- .3 Hinges: Solid brass concealed-bearing, to ANSI/BHMA A156.1:
  - .1 For Access controlled entry doors: Concealed Circuit Electric Hinge, Heavy Duty, complete with 2 –No.18 gauge wires, no external wires.
    - .1 Size: 115 x 115 mm
    - .2 Finish: Satin Nickel



- .2 For all other doors: Standard Hinges
  - .1 Size: 102 x 102 mm
  - .2 Finish: Satin Nickel
- .4 Flush Bolts: manual top and bottom bolt for inactive door leaf.
- .5 Frames:
  - .1 Exterior: Aluminum Clad, dark brown colour as selected by Departmental Representative
  - .2 Interior: Paint grade wood.
- .6 Sills. Aluminum with Polished Aluminum finish

### **2.3 GLAZING**

- .1 Door Factory Glazing: perimeter moldings flush with skin and made as integral part of skin.
- .2 6 mm tempered, frosted pattern chosen by Departmental Representative from manufacturer's standard designs, two panes with sealed airspace between, air-space 12 mm.

### **2.4 FABRICATION**

- .1 Prepare doors to receive hardware, using templates provided. Factory prepare doors to receive hardware, using proper tools, equipment and drill jigs, to ensure proper fit of hardware, for smooth operation.
- .2 Fabricate doors with reinforced door edge and blocking system for hardware. Use 125 mm deep top rail blocking for all doors with closers. Provide center blocking at strike edge for doors with locksets, latchsets and the like.
- .3 Fabricate doors to receive electrified hardware to have wiring installed inside the door running from the lockset hole to the top hinge location.

## **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 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.
- .2 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.
- .3 Adjust hardware for correct function.

**3.3 ADJUSTMENT**

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

**3.4 CLEANING**

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking; clean doors and frames.
- .3 Clean glass and glazing materials with approved non-abrasive cleaner.
- .4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 06 20 00 - Finish Carpentry: including interior wood casings
- .3 Section 07 21 13 - Board Insulation
- .4 Section 07 21 16 - Batt & Blanket Insulation
- .5 Section 07 26 00 - Vapour Retarder
- .6 Section 07 44 56 - Mineral Fibre Reinforced Cementitious Panels
- .7 Section 07 90 00 - Sealants
- .8 Section 09 21 16 - Gypsum Board Assemblies

**1.2 REFERENCE STANDARDS**

- .1 CGSB Standards:
  - .1 CAN/CGSB-12.3-M91: Flat, Clear Float Glass.
  - .2 CAN/CGSB-12.8-M90: Insulating Glass Units.
  - .3 CAN/CGSB-12.20-M89: Structural Design of Glass for Buildings.
  - .4 CAN/CGSB-79.1-M91: Screens, Aluminum Frame, Window.
- .2 CSA Standards:
  - .1 AAMA/WDMA/CSA/101/IS.2/A440-11: North American Fenestration Standard /Specification for Windows, Doors and Skylights.
  - .2 CAN/CSA-A-440-00(R2005): Windows.
  - .3 CAN/CSA A440S1-09: Canadian Supplement to AAMA/WDMA/CSA/101/IS.2/A440-08 - North American Fenestration Standard /Specification for Windows, Doors and Skylights.
  - .4 CAN/CSA-A-440.1-00(R2005): Users Selection guide to A440-00.
  - .5 CAN/CSA-A440.2-14: Fenestration Energy Performance.
  - .6 CAN/CSA-A440.3-09: User Guide to A440.2-09 - Fenestration Energy Performance.
  - .7 CAN/CSA-A440.4-07(R2012): Window, Door and Skylight Installation.
  - .8 CAN/CSA-G40.21-04(R2009): Structural Quality Steels.
- .3 Green Seal (GS)
  - .1 GS-11-15, Paints and Coatings.
- .4 Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.
    - .1 MPI #79, Primer, Alkyd, Anti-Corrosive for Metal.

- .5 South Coast Air Quality Management District (SCAQMD)
  - .1 SCAQMD Rule 1113-11, Architectural Coatings.
  - .2 SCAQMD Rule 1168-05, Adhesives and Sealants.
- .6 Screen Manufacturers Association (SMA)
  - .1 SMA 1201: 2007 (R2012) Specification for Insect Screens for Windows, Sliding Doors and Swinging Doors.

### **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 windows 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 Alberta, Canada.
  - .2 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, description of related components and exposed finishes, fasteners, and caulking. Indicate location of manufacturer's nameplates.
- .4 Test and Evaluation Reports:
  - .1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.
  - .2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:
    - .1 The product manufacturer.
    - .2 The type of product.
    - .3 The model number/series number.
    - .4 The primary product designation.
    - .5 The secondary product designation.
      - .1 Positive design pressure.
      - .2 Negative design pressure.
      - .3 Water penetration resistance test pressure.
      - .4 Canadian air infiltration and exfiltration levels.
    - .6 The test completion date.
  - .3 The report will also contain the following information:
    - .1 Test dates.
    - .2 Report preparation dates.
    - .3 Test information retention period.

- .4 Location of testing facilities.
  - .5 Full description of test samples, including:
    - .1 Condensation resistance.
    - .2 Safety drop - vertical sliding windows only.
    - .3 Block operation - sliding windows only.
    - .4 Sash strength and stiffness - [operable casement] [projecting].
    - .5 Sash pull-off - vinyl windows.
    - .6 Forced entry resistance.
    - .7 Mullian deflection - combination and composite windows.
  - .6 Complete description of amendments, as applicable.
  - .7 Conclusion.
  - .8 Drawings signed by the testing laboratory, if provided.
- .5 Sustainable Design Submittals:
- .1 Low-Emitting Materials:
    - .1 Submit listing of sealants, paints, primers, and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

#### **1.4 MOCK UP**

- .1 Construct a mock up of a typical window in exterior wall at location designated by Departmental Representative, including all necessary fasteners, accessories, flashings, membranes around windows, vapour retarders, batt insulation, sealants, glazing and related components. Do not proceed with the rest of the installation or fabrication of vinyl windows and until they have been accepted by the Departmental Representative. Coordinate with Sections 07 24 00 and 07 26 00.
- .2 Adjust installation methods are required by the Departmental Representative until adequate for the site conditions.
- .3 The accepted sample installations will become the prototype for all windows on the project and will be the minimum standard in terms of manufacture and installation quality acceptable.

#### **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 windows for incorporation into manual.

#### **1.6 QUALITY ASSURANCE**

- .1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### **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, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect windows from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**1.8 GLASS BREAKAGE**

- .1 Be responsible for all glass broken because of faulty setting and replace same at no cost to the Owner.

**Part 2 Products**

**2.1 WINDOWS**

- .1 Materials: to CAN/CSA-A440, supplemented as follows:
  - .1 All PVC windows by same manufacturer.
  - .2 Sash: vinyl.
  - .3 Main frame: vinyl, complete with integral nailing flange with slotted holes for attachment to framing. Provide shared mullion to combination casement/fixed windows.
  - .4 Glass:
    - .1 Float glass: to CAN/CGSB-12.3, glazing quality.
    - .2 Triple pane insulating glass units: to CAN/CGSB-12.8, with all lites of minimum 3 mm thick clear float glass, (or thicker as required to suit opening size and to withstand all superimposed loading), with Argon gas fill. Provide Low E coating as required to achieve Energy ratings. Provide 10 mm wide, prefinished white aluminum muntin bars between glass, to patterns as indicated on the drawings and reviewed shop drawings.
  - .5 Screens: to CAN/CGSB-79.1-M91.
    - .1 Insect screening mesh: count 18 x 14, plastic-coated fibrous glass.
    - .2 Fasteners: tamper proof.
    - .3 Screen frames: colour to match window frames.
    - .4 Mount screen frames for interior replacement.
  - .6 Jamb extensions: Vinyl colour to match window, of width to suit wall thickness. Factory seal between vinyl window frame and jamb extensions to maintain continuity of the air/vapour barrier.
- .2 Isolation coating: alkali resistant bituminous paint.
- .3 Sealants:
  - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.

## **2.2 WINDOW TYPES AND CLASSIFICATION**

- .1 Types:
  - .1 Fixed windows, Combination fixed/Casement: Casement type projected window with fixed panel as indicated on the drawings, with triple glazed insulating glass.
- .2 Classification rating: to AAMA/WDMA/CSA 101/I.S.2/A440.
  - .1 Primary designation:
    - .1 Performance classes: R.
    - .2 Performance grade: 60.
  - .2 Secondary designation:
    - .1 Positive design pressure: 2880 Pa.
    - .2 Negative design pressure: 2880 Pa.
    - .3 Water penetration resistance test pressure: 440 Pa. Water leakagerating: B7
    - .4 Canadian air infiltration and exfiltration levels: A3
  - .3 Surface condensation control: compliant with standard CAN/CSA-A440.2/A440.3.
  - .4 Ancillary properties (Energy rating).
    - .1 Overall coefficient of heat transfer (U-factor) 1.31 - 1.36 W/(m<sup>2</sup>.K).
    - .2 Solar heat gain coefficient (SHGC) 0.20
    - .3 Energy rating (ER) 22 – 23.
  - .5 Screens: on ventilating portion of windows.

## **2.3 FABRICATION**

- .1 Fabricate in accordance with CAN/CSA-A440 supplemented as follows:
  - .1 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
  - .2 Face dimensions detailed are maximum permissible sizes.
  - .3 Brace frames to maintain squareness and rigidity during shipment and installation.
  - .4 Fabricate sash with sealed glazing incorporating airspace and conforming to performance requirements of CAN2 12.8-97.
  - .5 Provide latches to all projected windows which prevent opening from the outside.
  - .6 Provide weatherstripping for all operable windows.

## **2.4 VINYL FINISHES**

- .1 Beige Standard Colour as selected by the Departmental Representative.
- .2 Finish to all components exposed to interior side of window: manufacturer's standard White Colour.

**2.5 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of isolation coating:
  - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
  - .2 Concrete, mortar and masonry.
  - .3 Wood.

**2.6 Glazing**

- .1 Glaze windows in accordance with CAN/CSA-A440.

**2.7 HARDWARE**

- .1 Hardware: stainless steel or white bronze sash locks and aluminum handles to provide security and permit easy operation of units. Provide roto handle tuck and turn operators to all operable windows.
- .2 Locks: provide operating sash with spring loading locking device, to provide automatic locking in closed position.

**2.8 AIR BARRIER AND VAPOUR RETARDER**

- .1 Equip window frames with site installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:
  - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
  - .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .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 Window installation:
  - .1 Install in accordance with AAMA/WDMA/CSA 101/LS.2/A440.
  - .2 Arrange components to prevent abrupt variation in colour.



- .3 Erect and secure window units in prepared openings plumb and square, free from warp, twist or superimposed loads, installed to achieve weather tight installation.
- .4 Attach windows securely to framing. All anchors and fitments concealed. Exposed heads of fasteners not permitted.
- .5 Secure work adequately and accurately to structure in required position, in a manner not restricting thermal and wind movement of windows and patio sliders.
- .6 Provide anchors that will permit sufficient adjustment for accurate alignment.
- .7 Leave room for lintel deflection above windows, free of rigid obstructions.
- .8 Adjust operable windows and hardware as required for smooth operation. Lubricate moving parts.
- .2 Caulking:
  - .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
  - .2 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Departmental Representative
- .3 Seals & Insulation
  - .1 Seal between inside portion of window frame and the sheet vapour retarder.
  - .2 Seal between exterior portion of window and self adhered membrane around window. Seal between exterior trim and adjacent materials and window frames.
  - .3 Completely fill in between window frames and adjacent framing, with batt insulation.
  - .4 Seal between window frame and adjacent sheet vapour retarder and interior and exterior side of window frames using sealant type 1 specified in Section 07 90 00, to maintain continuity of the vapour retarder between window frames and adjacent sheet vapour retarder.

### **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-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 window installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 06 40 00 - Architectural Woodwork
- .3 Section 07 92 00 - Joint Sealants
- .4 Section 09 21 16 - Gypsum Board Assemblies.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
  - .1 ANSI/BHMA A156.9-2010, Cabinet Hardware.
  - .2 ANSI/BHMA A156.11-2014, Cabinet Locks.
  - .3 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
  - .4 ANSI/BHMA A156.18-2012, Materials and Finishes.
  - .5 ANSI/BHMA A156.20-2012, Strap and Tee Hinges and Hasps.

**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 cabinet hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit two samples of each type.
- .4 Hardware List:
  - .1 Submit contract hardware list.
  - .2 Indicate specified hardware, including make, model, material, function, finish and other pertinent information.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.

**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 cabinet hardware for incorporation into manual.

**1.5 QUALITY ASSURANCE**

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**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: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect cabinet hardware from nicks, scratches, and blemishes.
  - .3 Protect prefinished surfaces with wrapping or strippable coating.
  - .4 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's product for all similar items.

**2.2 CABINET HARDWARE**

- .1 Cabinet hardware: to ANSI/BHMA A156.9, designated by letter B and numeral identifiers as listed below.
  - .1 Hinges: concealed hinge, 120 to 125 degree of opening, full overlay type for screw attachment complete with mounting plates
  - .2 Drawer & Door Pulls: back mounted pull, 128 mm wire style, brushed stainless steel finish
  - .3 Shelf rests: shelf rest installed in holes drilled at 25 mm intervals, steel construction, white finish.
  - .4 Drawer slides: side mount, steel construction, ¾ extension, ball bearing operation, rail disconnect system, bright zinc finish, length as required.

**2.3 COUNTER SUPPORT**

- .1 Round Design Adjustable Table Leg: 870 mm high with 30 mm adjustment, coordinate leg height with countertop, 60 mm diameter with mounting plate, 150 kg load capacity, chrome finish.

**2.4 MISCELLANEOUS HARDWARE**

- .1 Garment rods and shelves: wire type with integrated clothes hanger rod, prefinished white. Provide supports at minimum 1070 mm o.c. and maximum 200 mm from ends.
- .2 Linen and other in-unit storage shelving: wire type with integrated clothes hanger rod, prefinished white. Provide supports at minimum 1070 mm o.c. and maximum 200 mm from ends. Provide for a minimum of 4 adjustable shelves per closet / space.

**2.5 FASTENINGS**

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Use fasteners compatible with material through which they pass.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Install hardware to standard hardware location dimensions in accordance with manufacturer's recommendations and to project design requirements.
- .3 Install key control cabinet and establish key control set-up.

**3.2 ADJUSTING**

- .1 Adjust cabinet hardware for optimum, smooth operating condition.
- .2 Lubricate hardware and other moving parts.
- .3 Adjust cabinet door hardware to ensure tight fit at contact points with frames.

**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 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
  - .3 Remove protective material from hardware items where present.
  - .4 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 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 DEMONSTRATION**

- .1 Maintenance Staff Briefing:
  - .1 Brief maintenance staff regarding:
    - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
- .2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

**3.5 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 11 00 - Metal Doors and Frames
- .3 Section 08 14 16 - Flush Wood Doors
- .4 Section 08 16 13 - Fibreglass Doors
- .5 Section 08 50 00 - Windows
- .6 Section 08 71 00 - Door Hardware
- .7 Section 08 80 50 - Glazing
- .8 Section 28 13 00 - Access Control

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
  - .1 ANSI/BHMA A156.1-2013, American National Standard for Butts and Hinges.
  - .2 ANSI/BHMA A156.2-2011, Bored and Preassembled Locks and Latches.
  - .3 ANSI/BHMA A156.3-2008, Exit Devices.
  - .4 ANSI/BHMA A156.4-2008, Door Controls - Closers.
  - .5 ANSI/BHMA A156.5-2010, Auxiliary Locks and Associated Products.
  - .6 ANSI/BHMA A156.6-2010, Architectural Door Trim.
  - .7 ANSI/BHMA A156.8-2010, Door Controls - Overhead Stops and Holders.
  - .8 ANSI/BHMA A156.12-2013, Interconnected Locks and Latches.
  - .9 ANSI/BHMA A156.13-2012, Mortise Locks and Latches Series 1000.
  - .10 ANSI/BHMA A156.14-2013, Sliding and Folding Door Hardware.
  - .11 ANSI/BHMA A156.15-2011, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
  - .12 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
  - .13 ANSI/BHMA A156.17-2010, Self-closing Hinges and Pivots.
  - .14 ANSI/BHMA A156.18-2012, Materials and Finishes.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
  - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

**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 door hardware 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 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
  - .4 After approval samples will be returned for incorporation in Work.
- .4 Hardware List:
  - .1 Submit contract hardware list.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.

#### **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 door hardware for incorporation into manual.

#### **1.5 MAINTENANCE MATERIALS SUBMITTALS**

- .1 Extra Stock Materials:
  - .1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Tools:
    - .1 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

#### **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Employ an experienced hardware consultant who is a member of the Door and Hardware Institute and is an AHC, for scheduling, detailing, ordering, and coordinating hardware for this project.

#### **1.7 COORDINATION**

- .1 Before furnishing any hardware, check all drawings and specifications for hardware requirements, verifying door swings, check all shop drawings with frame and door lists and advise Departmental Representative in writing of discrepancies noted.
- .2 Deliver templates required for shop fabrication of wood and hollow metal doors and frames in ample time so as not to impede the progress of the work.

**1.8 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.

**Part 2 Products**

**2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's products only for similar items.

**2.2 DOOR HARDWARE**

- .1 Locks and latches:
  - .1 Locks and latches:
    - .1 For Access controlled entry doors: to ANSI/BHMA A156.2, series 4000, grade 1, designed for function and keyed as stated in Hardware Schedule.
    - .2 For all other doors: to ANSI/BHMA A156.2, series 4000 bored lock, grade 2, designed for function and keyed as stated in Hardware Schedule.
  - .2 Knobs: Orbit-style, plain.
  - .3 Escutcheons : round.
  - .4 Cores: Interchangeable.
  - .5 Normal strikes: box type, lip projection not beyond jamb.
  - .6 Cylinders: key into keying system as directed.
  - .7 Finished to Satin Chrome, 626.
- .2 Butts and hinges:
  - .1 Butts and hinges: to ANSI/BHMA A156.1, 5-knuckle, full-mortise, permanently lubricated non-detachable ball bearings, steel, Satin finished, with non-removable pins for out swinging doors. Hinges shall be a minimum of 4 1/2" high and 4" wide; standard weight hinges shall be supplied at all doors where specified.
  - .2 Self-closing hinges and pivots: to ANSI/BHMA A156.17, fully adjustable, Satin finished. Provide 2 self-closing hinges on fire labelled doors.
- .3 Door Closers and Accessories:
  - .1 Door controls (closers): to ANSI/BHMA A156.4, hold open as required, finish to selected by Departmental Representative.
  - .2 Door co-ordinator: surface for pairs of doors with overlapping astragal.
- .4 Deadbolts: to ANSI/BHMA A156.5, grade 2, 25 mm throw, designed for function and keyed as stated in Hardware Schedule.
  - .1 Cylinders: key into keying system as directed.
  - .2 Normal strikes: box type, lip projection not beyond jamb
  - .3 Cores: Interchangeable
  - .4 Finished to Satin Chrome, 626



- .5 Architectural door trim: to ANSI/BHMA A156.6.
  - .1 Door protection plates: kick plate, 1.27 mm thick stainless steel, 406 mm high x 813 mm wide to, hidden fastener installation.
- .6 Auxiliary hardware: to ANSI/BHMA A156.16, as listed below, finished to 626 Satin Chrome.
  - .1 Door Stop: Floor Mounted, Type L12131.
  - .2 Door Stop: Wall Mounted, Type L12011.
  - .3 Door Holder: Kick-down, door mounted, Type L11381.
  - .4 Door viewer: one-way wide angle viewer, minimum 150 degree angle of view, listed or labelled for fire rated doors.
- .7 Door bottom seal: door seal of extruded aluminum frame and solid closed cell neoprene weather seal, surface mounted with drip cap, closed ends, adjustable, clear anodized finish.
- .8 Thresholds: depth to suit wall type x full width of door opening, extruded aluminum, mill finish, serrated surface, with thermal break of rigid PVC, with vinyl door seal insert.
- .9 Weatherstripping:
  - .1 Head and jamb seal:
    - .1 Extruded aluminum frame and hollow closed cell neoprene insert, clear anodized finish.
    - .2 Adhesive backed neoprene material.
  - .2 Door bottom seal:
    - .1 Extruded aluminum frame and nylon brush sweep, clear anodized finish.
- .10 Astragal: adjustable, overlapping, extruded aluminum frame with vinyl insert, finished to match doors.

## **2.3 FASTENINGS**

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

## **2.4 KEYING**

- .1 Doors, to be keyed as directed. Prepare detailed keying schedule in conjunction with Departmental Representative.
- .2 Supply keys in triplicate for every lock in this Contract.

- .3 Supply 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply construction cores.
- .6 Hand over permanent cores and keys to Departmental Representative.

**2.5 FIRE-RATED OPENINGS**

- .1 Provide door hardware for fire-rated openings that comply with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Prior to installation, ensure that doors and frames are properly prepared and reinforced to receive finish hardware
- .5 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .6 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .7 Install key control cabinet.
- .8 Use only manufacturer's supplied fasteners.
  - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .9 Remove construction cores, locks when directed by Departmental Representative.
  - .1 Install permanent cores and ensure locks operate correctly.

**3.2 ADJUSTING**

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

### **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 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
  - .3 Remove protective material from hardware items where present.
  - .4 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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.4 DEMONSTRATION**

- .1 Keying System Setup and Cabinet:
  - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
  - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
  - .3 Lock key cabinet and turn over key to Departmental Representative.
- .2 Maintenance Staff Briefing:
  - .1 Brief maintenance staff regarding:
    - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
    - .2 Description, use, handling, and storage of keys.
    - .3 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

### **3.5 PROTECTION**

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

### **3.6 SCHEDULE**

- .1 Hardware Group 1 – Exterior Entry / Exit Door, single, coordinate supplied hardware with door supplier.
  - .1 1 1/2 pair hinges
  - .2 Closer with Overhead Stop and hold open
  - .3 Lockset – Electrically Locked (fail safe), ANSI D12DEU, interconnected with Section 28 13 00, Access Control
  - .4 Threshold
  - .5 Weatherstripping, including door bottom sweep

- .2 Hardware Group 2 – Exterior Entry / Exit Door, double, coordinate supplied hardware with door supplier.
  - .1 3 pair hinges,
  - .2 Closer, per leaf
  - .3 Lockset – Passage Latch, ANSI F75
  - .4 Top & bottom Flush Bolts on inactive leaf
  - .5 Threshold
  - .6 Weatherstripping, including door bottom sweep
  - .7 Wall stop or overhead stop to suit condition
- .3 Hardware Group 3 – Vestibule Door, single, coordinate supplied hardware with door supplier.
  - .1 1 1/2 pair hinges
  - .2 Closer with Overhead Stop and hold open
  - .3 Lockset – Passage Latch, ANSI F75
  - .4 Wall Stop
- .4 Hardware Group 4 – Vestibule Door, double, coordinate supplied hardware with door supplier.
  - .1 3 pair hinges
  - .2 Closer, per leaf
  - .3 Lockset – Electrically Locked (fail safe), ANSI D12DEU, interconnected with Section 28 13 00, Access Control
  - .4 Top & bottom Flush Bolts on inactive leaf
  - .5 Wall stops, per leaf
- .5 Hardware Group 5 – Interior Exit Door, single
  - .1 1 1/2 pair hinges
  - .2 Closer
  - .3 Lockset – Passage Latch, ANSI F75
  - .4 Kick plate
  - .5 Wall Stop
- .6 Hardware Group 6 – Interior Exit Door, double
  - .1 3 pair hinges
  - .2 Closer, per leaf
  - .3 Overhead stop to suit condition
  - .4 Lockset – Passage Latch, ANSI F75
  - .5 Top & bottom Flush Bolts on inactive leaf
  - .6 Kick plates
  - .7 Wall stop

- .7 Hardware Group 7 – Secure Storage Doors, Interior, double
  - .1 3 pair hinges
  - .2 Closer, per leaf
  - .3 Lockset – Storeroom Lock, ANSI F86
  - .4 Top and bottom flush bolts on inactive leaf
  - .5 Wall Stop or floor stop to suit conditions
- .8 Hardware Group 8 – Secure Storage Doors, Interior
  - .1 1 1/2 pair hinges
  - .2 Closer
  - .3 Lockset – Storeroom Lock, ANSI F86
  - .4 Kick plate
  - .5 Wall stop or floor stop to suit condition
- .9 Hardware Group 9 – Laundry Room Door
  - .1 1 1/2 pair hinges
  - .2 Closer
  - .3 Lockset – Passage Latch, ANSI F75
  - .4 Kick plate
  - .5 Wall Stop
- .10 Hardware Group 10 – Unit Entry Doors
  - .1 1 1/2 pair hinges, self-closing (Spring) hinges
  - .2 Lockset – Entrance Lock, ANSI F109
  - .3 Deadbolt – ANSI E0152
  - .4 Door Viewer
  - .5 Wall stop or floor stop to suit condition
- .11 Hardware Group 11 – Bedroom & Bathroom Doors
  - .1 1 1/2 pair hinges
  - .2 Lockset – Privacy Lock, ANSI F76
  - .3 Wall stop or floor stop to suit condition
- .12 Hardware Group 12 – Unit Closet Doors
  - .1 1 1/2 pair hinges
  - .2 Lockset – Passage Latch, ANSI F75
  - .3 Wall stop or floor stop to suit condition

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 08 11 00 – Metal Doors & Frames

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C542-05(2011), Standard Specification for Lock-Strip Gaskets.
  - .2 ASTM D790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .3 ASTM D1003-13, Standard Test Method for Haze and Luminous Transmittance of Plastics.
  - .4 ASTM D1929-14, Standard Test Method for Determining Ignition Temperature of Plastics.
  - .5 ASTM D2240-015, Standard Test Method for Rubber Property - Durometer Hardness.
  - .6 ASTM E84-15b, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .7 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .8 ASTM F1233-08(2013), Standard Test Method for Security Glazing Materials and Systems.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
  - .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
  - .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
  - .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
  - .5 CAN/CGSB-12.8-97, Insulating Glass Units.
  - .6 CAN/CGSB-12.11-M90, Wired Safety Glass.
- .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 - 50<sup>th</sup> Anniversary Edition.
  - .2 GANA Laminated Glazing Reference Manual - 2009.

**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 glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
  - .1 Submit testing of glass under provisions of Section 01 45 00 - Quality Control.
- .4 Sustainable Design Submittals:
  - .1 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restrictions requirements.

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

#### **1.5 QUALITY ASSURANCE**

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### **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: 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 glazing and frames from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

#### **1.7 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 Flat Glass:
  - .1 Silvered mirror glass: 6 mm thick.
    - .1 Type 1B-float glass for high humidity use.
    - .2 Tint: Clear.
    - .3 Edges: Flat polished edge. Seal edges to prevent chemical or atmospheric penetration of backing
  - .2 Wired glass: to CAN/CGSB-12.11, 6 mm thick.
    - .1 Type 1-polished both sides (transparent).
    - .2 Wire mesh styles: 4-rectangular.
  - .3 Clear Tempered Safety Glass: to CAN/CGSB-12.1-M90.
    - .1 Type: 2 – Tempered
    - .2 Class: B - Float Glass
    - .3 Category: II - 540 J impact resistance
    - .4 9.5 mm clear tempered glazing for stainless steel guardrail system
- .2 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

**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: neoprene, 50 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 tape:
  - .1 Preformed butyl compound, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; size to suit opening; black colour.
  - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2 %, designed for compression of 25 %, to effect an air and vapour seal; size to suit opening.
- .4 Lock-strip gaskets: to ASTM C542.
- .5 Mirror attachment accessories: Stainless steel clips.

**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.
- .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: INTERIOR - DRY METHOD (TAPE AND TAPE)**

- .1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at ¼ points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

**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 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.
- .2 Waste Management: separate waste materials for 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.

**3.6 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**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1      Section 06 40 00 - Architectural Woodwork
- .2      Section 07 26 00 - Vapour Retarders
- .3      Section 07 84 00 - Fire Stopping
- .4      Section 08 11 00 - Metal Doors and Frames
- .5      Section 09 21 16 - Gypsum Board Assemblies
- .6      Section 09 30 13 - Ceramic Tiling
- .7      Section 09 91 99 - Painting For Minor Works
- .8      Section 10 28 10 - Toilet and Bath Accessories

**1.2                REFERENCES**

- .1      Aluminum Association (AA)
  - .1      AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2      ASTM International
  - .1      ASTM C442/C442M-04e1), Standard Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
  - .2      ASTM C475/C475M-12e1), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .3      ASTM C645-14), Standard Specification for Nonstructural Steel Framing Members.
  - .4      ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.
  - .5      ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
  - .6      ASTM C1002-14, 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.
  - .7      ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .8      ASTM C1177/C1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - .9      ASTM C1178/C1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
  - .10     ASTM C1280-13a, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
  - .11     ASTM C1396/C1396M-14a, Standard Specification for Gypsum Wallboard.
- .3      Association of the Wall and Ceilings Industries International (AWCI)
  - .1      AWCI Levels of Gypsum Board Finish-97.

- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .5 Green Seal Environmental Standards (GS)
  - .1 GS-11-2013, Edition 3.1, Paints and Coatings.
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2013, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

### **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 gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 LEED Canada-NC Version 1.0
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.
  - .3 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants, paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

### **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 gypsum board assembly 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 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.

## **1.5 AMBIENT CONDITIONS**

- .1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum seven days before and during application of gypsum boards and joint treatment, and for four days minimum after completion of joint treatment. Avoid concentrated or irregular heating during drying.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Do not apply gypsum board to wood framing when moisture content of the framing exceeds 16%.
- .4 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

## **1.6 PROVISIONS FOR USING GLASS-MAT GYPSUM BOARD PRODUCTS**

- .1 In addition to the area indicated in this Section and on the drawings which are to receive glass-mat gypsum board products, install glass-mat gypsum board products in all locations where gypsum board will be erected before achieving a dry, water tight building condition for each specific area.
- .2 Once a dry, water tight condition exists for each specific area, the Subcontractor is no longer required to install glass-mat faced gypsum board in remaining areas scheduled for paper faced gypsum board products.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Gypsum board: to ASTM C1396/C1396M, regular, 12.7 mm and 15.9 mm thick, Type X as indicated on drawings, 1200 mm wide x maximum practical length, ends square cut, edges tapered.
- .2 Gypsum board for ceilings: to ASTM C1396/C1396M, non-sag type plain gypsum board, 12.7 mm and 15.9 mm thick, Type 'X' as indicated on drawings, x 1200 mm wide x maximum permissible length, ends square cut, edges tapered.
- .3 Gypsum board in fire rated construction (including fire rated ceilings): to ASTM C1396/C1396M, Type 'X' special ULC approved fire retardant type, 12.7 mm and 15.9 mm thick as indicated on drawings, x 1200 mm wide x maximum permissible length, ends square cut, edges tapered. Where required to meet ULC or Intertek Testing Services (Warnock Hersey) designs, use "C" formulation fire rated gypsum board.

- .4 Glass mat water-resistant gypsum backing board behind tile: to ASTM C1178/C1178M, 12.7 mm and 15.9 mm thick, Type 'X' as indicated on drawings, 1200 mm wide x maximum practical length.
- .5 Glass mat gypsum substrate sheathing: to ASTM C1177/C1177M, 12.7 mm and 15.9 mm thick, Type 'X' as indicated on drawings, 1200 mm wide x maximum practical length.
- .6 Gypsum board shaftliner: to C1396/C1396M, Section 6 Shaftliner Board and C 442, Type 'X', 25.4 mm, Type 'X' as indicated on drawings, 1200 mm wide x maximum practical length.
- .7 Studs to shaft walls: to ASTM C645, metal "C-H", "C-I", or "C-T" studs with "J" track and "J" or "J-L" corners, 102 mm studs and as selected from manufacturers limiting height table, unspliced lengths, as required, providing continuous edge support for liner board edges, 0.48 mm base steel thickness for attachment of gypsum board
- .8 Resilient drywall furring channels: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .9 Tape: to ASTM C475, 50 mm wide spark perforated tape; as recommended by the gypsum board manufacturer. To fibre glass faced smooth gypsum board use 50 mm wide fibreglass tape as recommended by the manufacturer.
- .10 Steel drill screws: to ASTM C1002, type W for application of gypsum board to wood, Type S for application of gypsum board to metal framing and type G for application of gypsum board to gypsum board. Power drilling self-applying type, case hardened, socketed countersunk head, galvanized, of type and sizes recommended by gypsum board manufacturer and as required for fire rated partitions.
- .11 Fasteners for fibre glass faced gypsum sheathing:
  - .1 For metal framing: wafer headed, rust resistant, type S-12 drill or Hi-Lo, minimum 25 mm length for steel studs and steel framing.
  - .2 For Wood Framing: wafer headed, rust resistant, type S-12 drill or Hi-Lo, type W rust resistant bugle head, coarse thread, sharp point screws for wood; as recommended by the manufacturer.
- .12 Trim: conforming to ASTM C1047; minimum 0.5 mm thickness commercial grade sheet steel with wiped coat zinc finish to ASTM A924/A924M, type specially design for use in gypsum board applications, flanges designed to be concealed with taping compound and as follows:
  - .1 Casing beads and trim: metal or metal and paper combination "J" type, beaded angle, with one side perforated for joint filling, to suit gypsum board thickness.
  - .2 Corner beads: square, metal or metal and paper combination, beaded angle, flanges 28.6 mm or 32 mm.
  - .3 Expansion joints: preformed metal, beaded, with one side perforated for joint filling.
  - .4 Control Joints: to ASTM C1047, pre-formed galvanized metal or plastic "V" type, perforated flanges.
- .13 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
  - .2 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

- .14 Polyethylene: to CAN/CGSB-51.34, Type 2, and in accordance with Section 07 26 00 - Vapour Retarders.
- .15 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .16 Joint compound: to ASTM C475, asbestos-free, slow setting, vinyl bedding and finishing compound, as recommended by gypsum board manufacturer.
- .17 Setting Compound: to fibreglass faced gypsum board, use setting compound for fibreglass tape instead of regular jointing compound for bedding of fibreglass tape (first coat). Use regular joint compound for all other coats to joints. Type as recommended by the fibreglass faced gypsum board manufacturer.
- .18 Plywood backing: as specified in Section 06 10 00.
- .19 Wood framing and blocking: as specified in Section 06 10 00.

## **2.2 FINISHES**

- .1 Texture finish: asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.
  - .1 Primer: VOC limit 50 g/L maximum to GS-11.

## **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. Verify that blocking for miscellaneous specialties, cabinets, and the like, has been installed before installing gypsum board.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .2 Ensure batt insulation, vapour retarder, sprayed urethane insulation/air barrier, and foam-in-place insulation have been placed and that all electrical boxes have vapour barrier behind them and all tears and rips have been repaired and all joints sealed. Do not proceed in application of gypsum board until the Departmental Representative has inspected and accepted the vapour retarder installation.

### **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 3:3000.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and 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, above recessed electrical fixtures, and as indicated on drawings, 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 and joists as indicated on drawings, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 55 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 or double layer gypsum board to wood or resilient metal furring or framing using screw fasteners for first and second layer. Install screws at a maximum of 200 mm on centre at periphery of board and at 300 mm on centre in field, along each framing member for both single and double layer application. For fire rated assemblies, install screws at 175 mm on centre for partitions and 150 mm on centre for ceilings.
  - .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.
  - .2 Double-Layer Application:
    - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
    - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
    - .3 Apply base layers at right angles to supports unless otherwise indicated.



- .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Shaftwall Application: in accordance with manufacturers printed instructions to achieve ratings as indicated on drawings.
- .4 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.
- .5 Apply water-resistant gypsum board where wall tiles to be applied and adjacent to slop sinks or janitors closets. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Apply joint treatment on areas to receive tile finish in accordance with manufacturers recommendations.
- .6 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, and the like, in partitions where perimeter sealed with acoustic sealant.
- .7 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .8 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.
- .9 Install gypsum board with face side out.
- .10 Do not install damaged or damp boards.
- .11 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 using contact adhesive for full length.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Install access doors to electrical and mechanical fixtures specified in respective sections.
  - .1 Rigidly secure frames to furring or framing systems.
- .6 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.
- .7 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWC Levels of Gypsum Board Finish:

- .1 Levels of finish:
  - .1 Level 0: no tapping, finishing or accessories required.
    - .1 Plenum areas above ceilings, in attics or in areas where the assembly is concealed.
  - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
    - .1 Where water resistant gypsum backing board is used as a substrate for tile and storage areas.
  - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
    - .1 Not used.
  - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
    - .1 Not used.
  - .5 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.
    - .1 Where non-textural flat paints are specified.
  - .6 Level 5: 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; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
    - .1 Where gloss, semi-gloss, or non-textural flat paints are specified or where severe lighting conditions occur.
- .8 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.
- .9 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.
- .10 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .11 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .12 Mix joint compound slightly thinner than for joint taping.
- .13 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .14 Allow skim coat to dry completely.
- .15 Remove ridges by light sanding using a 220 mesh open-weave silicon carbide sanding cloth 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.
  - .2 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 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.

**3.6 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                RELATED REQUIREMENTS**

- .1      Section 03 30 00 - Cast-In-Place Concrete
- .2      Section 07 92 00 - Joint Sealants
- .3      Section 09 21 16 - Gypsum Board Assemblies

**1.2                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).
- .2      American Society for Testing and Materials International (ASTM)
  - .1      ASTM C144-11, Specification for Aggregate for Masonry Mortar.
  - .2      ASTM C207-06 (2011), Specification for Hydrated Lime for Masonry Purposes.
  - .3      ASTM C847-14a, Specification for Metal Lath.
  - .4      ASTM C979/C979M-10, Specification for Pigments for Integrally Coloured Concrete.
- .3      Canadian General Standards Board (CGSB)
  - .1      CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .2      CGSB 71-GP-22M-89, Adhesive, Organic, for Installation of Ceramic Wall Tile.
  - .3      CAN/CGSB-75.1-[M88], Tile, Ceramic.
- .4      Canadian Standards Association (CSA International)
  - .1      CSA A123.3-15, Asphalt Saturated Organic Roofing Felt.
  - .2      CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .5      Terrazzo Tile and Marble Association of Canada (TTMAC)
  - .1      Tile Specification Guide 09 30 00, 2016/2017, Tile Installation Manual.

### 1.3 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 Elastomeric membrane and bond coat.
    - .6 Reinforcing tape.
    - .7 Levelling compound.
    - .8 Latex cement mortar and grout.
    - .9 Commercial cement grout.
    - .10 Organic adhesive.
    - .11 Waterproofing isolation membrane.
    - .12 Fasteners.
- .3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Wall tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

### 1.4 QUALITY ASSURANCE

- .1 Quality Assurance Submittals:
  - .1 Manufacturer's Instructions: manufacturer's installation instructions.

### 1.5 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

### 1.6 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.

### 1.7 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.

**1.8 MAINTENANCE**

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

**Part 2 Products**

**2.1 WALL TILE**

- .1 Ceramic tile: 108 x 108 x 6 mm size, bevelled edges, glazed surface, solif pattern, white colour as selected by Departmental Representative.

**2.2 MORTAR AND ADHESIVE MATERIALS**

- .1 Cement: to CSA-A5, type 10.
- .2 Sand: to ASTM C144, passing 16 mesh.
- .3 Hydrated lime: to ASTM C207.
- .4 Latex additive: formulated for use in cement mortar and thin set bond coat.
- .5 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.
- .6 Adhesives: as recommended by manufacturer.
  - .1 Maximum VOC limit 65 g/L.

**2.3 BOND COAT**

- .1 Dry set cement mortar: to ANSI A108.1.
- .2 Organic adhesive: to CGSB 71-GP-22M.
  - .1 Maximum VOC limit 65 g/L.
- .3 Latex Cement mortar: to ANSI A108.1, two-component universal dry-set mortar.
- .4 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>2</sup>.
  - .2 Bond Strength: 53 kg/cm<sup>2</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.
- .5 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.

## **2.4 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.
- .5 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.
- .6 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.

## **2.5 ACCESSORIES**

- .1 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Sealants: maximum VOC limit 250 g/L.

## **2.6 MIXES**

- .1 Dry set mortar: mix to manufacturer's instructions.
- .2 Organic adhesive: pre-mixed.
  - .1 Adhesives: maximum VOC limit 65 g/L.
- .3 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .4 Adjust water volumes to suit water content of sand.

**2.7 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.
  - .4 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.

**2.8 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.
- .8 Make internal angles square, external angles bullnosed.
- .9 Use bullnose edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.



- .10 Install divider strips at junction of tile flooring and dissimilar materials.
- .11 Allow minimum 24 hours after installation of tiles, before grouting.
- .12 Clean installed tile surfaces after installation and grouting cured.
- .13 Make control joints where indicated. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 00 - Joint Sealants. Keep building expansion joints free of mortar and grout.

**3.3 WALL TILE**

- .1 Install in accordance with TTMAC details.

**3.4 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00 - Cast-In-Place Concrete

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C501-84(2015, Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by Taber Abraser.
  - .2 ASTM D2047-11, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
  - .3 ASTM F1303-04(2014), Standard Specification for Sheet Vinyl Floor Covering with Backing.
  - .4 ASTM F1700-13a, Standard Specification for Solid Vinyl Floor Tile
  - .5 ASTM F-2169-15, Standard Specification for Resilient Stair Treads
- .2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2013, Architectural Coatings.
  - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

**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 flooring, adhesive, primer, sealer, 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.
- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Submit duplicate 300 x 300 mm sample pieces of sheet.
  - .3 Submit 300 mm long and edge strips.
- .4 Sustainable Design Submittals:
  - .1 LEED Canada-NC Version 1.0 Submittals.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer] content, and total cost of materials for project.

- .3 Low-Emitting Materials:
  - .1 Submit listing of adhesives, primers, and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

**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 resilient flooring 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 off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect resilient flooring from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**1.6 SITE CONDITIONS**

- .1 Ensure high ventilation rate, with maximum outside air, during installation.
  - .1 Vent directly to outside.
  - .2 Do not let contaminated air recirculate through a district or whole building air distribution system.

**Part 2 Products**

**2.1 RESILIENT SHEET FLOORING MATERIALS**

- .1 Linoleum sheet flooring: composed of natural ingredients which are mixed and calendered onto a jute backing:
  - .1 Pattern: marbleized.
  - .2 Thickness: 3.5 mm.
  - .3 Colour: as selected by Departmental Representative from manufacturer's standard colour range.
  - .4 Slip resistance: static coefficient of friction to ASTM D2047.
  - .5 Wear resistance to ASTM C501 .

## **2.2 RESILIENT TILE FLOORING MATERIALS**

- .1 High performance vinyl tile: to ASTM F1700, Class 3 - printed film vinyl tiles, Type B, embossed, 4 mm, 185 x 1220 mm size, in standard colour selected by Departmental Representative.
- .2 Resilient stair tread: vinyl, 25 mm vertical face, square nose, full tread deep, 3 – 6 mm thick, ribbed surface solid pattern, of dark gray colour selected by Departmental Representative.
- .3 Resilient stair riser: top set vinyl 2.0 mm thick, full riser height, solid pattern, of colour selected by Departmental Representative.
- .4 Resilient stair stringer: vinyl, 2.0 mm thick, solid pattern, to match tread colour.

## **2.3 ACCESSORIES**

- .1 Resilient base: continuous, top set, complete with premoulded end stops and external corners:
  - .1 Type: vinyl, 2.0 mm thick
  - .2 Style: cove.
  - .3 Height: 101.6 mm.
  - .4 Lengths: cut lengths minimum 2400 mm.
  - .5 Colour: as selected by Departmental Representative from manufacturer's standard colour range.
- .2 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
  - .1 Adhesives: VOC limit 50 g/L maximum to SCAQMD Rule 1168.
  - .2 Primer: in accordance with manufacturer's recommendations for surface conditions:
    - .1 VOC limit: 100 g/L maximum to SCAQMD Rule 1113
- .3 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product.
- .4 Metal edge strips: extruded aluminum, smooth, mill finish stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .5 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Examine conditions, substrates and work to receive work of this Section, co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

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

### **3.2 PREPARATION**

- .1 Prepare for installation in accordance with manufacturer's written recommendations.
- .2 Remove sub-floor ridges and bumps and fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface.
  - .1 Prohibit traffic until filler is completely cured and dry.
- .4 Prime and seal concrete slab and plywood sub-floor as recommended by resilient flooring manufacturer's written instructions.

### **3.3 APPLICATION: FLOORING**

- .1 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive that can be covered by flooring before initial set takes place.
- .2 Resilient sheet flooring:
  - .1 Lay flooring with seams parallel to building lines to produce minimum number of seams.
  - .2 Border widths: 1/3 minimum width of full material.
- .3 Run sheets in direction of traffic. Double cut sheet joints and continuously seal according to manufacturer's written instructions.
- .4 Heat weld seams of linoleum sheet flooring in accordance with manufacturer's written instructions.
- .5 Resilient tile flooring:
  - .1 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern.
  - .2 Border tiles: half tile width minimum.
  - .3 Install flooring to square grid pattern with joints aligned.
- .6 As installation progresses, and after installation roll flooring as recommended by flooring manufacturer, with 45 kg minimum roller to ensure full adhesion.
- .7 Cut flooring neatly around fixed objects.
- .8 Terminate resilient flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .9 Install metal edge strips at unprotected or exposed edges where flooring terminates.

**3.4 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.
- .7 Cope internal corners using premoulded corner units for right angle external corners and formed straight base material for external corners of other angles.
- .8 Use toeless type base where floor finish will be carpet, coved type elsewhere.
- .9 Install toeless type base before installation of carpet on floors.

**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.
  - .1 Remove excess adhesive from floor, base and wall surfaces without damage.
  - .2 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.
- .3 Waste Management: separate waste materials for 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.

**3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Protect new floors in accordance with manufacturer's printed instructions.
- .3 Repair damage to adjacent materials caused by resilient flooring installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 09 21 16 - Gypsum Board Assemblies.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM D256-10e1 - Izod Impact Strengths (ft #/in)
  - .2 ASTM C557 - 03(2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing
  - .3 ASTM D570-98(2010)e1, Standard Test Method for Water Absorption of Plastics
  - .4 ASTM D5319-12, Standard Specification for Glass Fibre-Reinforced Polyester Wall and Ceiling Panels.
  - .5 ASTM E84-15b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

**1.3 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 Submit complete written description, including total fabric weight, name of fabric backing, tensile strength, tear strength and fire rating characteristics.
- .3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Due to product lead times, order material immediately upon approval from Departmental Representative.
  - .2 Submit duplicate 280 x 215 mm samples of colours and textures of wall panels.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Wall panel: Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
  - .1 Front Finish: smooth finish, standard solid colour chosen by Departmental Representative from Manufacturer's standard colour range.

- .2 Dimensions: Thickness 2.29 mm nominal, Width 1.22 m nominal, Length as indicated on drawings
- .3 Tolerance: Length and Width: +/-3.175mm,
- .4 Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
  - .1 Water Absorption - 0.72% per ASTM D 570.
  - .2 Izod Impact Strength of 72 ft. lbs./in ASTM D 256
- .5
- .2 Aluminum Trim: Heavy weight extruded aluminum 6063-T5 alloy prefinished at the factory.
- .3 Fasteners: Non-staining nylon drive rivets.
- .4 Sealant: as recommended by covering manufacturer.
  - .1 Sealer: maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .5 Adhesive: water resistant, non-flammable to ASTM C557, as recommended by covering manufacturer.
  - .1 Adhesives: maximum VOC limit 50 g/L to SCAQMD Rule 1168.

### **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 PREPARATION**

- .1 Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface. Repair defects prior to installation.
- .2 Prepare surfaces according to covering manufacturer's instructions.

#### **3.3 INSTALLATION**

- .1 Comply with manufacturer's recommended procedures and installation sequence
- .2 Cut sheets to meet project requirements and verify support locations.
- .3 Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
- .4 Pre-drill fastener holes 3 mm oversize with high speed drill bit.
  - .1 Space at 8" (200mm) maximum on center at perimeter, approximately 1" from panel edge.
- .5 Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.



- .6 Install panels with manufacturer's recommended gap for panel field and corner joints.
  - .1 Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
  - .2 Drive fasteners for snug fit. Do not over-tighten.
- .7 Apply panel moldings and trims to all panel edges using silicone sealant providing for required clearances.
  - .1 All moldings and trims must provide for a minimum 3 mm of panel expansion at joints and edges, to insure proper installation.
  - .2 Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

### **3.4 CLEANING**

- .1 Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.
- .2 Proceed in accordance with Section 01 74 11 - Cleaning.
- .3 Clean surfaces to covering manufacturer's written instructions. Do not use abrasive cleaners

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 07 44 56 - Mineral Fibre Reinforced Cementitious Panels
- .2 Section 08 11 00 - Metal Doors and Frames
- .3 Section 08 14 16 - Flush Wood Doors
- .4 Section 09 21 16 - Gypsum Board Assemblies

**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 (including Addendum [2007]).
- .2 Green Seal Environmental Standards (GS)
  - .1 GS-11-11, Paints and Coatings.
- .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.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2007, Architectural Coatings

**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 paint and coating products 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.
- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Submit duplicate 200 x 300 mm x 3 mm thick hardboard sample panels of each paint, stain, clear coating, and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

- .4 Sustainable Design Submittals:
  - .1 Low-Emitting Materials:
    - .1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

**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 Provide and maintain dry, temperature controlled, secure storage.
  - .2 Store painting materials and supplies away from heat generating devices.
  - .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- .4 Fire Safety Requirements:
  - .1 Supply one 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.

**1.5 SITE CONDITIONS**

- .1 Heating, Ventilation and Lighting:
  - .1 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
  - .2 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
  - .2 Test concrete, masonry and plaster surfaces for alkalinity as required.
  - .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.
- .3 Additional application requirements:
  - .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.

**1.6 EQUIPMENT**

- .1 Use paint application equipment, brush, roller or spray of a type and quality best suiting the work and keep clean and in a workable condition.
- .2 When using spray equipment, use only 'airless spray guns' for spray application. Take all necessary precautions to prevent accidental application to adjacent surfaces which are not to receive paint, or which are to receive different colour, sheen or type of paint.

**1.7 ADDITIONAL MATERIALS**

- .1 Leave on the premises at location designated by the Owner, a minimum of 2% extra (in any case not less than 4 litres) of all colours and paint and finish types scheduled. Provide in 4 litre or one gallon containers.
- .2 Tightly seal containers and clearly label for identification.

**1.8 GUARANTEE**

- .1 Furnish a two year Master Painters Institute (MPI) Painting Contractors Guarantee, or alternatively, provide and pay for the cost of independent inspection and furnish a 100% two year Maintenance Bond to the full value of the Painting and Decorating contract, stating that the painting and decorating work will be in accordance with the standards and requirements incorporated in the Master Painters Institute Architectural Painting Specification Manual, latest edition.
- .2 For paints, stains, varnishes and the like, which are not listed under MPI, provide manufacturer's standard guarantee for the materials, and a two year Maintenance Bond to the full value of the Work where such painting, staining, varnishing are used.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Supply paint materials for paint systems from single manufacturer.
- .2 Conform to latest MPI requirements for painting work including preparation and priming.
- .3 Materials in accordance with MPI - Architectural Painting Specification Manual "Approved Product" listing.
  - .1 Use MPI listed materials having E3 rating where indoor air quality requirements exist.
  - .2 Primer: VOC limit [100] g/L maximum to SCAQMD Rule 1113.
  - .3 Paint: VOC limit [100] g/L maximum to SCAQMD Rule 1113.
  - .4 Clear Wood Finishes: VOC limit [275] g/L maximum to SCAQMD Rule 1113
- .4 Colours:
  - .1 Submit proposed Colour Schedule to Departmental Representative for review based on finishes schedule.
  - .2 Base colour schedule on selection of 6 colours.

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

.6 Gloss/sheen ratings:

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

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

- .2 Gloss level ratings of painted surfaces as indicated.
- .7 Exterior painting:
- .1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.
    - .1 EXT 5.1D – Alkyd Semi-Gloss finish.
  - .2 Galvanized Metal: high contact/high traffic areas (doors, frames, railings and handrails, etc.).
    - .1 EXT 5.3B - Alkyd Semi-Gloss finish.
  - .3 Dressed Lumber: doors, door and window frames, casings, battens, smooth facias, etc.
    - .1 EXT 6.3B - Alkyd Satin finish.
- .8 Interior painting:
- .1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.
    - .1 INT 5.1E Alkyd – Semi Gloss finish.
  - .2 Galvanized Metal: high contact/high traffic areas (doors, frames, railings and handrails, etc.).
    - .1 INT 5.3C - Alkyd Semi Gloss finish (over cementitious primer).
  - .3 Dressed Lumber: doors, door and window frames, casings, mouldings, etc.:
    - .1 INT 6.3A - Latex Semi Gloss finish.

- .4 Plaster and gypsum board (Walls): gypsum wallboard, drywall, "sheet rock" type material, etc.
  - .1 INT 9.2A - Latex Eggshell finish (over latex sealer).
- .5 Plaster and gypsum board (Ceilings): gypsum wallboard, drywall, "sheet rock" type material, etc.
  - .1 INT 9.2A - Latex Flat finish (over latex sealer).
- .6 Wood paneling and casework: partitions, panels, shelving, millwork:
  - .1 INT 6.4Y - Clear lacquer Satin finish.

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual except where specified otherwise.

#### **3.2 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. Do not apply finishes unless the moisture content of surfaces are below the following maximum values:
  - .1 Gypsum board: 12%

#### **3.3 PREPARATION**

- .1 Protection of in-place conditions:
  - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore 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.
- .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.
- .4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual specific requirements and coating manufacturer's recommendations.
- .5 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.
- .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
  - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
  - .2 Apply wood filler to nail holes and cracks.
  - .3 Tint filler to match stains for stained woodwork.
- .7 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.
- .8 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.
- .9 Touch up of shop primers with primer as specified.

### **3.4 APPLICATION**

- .1 Paint only after prepared surfaces have been accepted by Departmental Representative.
- .2 Use method of application approved by Departmental Representative.
  - .1 Conform to manufacturer's application recommendations.
- .3 Apply coats of paint in continuous film of uniform thickness.
  - .1 Repaint thin spots or bare areas before next coat of paint is applied.
- .4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .5 Sand and dust between coats to remove visible defects.
- .6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .7 Finish closets and alcoves as specified for adjoining rooms.
- .8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- .9 Allow an "out gassing" period at the end of the project of minimum 3 days before Owner's move in.
- .10 Mechanical/Electrical Equipment:
  - .1 Keep sprinkler heads free of paint.
  - .2 Paint fire protection piping red.

- .3 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .4 Paint natural gas piping yellow.
- .5 Paint both sides and edges of backboards for telephone and electrical equipment before installation.
  - .1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

**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 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.
- .4 Place paint, stains, and primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 14 16 - Flush Wood Doors
- .3 Section 09 21 16 - Gypsum Board Assemblies

**1.2 REFERENCES**

- .1 Aluminum Association, Inc. (AAI)
  - .1 AAI DAF45-03, Designation System for Aluminum Finishes.
- .2 ASTM International Inc.
  - .1 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM B32-08(2014), Standard Specification for Solder Metal.
  - .3 ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .3 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.
- .4 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .2 CSA W47.2-11 (R2015), Certification of Companies for Fusion Welding of Aluminum.
  - .3 CSA W59.2-M1991(R2013), Welded Aluminum Construction.
- .5 Canadian Sheet Steel Building Institute (CSSBI)
  - .1 CSSBI SSF 6-2012, Sheet Steel Facts #6, Metallic Coated Sheet Steel for Structural Building Products-July 1995.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .7 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual.
    - .1 MPI #76, Quick Dry Alkyd Metal Primer.
    - .2 MPI #96, Quick Dry Enamel Gloss.

**1.3 ACTION SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.
  - .2 Submit drawn-to-scale details for individually fabricated or incised lettering indicating word and letter spacing.
- .3 Samples:
  - .1 Submit duplicate representative sample of each type sign, sign image and mounting method including, but not limited to: cast letters, and wall plates fixed mounting installation method.

**1.4 INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature panel signage or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Casting aluminum: to certified Aluminum Association Alloy Designation No. 43.
- .2 Acrylic sheet: polymethylmethacrylate (PMMA) cast sheet suitable for intended use in sign fabrication, colour as selected by Departmental Representative.
- .3 Engraving sheet: lamicoid 3.2 mm thick plastic sheet, black core.
- .4 Self-stick foam tape: as recommended by manufacturer, 352.4 kg/m<sup>3</sup> density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides.
  - .1 Width: to suit sign sizes.
- .5 Adhesives, paints, sealants and solvents for acrylic sheet: type recommended by sheet manufacturer for applicable condition.

**2.1 SIGN GRAPHICS**

- .1 Sign graphics: well defined, arranged for balanced appearance, and properly word and letter spaced.
- .2 Silk screen process: apply one colour photographic produced silk screen printed images to face side of transparent sign faces; face side of opaque sign faces.
- .3 Engraving: apply sign images using pantograph mechanical engraving machine to obtain incised paint-filled letters as detailed or specified.

**2.2 CAST LETTERS**

- .1 Cast letters of solid aluminum accurately formed to profiles as detailed; with smooth faces free from surface defects or blemishes.
- .2 Finish letters, after fabrication with belt polished high luster with acrylic top coat.
- .3 Exterior Address signage:
  - .1 Letter Style: Helvetica, individually cast;
  - .2 Letter sizes: 200 mm high;
  - .3 Sign Readout: Building address;
  - .4 Finish on letters: polished face of letters to match clear anodized aluminum

**2.3 WALL PLATES**

- .1 Plastic wall plates:
  - .1 Fabricate from clear acrylic sheet 3.2 mm thick. Sizes as indicated.
  - .2 Sign graphics: apply by silk screen.
- .2 Fixed mounting:
  - .1 Prepare wall plates for fixing by self-stick foam tape.
  - .2 Include back-up plates for fixing to uneven surfaces where required.

**2.4 DOOR PLATES**

- .1 Fabricate sign faces of cast solid aluminum alloy.
  - .1 Size: 100 mm high x 3.2 mm thick.
  - .2 Engraving
- .2 Sign graphics: apply by engraving, minimum 38 mm high text/numbers.
- .3 Fixed mounting: use self-stick foam tape.
- .4 Mounting on transparent surfaces: use self-stick foam tape. Include blank back-up plate for opposite side.
- .5 Locations:
  - .1 Each unit door (numbers as directed by Departmental Representative);
  - .2 Each Service, Laundry or Storage Room door (text as directed by Departmental Representative).

**2.5 FABRICATION**

- .1 Fabricate signs in accordance with details, specifications and shop drawings.
- .2 Build units square, true, accurate to size, free from visual or performance defects.
- .3 Fit and securely join sections to obtain tight, closed joints.
- .4 Allow for thermal movement without distortion of components.
- .5 Inconspicuous fasteners of same finish and colour as base material.
- .6 Polish exposed edges of plastic and metal to smooth, slightly convex profile.
- .7 Manufacturer's nameplates on sign surface permitted in non visible locations in completed work.

**2.6 FINISHES**

- .1 Chrome and nickel plating: to ASTM B456, satin finish.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Manufacturer's Instructions: compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Erect and secure signs plumb and level at elevations as directed by Departmental Representative.
- .3 Comply with sign manufacturer's installation instructions and approved shop drawings.
- .4 Mechanical attachment:
  - .1 To concrete or solid masonry: use lag screws and expansion bolts or screws and fibre plugs, as appropriate for stresses involved.
  - .2 To hollow masonry: use toggle bolts or equivalent.
  - .3 To wood: use screws.
  - .4 Secure into framing members behind stud walls or above ceilings.
  - .5 Mechanical fasteners on exterior: non-staining, non-ferrous type.
  - .6 Fabricate special fasteners as required for installation conditions.
  - .7 Mechanical fasteners and methods of attachment subject to Departmental Representative's approval.
    - .1 Obtain Departmental Representative's approval before fixing to structural steel.
- .5 Adhesive attachment:
  - .1 Use self-stick adhesive foam tape to manufacturer's instructions to fix sign and prevent "rocking".
  - .2 Keep tape maximum 1.6 mm from edges.

**3.2 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
  - .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
  - .2 Leave signs clean.
  - .3 Remove debris from interior of sign boxes.
  - .4 Touch up damaged finishes.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A276 . 276M-16, Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B209 / 209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - .3 ASTM B210 / 210M-12, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes (Metric).
  - .4 ASTM B211 / 211M-12e1, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire Metric.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 62-GP-9M-80, Prefabricated Markings, Positionable, Exterior, for Aircraft Ground Equipment and Facilities.
- .3 CSA International
  - .1 CAN/CSA O80 Series-08, Wood Preservation.
  - .2 CSA O121-08, Douglas Fir Plywood.
  - .3 CSA W47.2-11 (R2015), Certification of Companies for Fusion Welding of Aluminum.
- .4 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.

**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 traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.
  - .2 Submit drawn-to-scale details for individually fabricated or incised lettering indicating word and letter spacing.

**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 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Sign supports:
  - .1 Timber posts:
    - .1 Species: Spruce or Fir.
    - .2 Type: pressure treated.
    - .3 Dimensions: 100 x 100 mm.
  - .2 Posts to be treated in accordance with CAN/CSA O80 Series.
- .2 Anchor and connecting bolts, 'U' clamps and miscellaneous hardware for overhead sign installations: fabricate from 304 stainless steel as specified in ASTM A276.
- .3 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.
- .2 Signboards:
  - .1 Aluminum sheet: to ASTM B209M, precut to required dimensions.
    - .1 Thickness for signboards up to 750 mm wide: 1.6 mm minimum.
    - .2 Thickness for signboards 750-1200 mm wide: 2.1 mm minimum.
    - .3 Sizes to be standard local municipal sizes for each type of sign required.

### **2.2 FABRICATION**

- .1 Supports:
  - .1 Connect aluminum support members by welding in accordance with CSA W47.2. Work to be performed by Canadian Welding Bureau qualified members only. Flame cutting of members not permitted.
  - .2 Welds to be of same strength as adjacent member or casting.
  - .3 Reinforce in area of electrical hand holes to equal strength of full section member.
  - .4 Remove sharp edges and burrs.
- .2 Signboards:
  - .1 Aluminum blanks:
    - .1 Degrease, etch and bonderize with chemical conversion coating.
    - .2 Clean surfaces with xylene thinner. Dry.

- .3 For non-reflective signs, spray face with one coat vinyl pretreatment coating and two finish coats of required colour.
      - .4 For aluminum signboards that are to be painted before installation, spray and bake face of signboards with two coats of enamel in accordance with MPI-EXT 5.4A.
    - .2 Reflective background sheeting and lettering:
      - .1 Cut and apply in accordance with manufacturer's instructions.
      - .2 Apply adhesive coated material with heat lamp vacuum applicator or by squeeze roll application method. Apply pressure sensitive material with roller or squeegee.
      - .3 Edge wrap sheeting on each extrusion prior to bolting extrusions. Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.
      - .4 Reflective signboard faces may be prepared using silk screen transparent ink.
  - .3 Sign read-out:
    - .1 Provide "Handicap Parking - Permit Required" signs (note: this is in addition to the handicap logo painted on the concrete or asphalt paving).

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Sign support:
  - .1 Erect supports as indicated. Permissible tolerance: 50 mm maximum departure from vertical for direct buried supports.
  - .2 Erect posts plumb and square.
  - .3 Wooden post installation:
    - .1 Excavate post holes to 305 mm minimum diameter. Compact bottom of hole to provide firm foundation. Set post and backfill in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.
- .2 Signboard:
  - .1 Fasten signboard(s) to supporting posts and brackets 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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Carefully dismantle and salvage wood, aluminum and steel materials for recycling.
  - .2 Dismantle electrical equipment. Terminate power feed as indicated. Salvage luminaires and pack in weatherproof containers with glassware adequately protected. Salvage brackets, hardware and the like. Dispose of lamps, wiring, conduit and accessories.
  - .3 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 traffic signage installation and salvage operations.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 08 70 00 - Hardware

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A653/A653M 15, Standard Specification for Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .3 Green Seal Environmental Standards
  - .1 Standard GC-03-97, Anti-Corrosive Paints.
  - .2 Standard GS-11-11, Paints and Coatings.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual.
    - .1 MPI # 76, Quick Dry Alkyd Metal Primer.
    - .2 MPI # 81, Machinery Enamel.
    - .3 MPI # 96, Quick Dry Enamel Gloss.

**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 wire mesh partitions or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
  - .1 Indicate partition panel modules and types, materials, gauges, finishes, door and other openings, hardware, fastening methods to adjacent structure, ceiling details, and assembly methods.
- .4 Samples:
  - .1 Submit duplicate 300 x 300 mm samples of each type partition and colour and finish on actual base metal.
  - .2 Erect trial assembly of at least two modules of each type partition, on site where directed by Departmental Representative.

- .5 Quality control submittals: submit following in accordance with Section 01 45 00 - Quality Control.

- .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

#### **1.4 QUALITY ASSURANCE**

- .1 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Erect one of each type door and two of each type partition panel.
  - .3 Coordinate construction of mock-up with regular site meetings for inspection of mock-up before proceeding with work.
  - .4 When accepted, mock-up will demonstrate minimum standard for this work.
  - .5 Mock-up may remain as part of finished work.

#### **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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 GENERAL**

- .1 This specification is based on premanufactured wire mesh partition system. In lieu of premanufactured wire mesh partition system, the Contractor may use heavy chain link mesh and steel posts and doors.

#### **2.2 MATERIALS**

- .1 Partition mesh: painted
  - .1 Woven wire screen: steel, painted, 50 x 50 mm clear opening space between wires, 3.4 mm wire,.
- .2 Steel sections and plates: to CAN/CSA-G40.20, type 44W.
  - .1 Posts: hollow steel tubing, round 63.2 mm diameter, painted, designed to fasten to floors, walls or ceiling, minimum wall thickness 2 mm.
  - .2 Extension posts: 44 x 44 mm hollow steel tubing, minimum wall thickness 1.6 mm.
  - .3 Angle frame: 32 x 32 x 3 mm.
  - .4 Post caps: manufacturer's standard formed cap; finish to match other components.

- .3 Welding materials: to CSA W59.
- .4 Bolts, fasteners and fastening hardware: manufacturer's standard to suit design and application.

## **2.3 FABRICATION**

- .1 Panels:
  - .1 Fabricate panels to create locker sizes or shapes as required consisting of wire mesh as indicated, welded at 150 mm on centre to angle frame.
  - .2 Provide panels to create top of lockers at height indicated.
  - .3 Mitre and weld frame corners.
  - .4 Provide 20 x 6 mm flat bars across panels at third points on 2400 mm dimension.
- .2 Posts:
  - .1 Ceiling high with floor and ceiling plates for fixing
  - .2 Include corner, wall, door and other special posts to manufacturer's standard.
- .3 Post extensions:
  - .1 Length required to telescope 300 mm into post and extend posts to ceiling.
  - .2 Weld ceiling plate on upper end for fixing.
  - .3 Supply extension posts for every post where required.
- .4 Fabricate partitions to fit around all duct work and the like.
- .5 Swing doors: standard doors:
  - .1 Sizes as indicated.
  - .2 Construct doors and transom above of angle frame and wire mesh same as panels.
  - .3 Reinforce door with 40 x 5 mm or equivalent flat bar centre rail and 20 x 6 mm or equivalent flat bar bracing from centre rail to opposite corners on hinge side.
- .6 Swing door hardware:
  - .1 Equip doors with hasp for padlock.
  - .2 Equip standard doors with 1-1/2 pair of butts.

## **2.4 FINISHES**

- .1 After fabrication, clean and paint components with manufacturer's standard primer and 2 coat enamel finish.
  - .1 Standard colour selected by Departmental Representative.
  - .2 Paint materials: in accordance with Section 09 91 23 - Interior Painting.

**Part 3            Execution**

**3.1                MANUFACTURER'S INSTRUCTIONS**

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

**3.2                SITE MEASUREMENTS**

- .1        Take site measurements of to confirm dimensions prior to starting work

**3.3                ERECTION**

- .1        Install mesh enclosures and doors in accordance with manufacturer's printed instructions.
- .2        Erect enclosures plumb, level, straight, rigidly supported, and securely fastened to abutting surfaces, free from superimposed loads.
- .3        Fix to masonry and concrete using lag bolts and shields; to hollow walls using bolts and toggle type anchors; to steel supports with bolts in threaded holes or spot welds. Where attachment to steel stud and gypsum board partitions occur, ensure there is blocking installed in partitions at each location where mesh partitions are attached to steel stud and gypsum board partitions
  - .1        Locate fasteners on interior side where possible for maximum security.
- .4        Install doors and adjust for proper closing, locking and smooth operation.

**3.4                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 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 09 21 16 - Gypsum Board Assemblies.

**1.2 REFERENCES**

- .1 Aluminum Association (AA)
  - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

**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 wall and corner guards 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. Indicate VOC's for material as follows:
    - .1 Caulking materials during application and curing.
    - .2 Adhesives.
- .3 Installation Drawings:
  - .1 Indicate on drawings large scale details, materials, finishes, dimensions, anchorage and assembly.
- .4 Samples:
  - .1 Submit duplicate 300 mm long samples of profiles and colours for corner guards.

**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 Store and protect wall and corner guards from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Metal corner guards: 1.6 mm thick, 65 x 65 mm size, 1220 mm long, with 3.2 mm corner radius type 304 satin finished stainless steel, with removable protective paper cover, adhesive mounted.

**2.2 ACCESSORIES**

- .1 Adhesive: water resistant type as recommended by manufacturer for substrate.

**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 wall and corner guards installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .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 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.

**3.3 INSTALLATION**

- .1 Install units on solid backing and erect with materials and components straight, tight and in alignment.
- .2 Adhesive apply corner guards to finished wall surfaces at locations indicated.
- .3 Install corner guards starting above base, and extending to heights indicated.

**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 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.

- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .6 Waste Management: separate waste materials for 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.

**3.5 PROTECTION**

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

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .2 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3 ASTM A924/A924M-14, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

**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 and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.
- .4 Samples:
  - .1 Submit samples for each type of accessory.

**1.4 CLOSEOUT SUBMITTALS**

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

**1.5 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.

**1.6 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: 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.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.
- .2 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 Shower rods: chrome plated 25 mm [1.2 mm wall thickness] steel tubing of required length with satin chrome finished flanges, 12 shower curtain hooks. Shower rod material and anchorage to withstand downward pull of 0.9 kN. Provide for
- .2 Mirror: 915 mm wide & 1221 mm high, wall mounted unit, fixed framed mirror 6 mm, stainless steel frame.
- .3 Other Washroom Accessories
  - .1 All washroom accessories to be residential grade, from same manufacturer product line, finishes to consistent for all products, finishes to be selected by Departmental Representative.
  - .2 Toilet tissue dispenser: single roll type, surface mounted. roll under spring tension for controlled delivery. Provide 1 per Toilet.
  - .3 Towel bar: 16 - 19 mm diameter steel tubing, minimum 457 mm long, matching end brackets, concealed fasteners. Provide minimum 1 towel bar per bedroom located in the unit bathroom.
  - .4 Robe hook: Provide minimum 1 per bedroom located on the back of the back of bedroom door.
- .4 Grab bars: 30/32 1.6 mm wall] tubing of stainless steel, 76 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

### **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 blocking and components for installation on studding and building framing.

**2.4 FINISHES**

- .1 Chrome and nickel plating: to ASTM B456, satin or polished finish.
- .2 Manufacturer's or brand names on face of units not acceptable.

**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 before 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 blocking to stud prior to plaster or drywall finish.
  - .2 Shower compartments: use male to female through bolts.
- .2 Locate accessories where indicated. Exact locations determined by Departmental Representative.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.
- .5 Install mirrors in accordance with Section 08 80 50 - Glazing.
- .6 Install grab bars on built-in anchors provided by bar manufacturer.

**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.
  - .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 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.

**3.5 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 10, Standard for Portable Fire Extinguishers.

**1.2 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 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 02 81 01 - Hazardous Materials.
- .3 Provide shop drawings.
- .4 Quality control submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
  - .2 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.
- .5 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.3 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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS**

- .1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
  - .1 Size 2.25 kg or as indicated.

**2.2 CABINETS**

- .1 Surface type as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.
- .2 Cabinet to maintain fire resistive rating of construction in which they occur.
- .3 Cabinet door: with 5 mm full glass panel metal panel.
- .4 Finish:
  - .1 Tub: prime coated.
  - .2 Door and frame: No.4 satin finish stainless steel.

**2.3 IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10 CAN/ULC-S508.
- .2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

**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 or mount extinguishers in cabinets or on brackets as indicated in accordance with NFPA 10.

**3.3 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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 40 00 - Architectural Woodwork
- .2 Division 22 - Plumbing
- .3 Division 23 - Heating, Ventilating and Air Conditioning
- .4 Division 26 - Electrical

**1.2 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 and datasheet and include product characteristics, performance criteria, physical size, finish and limitations and the following:
    - .1 Description of equipment giving manufacturers name, type, model, year and capacity.
    - .2 Details of operation, servicing and maintenance.
    - .3 Recommended spare parts list.
- .3 Closeout Submittals:
  - .1 Provide operation and maintenance data for all appliances for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**Part 2 Products**

**2.1 RANGE**

- .1 Range, free standing single oven type, nominal width 762 mm. One for each residential unit.
  - .1 Electrical: 210/220 volt, 3 phase.
  - .2 Self-clean oven, vision panel and interior oven light
  - .3 Ceramic glass range top, Four (4) top burners.
  - .4 Two (2) chromed steel racks.
  - .5 Colour: White.

**2.2 MICROWAVE OVEN**

- .1 Microwave ovens: Over the Range microwave oven and range hood combination, nominal width 762 mm. One for each residential unit.
  - .1 Overall exterior dimensions: width: 762 mm x depth: 395 mm x height: 435 mm.
  - .2 Electrical: 110/120 volt, single phase
  - .3 Interior Capacity: 0.048 cu. m. (1.7 cu.ft.), minimum
  - .4 Power: 1000 W.

- .5 Venting Air Flow: minimum 300 cfm.
- .6 Door: intrusion-proof, see-through window, modular interlock system.
- .7 Interior light: door/controller actuated.
- .8 Timer mechanism: digital display, end of cooking cycle signal.
- .9 Colour: White.

**2.3 DISHWASHER**

- .1 Dishwasher: Built-in, under counter Model. One for each residential unit.
  - .1 Overall exterior dimensions: width 600 mm x depth 628 mm depth x height 876 mm height.
  - .2 Electrical: 110/120 volt, single phase
  - .3 ENERGY STAR qualified.
  - .4 Energuide Rating: 269 kWh/Year maximum.
  - .5 Washing Cycles: 4 minimum
  - .6 Sound: maximum 52 dba
  - .7 Colour: White.

**2.4 REFRIGERATOR**

- .1 Refrigerator and freezer: top mount freezer, reversible door. One or two for each residential unit, as indicated on the drawings.
  - .1 Overall exterior dimensions: width: 762 mm x depth: 863 mm x height: 1753 mm.
  - .2 Electrical: 110/120 volt, single phase.
  - .3 Capacity: 18 cu.ft., minimum. Freezer Capacity, approximately 4 cu.ft.
  - .4 ENERGY STAR qualified.
  - .5 Interior light: door/controller actuated.
  - .6 Colour: White.

**2.5 WASHING MACHINE**

- .1 Washing Machine: Free-standing, top load. Three total.
  - .1 Overall exterior dimensions: width 698 mm x depth 670 mm x height 1102 mm.
  - .2 Capacity: 3.5 cu.ft., minimum
  - .3 Water level options: 3 minimum
  - .4 Temperature level options: 4 minimum
  - .5 End of Cycle Signal: Yes
  - .6 Controls: Manual knob
  - .7 Colour: White.



**2.6 CLOTHES DRYER**

- .1 Clothes: Free-standing, top load, easy access / removable lint trap. Three total.
  - .1 Overall exterior dimensions: width 736 mm x depth 712 mm x height 1102 mm.
  - .2 Capacity: 6.0 cu.ft., minimum
  - .3 Power: 5000 W minimum
  - .4 Drying Cycles: 10 minimum
  - .5 Temperature levels: 3 minimum
  - .6 End of Cycle Signal: Yes
  - .7 Controls: Manual knob
  - .8 Colour: White.

**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 equipment in accordance with manufacturer's instructions.
- .2 Co-ordinate connection of mechanical and electrical services.
- .3 Adjust equipment for smooth and proper operation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 09 21 16 - Gypsum Board Assemblies.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and data sheets for horizontal louver blinds and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings dimensions in relation to window jambs, operator details, head anchorage details, hardware and accessories details.
- .4 Samples:
  - .1 Submit duplicate samples of manufacturer's standard colours for selection by Departmental Representative.

**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 Store and protect horizontal louvre blinds from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 DESIGN CRITERIA**

- .1 Design horizontal louvre blinds to following requirements:
  - .1 Allow wear susceptible parts to be replaceable by either user or manufacturer.

- .2 Guarantee of at least five-years of available replacement parts following discontinue of products manufacture.
- .3 Include instructions for replacing or repairing worn parts, including inventory numbers for parts and procedures for ordering replacement parts.
- .4 Allow for refurbishing or return of used vertical louvre blinds.
- .5 Permit effective disassembly of components in for recycling of materials.
- .6 Include stamps on major plastic components indicating composition code to facilitate recycling efforts.

## **2.2 MATERIALS AND FABRICATION**

- .1 Slats: 25 mm wide x 0.20 mm nominal thickness plus or minus 0.005 mm,, with rounded corners and rough edges removed.
  - .1 Aluminum alloy, corrosion resistant spring-tempered.
  - .2 Colour and finish: as selected by Departmental Representative.
- .2 Ladders:
  - .1 Braided 100% polyester yarn designed for full tilting action while retaining same level and position of each slat.
  - .2 Ladders spaced not more than 150 mm from end of slats and maximum 480 mm on centre.
  - .3 Where tapes are driven by tilters lock cord positively to driving drums to prevent slippage and ensure accurate timing
  - .4 Design taperolls for full tilting action while retaining the same level on each slat
- .3 Headrails:
  - .1 One piece steel channel with rolled edges, formed to provide sufficient strength to support blind without sagging, twisting or distorting.
  - .2 Metal minimum 0.50 mm thick.
  - .3 Finish to match slats.
- .4 Bottom rails:
  - .1 Lock seam tubular steel section formed to a closed oval tubular shape, contoured to match slat curavture and with soft molded plastic end caps.
  - .2 Minimum 0.45 mm thick.
- .5 Bottom rail end caps:
  - .1 Soft moulded plastic fitted snugly over ends of rails.
  - .2 Colour to match slats.
- .6 Tilt rods: solid steel.
- .7 Tassels:
  - .1 Soft moulded plastic.
  - .2 Colour to match slats.
- .8 Pulleys: designed to permit ease of operation with minimum wear to cord.

- .9 Valance: same material colour and finish as slats.
- .10 Tilters:
  - .1 Fully enclosed and lubricated, with positively locked to drum to prevent slippage and ensure accurate timing.
  - .2 Use anti-friction materials for worm and gear.
- .11 Cord locks: designed to provide smooth operation with feature to prevent accidental dropping of blinds.
- .12 Ladder cap: designed to provide sufficient retention when snapped onto bottom rail to hold ladders in proper position.
- .13 Installation brackets: end and centre type complete with safety locking caps to secure headrail and valance.
- .14 Lift cords: 1.98 mm diameter, minimum tensile strength 689 kPa, with tassels.
- .15 Hold down clips: sill mountings, to engage bottom rail end caps.
- .16 Tilter controls: transparent wand, minimum 8 mm diameter.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive horizontal louvre blinds previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to horizontal louvre blinds installation.
  - .1 Visually inspect substrate.
  - .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 blinds at exterior windows on all elevations on all floors.
- .2 Include centre brackets where necessary to prevent deflection of headrail.
- .3 Adjust to provide for operation without binding.
- .4 Use non corrosive metal fasteners for installation, concealed in final assembly.

#### **3.3 ADJUSTING**

- .1 Adjust horizontal louvre blinds components 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.
  - .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 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.

**3.5 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 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 all equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
  - .1 Drawings to show:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .2 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.
  - .3 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.

**1.2 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 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
    - .7 Colour coding chart.

- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to 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.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 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.
  - .2 Transfer information weekly to prints, revising prints to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-Built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to 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.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One head gasket set for each heat exchanger.
  - .4 One glass for each gauge glass.
  - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 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 all equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**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 SYSTEM 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 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.4 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 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.

**3.6 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 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 the Province of Alberta, Canada.
  - .2 Indicate:
    - .1 Materials.
    - .2 Finishes.
    - .3 Method of anchorage
    - .4 Number of anchors.
    - .5 Supports.
    - .6 Reinforcement.
    - .7 Assembly details.
    - .8 Accessories.
- .4 Samples:
  - .1 Submit samples of following:
    - .1 Each type of sprinkler head.
    - .2 Signs.
- .5 Test reports:
  - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .7 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
- .8 Field Quality Control Submittals:
  - .1 Manufacturer's Field Reports: manufacturer's field reports specified.

**1.2 CLOSEOUT SUBMITTALS**

- .1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.

- .2 Manufacturer's Catalog Data, including specific model, type, and size for:
  - .1 Pipe and fittings.
  - .2 Alarm valves.
  - .3 Valves, including gate, check, and globe.
  - .4 Sprinkler heads.
  - .5 Pipe hangers and supports.
  - .6 Pressure or flow switch.
  - .7 Fire department connections.
  - .8 Mechanical couplings.
- .3 Drawings:
  - .1 Sprinkler heads and piping system layout.
    - .1 Prepare 760 mm by 1050 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
    - .2 Show data essential for proper installation of each system.
    - .3 Show details, plan view, elevations, and sections of systems supply and piping.
    - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
  - .2 Electrical wiring diagrams.
- .4 Design Data:
  - .1 Calculations of sprinkler system design.
  - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
- .5 Field Test Reports:
  - .1 Preliminary tests on piping system.
- .6 Records:
  - .1 As-built drawings of each system.
    - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
    - .2 Submit drawings on PDF with title block similar to full size contract drawings.
- .7 Operation and Maintenance Manuals:
  - .1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

### **1.3 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: company or person specializing in wet sprinkler systems with documented experience.

- .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

#### **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 Storage and Protection:
  - .1 Store materials in a dry location.
  - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

### **Part 2 Products**

#### **2.1 DESIGN REQUIREMENTS**

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area for ordinary hazard occupancy.
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.
- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .6 Location of Sprinkler Heads:
  - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for ordinary hazard occupancy.
  - .2 Uniformly space sprinklers on branch.

- .7 Water Distribution:
  - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
  - .2 Discharge from individual heads in hydraulically most remote area to be 100 % of specified density.
- .8 Density of Application of Water:
  - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
- .9 Sprinkler Discharge Area:
  - .1 Area: hydraulically most remote area as defined in NFPA 13.
- .10 Friction Losses:
  - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

## **2.2 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Grooved couplings and fittings made from minimum 90% recycled metal.

## **2.3 ABOVE GROUND PIPING SYSTEMS**

- .1 Provide fittings for changes in direction of piping and for connections.
  - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will be permitted.
- .2 Field welding will be permitted.

## **2.4 PIPE, FITTINGS AND VALVES**

- .1 Pipe:
  - .1 Ferrous: to NFPA 13.
  - .2 Copper tube: to NFPA 13.
- .2 Fittings and joints to NFPA 13:
  - .1 Ferrous: screwed, welded, flanged or roll grooved.
    - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
  - .2 Copper tube: screwed, soldered, brazed, grooved.
  - .3 Provide threaded fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.

- .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
- .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
- .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
- .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
- .8 Side outlet tees using rubber gasketed fittings are not permitted.
- .9 Sprinkler pipe and fittings: metal.
- .3 Valves:
  - .1 ULC listed for fire protection service.
  - .2 Gate valves: open by counterclockwise rotation.
  - .3 Provide rising stem valve where more than one alarm valve is powered by the same supply line.
- .4 Pipe hangers:
  - .1 ULC listed for fire protection services in accordance with NFPA.

## **2.5 SPRINKLER HEADS**

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type:
  - .1 Type A: upright bronze.
  - .2 Type B: pendant chrome link and lever type.
  - .3 Type C: pendant chrome glass bulb type.
  - .4 Type D: recessed polished chrome fusible link type with ring and cup.
  - .5 Type E: flush polished chrome link and lever type.
  - .6 Type F: side wall polished chrome link and lever type.
- .3 Provide nominal 1.2 cm orifice sprinkler heads.
  - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
  - .2 Provide polished chromium-plated pendent sprinklers below suspended ceilings.
  - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
  - .4 Provide sprinkler heads as indicated.
  - .5 Deflector: not more than 75 mm below suspended ceilings.
  - .6 Ceiling plates: not more than 25 mm deep.
  - .7 Ceiling cups: not permitted.

## **2.6 ALARM CHECK VALVE**

- .1 Alarm check valve to NFPA 13 and ULC listed for fire service.

- .2 Provide variable pressure type alarm valve complete with alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories, and appurtenances for proper operation of system.
- .3 Provide valve complete with internal components that are replaceable without removing the valve from the installed position.

**2.7 WATER MOTOR ALARMS**

- .1 Provide alarms approved weatherproof and guarded type, to sound locally on flow of water in each corresponding sprinkler system.
- .2 Mount alarms on outside of outer walls of each building at location as directed.
- .3 Provide separate drain piping directly to exterior of building.

**2.8 SUPERVISORY SWITCHES**

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves:
  - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Pressure or flow switch type:
  - .1 With normally open and normally closed contacts and supervisory capability.
  - .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
  - .3 Connect into building fire alarm system.
  - .4 Connection of switch: Section 28 31 00 - Fire Detection and Alarm.
  - .5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.
- .4 Pressure alarm switch:
  - .1 With normally open and normally closed contacts and supervisory capability.

**2.9 WATER GONG**

- .1 To NFPA 13 and ULC listed for fire service. Location as indicated.

**2.10 FIRE DEPARTMENT CONNECTION**

- .1 Provide connections approximately 1.5m above finish grade, location as indicated.
- .2 To NFPA 13 and ULC listed, Siamese type.
- .3 Polished bronze recessed of approved two-way type with 2.5inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.
- .4 Thread specifications: compatible with local fire department.
- .5 Install a 90-degree elbow with drain connection at the low-point near each fire department connection to allow for system drainage to prevent freezing.

**2.11 PRESSURE GAUGES**

- .1 ULC listed and to Section 23 05 19.01 - Thermometers and Pressure Gauges - Piping Systems.
- .2 Maximum limit of not less than twice normal working pressure at point where installed.

**2.12 PIPE SLEEVES**

- .1 Provide pipe sleeves where piping passes through walls and floors.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls or floors.
- .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
  - .1 Firmly pack space with mineral wool insulation.
  - .2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass.
  - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
  - .1 Provide cast-iron sleeves.
  - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
- .6 Sleeves in Other than Masonry and Concrete Walls, Floors, and Roofs:
  - .1 Provide 0.61 mm thick galvanized steel sheet.

**2.13 ESCUTCHEON PLATES**

- .1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.
- .2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

**2.14 INSPECTOR'S TEST CONNECTION**

- .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
- .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

**2.15 SIGNS**

- .1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA 13.



- .2 Permanently fix hydraulic design data nameplates to riser of each system.

**2.16 SPARE PARTS CABINET**

- .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

**3.3 PIPE INSTALLATION**

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.

**3.4 ELECTRICAL CONNECTIONS**

- .1 Provide electrical work associated with this section under Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide fire alarm system under Section 28 31 00 - Fire Detection and Alarm.
- .3 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with the National Electrical Code.
- .4 Provide wiring in rigid metal conduit or intermediate metal conduit.

**3.5 DISINFECTION**

- .1 Disinfect new piping.
- .2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.
- .3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

- .4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

### **3.6 FIELD PAINTING**

- .1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pre-treatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:
  - .1 Piping in Finished Areas:
    - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
    - .2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
    - .3 Provide piping with self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.
  - .2 Piping in Unfinished Areas:
    - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, mechanical equipment room, spaces where walls or ceiling are not painted or not constructed of a prefinished material.
    - .2 Provide piping with self-adhering red plastic bands spaced at maximum of 6 m intervals.

### **3.7 FIELD QUALITY CONTROL**

- .1 Site Test, Inspection:
  - .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
  - .2 Test, inspect, and approve piping before covering or concealing.
  - .3 Preliminary Tests:
    - .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
    - .2 Flush piping with potable water in accordance with NFPA 13.
    - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
    - .4 Test alarms and other devices.

- .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
- .4 Formal Tests and Inspections:
  - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
  - .2 Submit written request for formal inspection at least 15 days prior to inspection date.
  - .3 Repeat required tests as directed.
  - .4 Correct defects and make additional tests until systems comply with contract requirements.
  - .5 Furnish appliances, equipment, instruments, connecting devices, personnel for tests.
  - .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .3 CLEANING
  - .1 Clean in accordance with Section 01 74 11 - Cleaning.
    - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 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 all equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .2 Shop drawings and product data accompanied by:
    - .1 Detailed drawings of bases, supports, and anchor bolts.
    - .2 Acoustical sound power data, where applicable.
    - .3 Points of operation on performance curves.
    - .4 Manufacturer to certify current model production.
    - .5 Certification of compliance to applicable codes.
  - .3 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.

**1.2 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 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
    - .7 Colour coding chart.
  - .3 Maintenance data to include:
    - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

- .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
- .5 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.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 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.
  - .2 Transfer information weekly to prints, revising prints to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass.

- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect all equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**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 SYSTEM CLEANING**

- .1 Clean interior and exterior of all systems including strainers.

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

**3.4 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 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.

**3.6 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Coordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
  - .2 Submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction. Indicate VOC's for adhesive and solvents during application and curing.
- .4 Shop Drawings.
  - .1 Submit shop drawings to indicate:
    - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
    - .2 Wiring and schematic diagrams.
    - .3 Dimensions and recommended installation.
    - .4 Pump performance and efficiency curves.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Instructions: submit manufacturer's installation instructions.
- .7 Manufacturers' Field Reports: manufacturers' field reports specified.
- .8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:
  - .1 Manufacturers name, type, model year, capacity and serial number.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list with names and addresses.

**1.2 QUALITY ASSURANCE**

- .1 Pre-Installation Meeting:
  - .1 Convene pre-installation meeting one week prior to beginning work of this Section on-site installations in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM), Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
    - .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.



- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .4 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.2 DOMESTIC HOT WATER CIRCULATING PUMPS**

- .1 Capacity: as indicated.
- .2 Construction: closed-coupled, in-line centrifugal, all bronze construction, shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings.
- .3 Motor: drip-proof, with thermal overload protection.
- .4 Supports: provide as recommended by manufacturer.

**2.3 SUMP PUMP SUBMERSIBLE**

- .1 Capacity: as indicated.
- .2 Construction: duplex CSA approved, housing epoxy coated cast iron, bronze fitted stainless steel shaft, non-clog bronze impeller, and mechanical shaft seal.
- .3 Motor: as indicated. Hermetically sealed, with automatic overload protection.
- .4 Control: integral diaphragm type level control and duplex control box.

**2.4 BILGE AND SEWAGE PUMP**

- .1 Capacity: as indicated.
- .2 Construction: duplex, vertical extended shaft, single stage centrifugal, designed to handle 50 mm solids and for sump depth as indicated, square with manhole.
- .3 Motor: as indicated, drip-proof, with overload and under voltage protection.
- .4 Control: copper ball float operated heavy duty switch. Automatic electric alternator with selector relays to alternate or activate both pumps. Adjustable float stops on stainless steel rod.
- .5 Alarm: low voltage powered integral bell and audible and visual alarm located as indicated controlled by float or pressure operated switch.
- .6 Sump: concrete one piece, to manufacturer's standard, with heavy bituminous coating inside and out.

**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        Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2        Ensure pump and motor assembly do not support piping.
- .3        Align vertical pit mounted pump assembly after mounting and securing cover plate.
- .4        Place 150 mm sand under sump pit tank.

**3.3                FIELD QUALITY CONTROL**

- .1        Site Tests/Inspection:
  - .1            Check power supply.
  - .2            Check starter protective devices.
- .2        Start-up, check for proper and safe operation.
- .3        Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .4        Adjust flow from water-cooled bearings.
- .5        Adjust impeller shaft stuffing boxes, packing glands.
- .6        Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1            Materials and resources.
  - .2            Storage and collection of recyclables.
  - .3            Construction waste management.
  - .4            Resource reuse.
  - .5            Recycled content.
  - .6            Local/regional materials.
  - .7            Certified wood.
  - .8            Low-emitting materials.

**3.4                START-UP**

- .1        General:
  - .1            In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified herein.
  - .2            Procedures:
    - .1            Check power supply.

- .2 Check starter O/L heater sizes.
- .3 Start pumps, check impeller rotation.
- .4 Check for safe and proper operation.
- .5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
- .6 Test operation of hands-on-auto switch.
- .7 Test operation of alternator.
- .8 Adjust leakage through water-cooled bearings.
- .9 Adjust shaft stuffing boxes.
- .10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
- .11 Check base for free-floating, no obstructions under base.
- .12 Run-in pumps for 12 continuous hours.
- .13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
- .14 Adjust alignment of piping and conduit to ensure full flexibility.
- .15 Eliminate causes of cavitation, flashing, air entrainment.
- .16 Measure pressure drop across strainer when clean and with flow rates as finally set.
- .17 Replace seals if pump used to degrease system or if pump used for temporary heat.
- .18 Verify lubricating oil levels.

### **3.5 PV - SANITARY AND STORM WATER PUMPS**

- .1 Application tolerances:
  - .1 Flow: plus 10%; minus 0%.
  - .2 Pressure: plus 10%; minus 5%.
- .2 PV Procedures:
  - .1 Fill sump at rate slower than capacity of pump #1.
  - .2 Record levels at which pump #1 starts and stops. Determine flow rate by observing time taken to down water level.
  - .3 Fill sump at rate faster than capacity of pump #1 but slower than capacities of pumps #1 and #2 operating in parallel.
  - .4 Record levels at which pumps start and stop - water level rising and water level falling.
  - .5 Verify operation of alternator.
  - .6 Adjust water level controls as necessary.
  - .7 Fill sump at rate faster than capacities of pumps #1 and #2 operating in parallel.
  - .8 Record levels at pump starts and stops - water level rising and falling.
  - .9 Check operation of alternator.
  - .10 Adjust level controls as necessary.

- .11 Check level at which high water level alarm starts and stops. Adjust as necessary.
- .3 Check removability of pumps for servicing without interfering with installation or operation of other equipment.
- .4 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

### **3.6 REPORTS**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.
- .2 Include:
  - .1 PV results on approved PV Report Forms.
  - .2 Product Information report forms.
  - .3 Pump performance curves (family of curves) with final point of actual performance.

### **3.7 TRAINING**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
  - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .3 ASTM B88M, 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, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67, Butterfly Valves.
  - .2 MSS-SP-70, Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
  - .1 NRCC 38728, National Plumbing Code of Canada (NPC).
- .9 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, (TDGA).

**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 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.

**Part 2 Products**

**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.2 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

**2.3 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 and smaller: wrought copper to ANSI/ASME B16.22, cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

**2.4 JOINTS**

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .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.

## **2.5 GATE VALVES**

- .1 NPS 2 and under, soldered:
  - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
  - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.
- .3 NPS 2 1/2 and over, in mechanical rooms, flanged:
  - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.
- .4 NPS 2 1/2 and over, other than mechanical rooms, flanged:
  - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

## **2.6 GLOBE VALVES**

- .1 NPS2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 Lockshield handles: as indicated.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 Lockshield handles: as indicated.

## **2.7 SWING CHECK VALVES**

- .1 NPS 2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

- .3 NPS 2 1/2 and over, flanged:
  - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

## **2.8 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.

## **2.9 BUTTERFLY VALVES**

- .1 NPS 2-1/2 and over, wafer:
  - .1 To MSS-SP-67, Class 200.
  - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
  - .3 Lever operated, NPS8 and over, gear operated.
- .2 NPS 2-1/2 and over, grooved ends:
  - .1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.
  - .2 Operator:
    - .1 NPS 4 and under: lever handle.
    - .2 NPS 6 and over: gear operated.

## **Part 3 Execution**

### **3.1 APPLICATION**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with NPC and the 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 gate 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 times 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, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

### **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 approval of Departmental Representative.
- .2 Coordinate with Section 33 11 16- Site Water Utility Distribution Piping and Section 33 11 16.01 - Incoming Site Water Utility Distribution Piping.
- .3 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

### **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.
- .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  - .3 Bring HWS storage tank up to design temperature slowly.
  - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
  - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

### **3.9 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 off 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 Reports:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.
  - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

**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.
- .2 Operational requirements in accordance with Section 01 47 19 - Sustainable Requirements: Operation, include:
  - .1 Cleaning materials and schedules.
  - .2 Repair and maintenance materials and instructions.

**3.11 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM B32, Standard Specification for Solder Metal.
  - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
  - .3 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA B67], Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
  - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .3 CAN/CSA-B125.3, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36, Commercial Adhesives.
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

**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 datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 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.

**Part 2 Products**

**2.1 SUSTAINABLE MATERIAL**

- .1 Sustainable Requirements: materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.
- .2 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Maximum VOC limit in accordance with Section 01 35 21 - LEED Requirements.

**2.2 COPPER TUBE AND FITTINGS**

- .1 Above ground sanitary 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, type 50A, to ASTM B32.

**2.3 CAST IRON PIPING AND FITTINGS**

- .1 Buried sanitary, storm, and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating of epoxy.
  - .1 Joints:
    - .1 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.
    - .2 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
      - .2 Cold caulking compounds.
- .2 Above ground sanitary 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 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 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 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .4 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
  - .2 ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-Series B1800, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36, Commercial Adhesives.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

**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 datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

**1.3 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 Store at temperatures and conditions recommended by manufacturer.

**Part 2 Products**

**2.1 MATERIAL**

- .1 Sustainable Requirements: materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.

- .2 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Maximum VOC limit in accordance with Section 01 35 21 - LEED Requirements.

**2.2 PIPING AND FITTINGS**

- .1 For buried and above ground DWV piping to:
  - .1 CAN/CSA B1800.

**2.3 JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

**Part 3 Execution**

**3.1 APPLICATION**

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

**3.2 INSTALLATION**

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 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 cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less). For radon piping ensure cap is labelled as such.



**3.5 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)
  - .1 ANSI Z21.10.3A/CSA 4.3, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings above 75,000 Btu per Hour, Circulating and Instantaneous.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
  - .2 CAN/CSA-B149.1, Natural Gas and Propane Installation Code.
  - .3 CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

**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 datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate:
    - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

**1.3 CLOSEOUT SUBMITTALS**

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

**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.

**1.5 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 COMPONENTS**

- .1 Sustainable Requirements:
  - .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.2 GAS (POWER BURNER) WATER HEATER**

- .1 To ANSI Z21.10.3/CSA 1-4.3 with a recovery rate of 560.92 L/h based on 56 degrees C rise and 44kW input. Thermal efficiency of 98%.
- .2 Tank: 379 L, glass lined steel, 705 mm dia x 1930.4 mm high 50 mm foam insulation, PVC jacket.
- .3 Gas burner: complete with high limit control, gas valve, gas pressure regulator, 100% safety shut-off, firepower gas burner with air distribution ring.
- .4 3 year warranty certificate.

**2.3 TRIM AND INSTRUMENTATION**

- .1 Drain valve: NPS 3/4 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.

**2.4 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply anchor bolts and templates for installation in concrete support pad in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Size anchor bolts to withstand seismic zone 4 acceleration and velocity forces.

**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 Install natural gas fired domestic water heaters in accordance with CAN/CSA-B149.1.

**3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's factory trained, certified Engineer to start up and commission 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
  - .1 ANSI/AWWA C700, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
  - .2 ANSI/AWWA C701, Standard for Cold Water Meters-Turbine Type for Customer Service.
  - .3 ANSI/AWWA C702, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
  - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
  - .2 CSA B79, Commercial and Residential Drains and Cleanouts.
  - .3 CAN/CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO)
  - .1 International Performance Measurement and Verification Protocol (IPMVP).
    - .1 IPMVP Version.
- .5 Plumbing and Drainage Institute (PDI)
  - .1 PDI-WH201, Water Hammer Arresters Standard.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation Meetings:
  - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building construction subtrades.
    - .4 Review manufacturer's written installation instructions and warranty requirements.

**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 plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures. Indicate VOC's:
- .3 Shop Drawings:
  - .1 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details, and accessories for following: All plumbing fixtures.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

#### **1.5 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

### **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.

- .3 Type 2: combination funnel floor drain; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

## **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 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, gasket, vandal-proof screws.

## **2.3 NON-FREEZE WALL HYDRANTS**

- .1 Recessed type with integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Polished bronze finish.

## **2.4 WATER HAMMER ARRESTORS**

- .1 Copper construction, bellows type: to PDI-WH201.

## **2.5 BACK FLOW PREVENTERS**

- .1 Preventers: to CSA-B64 Series, application as indicated, double check valve assembly back flow preventer.

## **2.6 PRESSURE REGULATORS**

- .1 Capacity: as indicated.
  - .1 Inlet pressure: 1034 kPa.
  - .2 Outlet pressure: 413 kPa.
- .2 Up to NPS 1-1/2 bronze bodies, screwed: to ASTM B62.
- .3 NPS 2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.
- .4 Semi-steel spring chambers with bronze trim.

## **2.7 BACKWATER VALVES**

- .1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.
- .2 Access:
  - .1 Surface access.
  - .2 Access pipe with cover: maximum 300mm depth.
  - .3 Steel housing with gasketed steel cover.
  - .4 Concrete access pit with cover, as indicated.

**2.8 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

**2.9 WATER MAKE-UP ASSEMBLY**

- .1 Complete with backflow preventer pressure gauge on outlet, pressure reducing valve to CAN/CSA-B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

**2.10 WATER METERS**

- .1 Displacement type to ANSI/AWWA C700.
- .2 Capacity: as indicated.

**2.11 TRAP SEAL PRIMERS**

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

**2.12 STRAINERS**

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS 2 1/2 and over, cast iron body, flanged ends, with bolted cap.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialties and accessories 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 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.

**3.3 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.

### **3.4 CLEANOUTS**

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

### **3.5 NON-FREEZE WALL HYDRANTS**

- .1 Install 600 mm above finished grade and as indicated.

### **3.6 WATER HAMMER ARRESTORS**

- .1 Install on branch supplies to fixtures or group of fixtures.

### **3.7 BACK FLOW PREVENTERS**

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
  - .1 Drains.
  - .2 Backwater Valves.
  - .3 Water Make-up Assembly.
- .2 Pipe discharge to terminate over nearest drain.

### **3.8 BACKWATER VALVES**

- .1 Install in main sewer lines and at weeping tile connection in pit provided at building cleanout.
- .2 Install in access pit as indicated.

### **3.9 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

### **3.10 TRAP SEAL PRIMERS**

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

### **3.11 STRAINERS**

- .1 Install with sufficient room to remove basket for maintenance.

### **3.12 WATER METERS**

- .1 Install water meter provided by local water authority.

- .2 Install water meter as indicated.

### **3.13 WATER MAKE-UP ASSEMBLY**

- .1 Install on valved bypass.
- .2 Pipe discharge from relief valve to nearest floor drain.

### **3.14 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.
  - .4 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

### **3.15 TESTING AND ADJUSTING**

- .1 General:
  - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13- General Commissioning (Cx) Requirements: General Requirements, supplemented as specified.
- .2 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
  - .1 Pressure at fixtures: +/- 70 kPa.
  - .2 Flow rate at fixtures: +/- 20%.
- .4 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.
- .5 Floor drains:
  - .1 Verify operation of trap seal primer.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check operations of flushing features.

- .4 Check security, accessibility, removability of strainer.
- .5 Clean out baskets.
- .6 Vacuum breakers, backflow preventers, backwater valves:
  - .1 Test tightness, accessibility for O M of cover and of valve.
  - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
  - .3 Verify visibility of discharge from open ports.
- .7 Access doors:
  - .1 Verify size and location relative to items to be accessed.
- .8 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .9 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .10 Wall hydrants:
  - .1 Verify complete drainage, freeze protection.
  - .2 Verify operation of vacuum breakers.
- .11 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .12 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.
- .13 Hose bibbs, sediment faucets:
  - .1 Verify that flow and pressure meet design criteria.
  - .2 Check for leaks, replace compression washer if required.
- .14 Hydronic system water Make-up Assembly:
  - .1 Verify flow, pressure, and connection.
- .15 Water meters:
  - .1 Verify location and accessibility.
  - .2 Test meter reading accuracy.

**3.16 CLOSEOUT ACTIVITIES**

- .1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

**3.17 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.

**3.18 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA Group
  - .1 CAN/CSA-B45, Plumbing Fixtures, (Consists of B45.0, B45.1, B45.2, B45.3, B45.4, B45.5, B45.6, B45.7, B45.8 and B45.9).
  - .2 CSA B125.3, Plumbing Fittings.
  - .3 CSA B651, Accessible Design for the Built Environment.
- .2 Green Seal (GS)
  - .1 GS-36, Adhesives for Commercial Use.
- .3 South Coast Air Quality Management District (SCAQMD)
  - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

**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 washroom fixtures and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 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): minimum pressure required for flushing.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

**1.4 DELIVERY, STORAGE AND HANDLING**

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

- .2 Store and protect specified materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## Part 2 Products

### 2.1 SUSTAINABLE MATERIAL

- .1 Adhesives and sealants: maximum VOC limit 250 g/L to GS-36 Standard and in accordance with Section 01 35 21 - LEED Requirements.

### 2.2 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CSA B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: as indicated.
- .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.
- .7 Water closets:

| WC type | Mounting | Bowl  | Flush valve | Flush tank | Handicapped |
|---------|----------|-------|-------------|------------|-------------|
| Wall    | Floor    | Elong | Reg         | Exp'd      | Conc'd      |
| WC-1    | X        | X     |             | X          |             |

- .1 WC-1: floor-mounted, flush tank.
  - .1 Bowl: vitreous china, syphon jet, elongated rim, close-coupled combination, bowl and bolt caps.
  - .2 Closet tank: vitreous china with, flapper type flush valve assembly for ultra-low flush cycle: adjustable from 3.8 - 17 litres/flush, factory set to 3.8 litres/flush.
- .8 Water Closet Seats.
  - .1 Seat: white, elongated, closed front, moulded solid plastic, cover, stainless steel check hinges, stainless steel insert post.
- .9 Washroom Lavatories:
  - .1 L-1: counter-top:
    - .1 Porcelain-on-steel, white, self-rimming, with front overflow, gasket, swivel clamps, semi-oval bowl, supply openings on 100 mm centres. Sizes: 511 x 419 mm outside.

- .10 Washroom Lavatory Trim:
  - .1 102mm centerset, 127mm long spout chrome plated brass, single handed mixing faucet handle, mixing spout, diamond coated ceramic cartridge control mechanism, handle shall return to neutral position when valve is turned off.
    - .1 Provide accessories to limit maximum flow rate to 5.6 liters/minute at 414 kPa.
    - .2 Waste fitting: Pop-up.
- .11 Fixture piping:
  - .1 Hot and cold water supplies to fixtures:
    - .1 Chrome plated flexible supply pipes with handwheel stop, reducers, escutcheon.
  - .2 Waste:
    - .1 Brass P trap with clean out on fixtures not having integral trap.
    - .2 Chrome plated in exposed places.

### **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 washroom fixtures 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 Mounting heights:
  - .1 Standard: as indicated, measured from finished floor.

#### **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 Water closets: flushing action.
  - .2 Aerators: operation, cleanliness.

- .3 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.

**3.4 CLEANING**

- .1 Progress Cleaning: 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.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-B45 Series, Plumbing Fixtures.
  - .2 CAN/CSA-B125.3, Plumbing Fittings.

**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 datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 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.

**1.4 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.

**Part 2 Products**

**2.1 SUSTAINABLE MATERIAL**

- .1 Materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.

**2.2 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, Size: 610 x 610 x 254 mm.
  - .2 Supply fitting: with built-in elevated vacuum breaker, indexed cross handles, heavy duty 1219 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 18 litres/minute at 414 kPa.
- .8 Stainless steel counter-top sinks.
  - .1 SK-1: double compartment, non-ledge back:
    - .1 From 1.0 mm thick type 302 stainless steel, self-rimming, undercoated, clamps. Overall sizes: 838 x 559 x 254 mm.
    - .2 Trim: chrome plated brass, with swing spout, aerator, single lever handle to return to neutral position when valve is turned off, diamond coated ceramic cartridge control mechanism, accessories to limit maximum flow rate to 6.8 litres/minute at 414 kPa, spray fitting, stainless steel braided hose to extend to 864mm usable length.
    - .3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
- .9 Laundry tubs:
  - .1 SK-2: Single compartment.
    - .1 From 1.0 mm thick type 302 stainless steel, self-rimming, undercoated, clamps, waste plug with rubber stopper, adjustable tailpiece, cast brass trap with cleanout. Sizes: 635 x 560 x 305 mm.
    - .2 Trim: chrome plated brass, with swing spout, aerator, two lever handle, controls, accessories to limit maximum flow rate to 5.7 litres/minute at 414 kPa.
- .10 Fixture piping:
  - .1 Hot and cold water supplies to each fixture:
    - .1 Chrome plated flexible supply pipes each with handwheel stop, reducers, escutcheon.
  - .2 Waste:
    - .1 Brass P trap with clean out on each fixture not having integral trap.
    - .2 Chrome plated in all exposed places.

### **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.

**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.
- .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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-B45, Plumbing Fixtures.
  - .2 CAN/CSA-B125.3, Plumbing Fittings.

**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 datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data including monitoring requirements for incorporation into manuals 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.

**1.4 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.

**Part 2 Products**

**2.1 MANUFACTURED UNITS**

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

- .7 Baths:
  - .1 BT-1: recessed tub.
    - .1 One-piece vacuum formed acrylic reinforced with fibreglass, 3 level corner shelves, sound insulating package. Sizes 1524 x 812 x 2007 mm.
    - .2 Waste: concealed pop-up waste and overflow fitting with lever-operated mechanism.
    - .3 Trim: chrome plated brass combination shower and over-rim bath supply fittings with volume control, pressure balancing mixing valve, hot water zone handle limit adjustable on site, 120° spray pattern shower head with bent shower arm and escutcheon. Valve body to maintain balanced pressure of hot and cold water. Provide accessories to limit maximum flow rate to 5.7 litres/minute at 414 kPa.
    - .4 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
- .8 Individual shower stall showerhead.
  - .1 SH-1/SH-2: individual showerhead.
    - .1 Trim: chrome plated brass combination shower and over-rim bath supply fittings with volume control, pressure balancing mixing valve, hot water zone handle limit adjustable on site, 120° spray pattern shower head with bent shower arm and escutcheon. Valve body to maintain balanced pressure of hot and cold water. Provide accessories to limit maximum flow rate to 5.7 litres/minute at 414 kPa.
  - .2 Shower supply valve:
    - .1 Pressure-balanced-actuated element, volume control, 40 degrees C maximum setting, strainer and check-stops on each inlet, lever handle.
  - .3 SH-1: plastic shower cabinet.
    - .1 Cabinet/Base: one-piece vacuum formed acrylic reinforced with fiberglass.
    - .2 Sizes: as indicated.
    - .3 Base: with chrome plated brass strainer and tailpiece.
    - .4 Accessories: soap dish, glass door.
  - .4 SH-2: barrier free plastic shower cabinet.
    - .1 Cabinet/Base: one-piece vacuum formed acrylic reinforced with fiberglass, complete with L-shaped stainless steel grab bar on each side wall, two stainless steel grab bar on back wall, and upper & lower toiletry shelves.
    - .2 Sizes: as indicated.
    - .3 Base: with chrome plated brass strainer and tailpiece.
    - .4 Accessories: stainless steel curtain rod. Install shower trims on right hand side.
- .9 Fixture piping:
  - .1 Hot and cold water supplies to each fixture.

- .1 Chrome plated rigid supply pipes each with hand wheel stop, reducers, escutcheon.
- .2 Waste:
  - .1 Brass P trap with cleanout on each fixture not having integral trap.
  - .2 Chrome plated in all exposed places.

**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 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.
- .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.

**END OF SECTION**

**Part 1 General**

**1.1 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 all HVAC Equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .2 Shop drawings and product data accompanied by:
    - .1 Detailed drawings of bases, supports, and anchor bolts.
    - .2 Acoustical sound power data, where applicable.
    - .3 Points of operation on performance curves.
    - .4 Manufacturer to certify current model production.
    - .5 Certification of compliance to applicable codes.
  - .3 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.

**1.2 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 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
    - .7 Colour coding chart.
  - .3 Maintenance data to include:
    - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

- .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to 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.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 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.
  - .2 Transfer information weekly to prints, revising prints to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to 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.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.



- .2 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass.
  - .4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

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

- .1 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect all equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

#### **Part 2 Products**

##### **2.1 NOT USED**

#### **Part 3 Execution**

##### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for 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 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.

**3.3 SYSTEM CLEANING**

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

**3.4 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.5 DEMONSTRATION**

- .1 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.

**3.6 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.

**3.7 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-11, Environmental Standard for Paints and Coatings.
- .3 National Fire Code of Canada (NFCC 2010)
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113, Architectural Coatings.
  - .2 SCAQMD Rule 1168, Adhesive and Sealant Applications.

**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 datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

**Part 2 Products**

**2.1 MATERIAL**

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
  - .1 Primers, Paints and Coating: in accordance with manufacturer's recommendations for surface conditions.
  - .2 Primer: maximum VOC limit 250 g/L to Standard GS-11.
  - .3 Paints: maximum VOC limit 150 g/L to Standard GS-11.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .1 Sealants: maximum VOC limit to SCAQMD Rule 1168.
- .3 Sealants: maximum VOC limit to SCAQMD Rule 1168.

- .4 Adhesives: maximum VOC limit to SCAQMD Rule 1168.
- .5 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

### **Part 3 Execution**

#### **3.1 APPLICATION**

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

#### **3.2 CONNECTIONS TO EQUIPMENT**

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

#### **3.3 CLEARANCES**

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.

#### **3.4 DRAINS**

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
  - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

#### **3.5 AIR VENTS**

- .1 Install automatic air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

#### **3.6 DIELECTRIC COUPLINGS**

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.

- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

### **3.7 PIPEWORK INSTALLATION**

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
  - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, and conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
  - .1 Install in accessible locations.
  - .2 Remove interior parts before soldering.
  - .3 Install with stems above horizontal position unless indicated.
  - .4 Valves accessible for maintenance without removing adjacent piping.
  - .5 Install globe valves in bypass around control valves.
  - .6 Use gate valves at branch take-offs for isolating purposes except where specified.
  - .7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
  - .8 Install ball valves for glycol service.
  - .9 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.15 Check Valves:

- .1 Install silent check valves on discharge of pumps and as indicated.
- .2 Install swing check valves in horizontal lines as indicated.

**3.8 SLEEVES**

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: [6] mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
  - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
  - .2 Other floors: terminate 25 mm above finished floor.
  - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
  - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
  - .2 Elsewhere:
    - .1 Provide space for fire stopping.
    - .2 Maintain fire rating integrity.
  - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
  - .4 Ensure no contact between copper pipe or tube and sleeve.

**3.9 ESCUTCHEONS**

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws.
  - .1 Chrome or nickel plated brass or type 302 stainless steel..
- .3 Sizes: outside diameter to cover opening or sleeve.
  - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

**3.10 PREPARATION FOR FIRE STOPPING**

- .1 Install fire stopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.

- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

**3.11 FLUSHING OUT OF PIPING SYSTEMS**

- .1 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant mechanical sections.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

**3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK**

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

**3.13 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1, 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).

**1.2 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 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.

**1.3 QUALITY ASSURANCE**

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial regulations.
- .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 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.

**Part 2 Products****2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.2 GENERAL**

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

**2.3 MOTORS**

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W 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, 208 V, unless otherwise indicated.

**2.4 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.

**2.5 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: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave determined during commissioning.

- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

## **2.6 DRIVE GUARDS**

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives;
  - .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
  - .3 38 mm dia holes on both shaft centres for insertion of tachometer.
  - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
  - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .5 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 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.
- .2 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

**3.4 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 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A105/A105M, Standard Specification for Carbon Steel Forgings, for Piping Applications.

**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 datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Manufacturer, model number, line contents, pressure and temperature rating.
    - .2 Movement handled, axial, lateral, angular and the amounts of each.
    - .3 Nominal size and dimensions including details of construction and assembly.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.
  - .1 Data to include:
    - .1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

**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.

**Part 2 Products**

**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.

**2.2 SLIP TYPE EXPANSION JOINTS**

- .1 Application: for axial pipe movement, as indicated.
- .2 Repacking: under full line pressure.
- .3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with ends for welding.
- .4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B, hard chrome plated.
- .5 Anchor base: construction steel, welded to body.
- .6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.
- .7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.
- .8 Packing rings: 6 minimum, PTFE impregnated non-asbestos.
- .9 Thermal plastic packing: PTFE impregnated non-asbestos slug supplied loose.
- .10 Lubricating fittings: pet cocks with grease nipple.
- .11 Plunger body and plunger:
  - .1 Plunger body: heavy wall carbon steel welded to body.
  - .2 Plunger: carbon steel with hex head for use with socket wrench.
- .12 Lubricant: to manufacturer's recommendations.
- .13 Lubricant gun: complete with hose assembly.
- .14 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug.

**2.3 BELLOWS TYPE EXPANSION JOINTS**

- .1 For axial, lateral or angular movements, as indicated.
- .2 Maximum operating pressure: as indicated.
- .3 Maximum operating temperature: as indicated.
- .4 Type A: controlled flexing, factory tested to 1 times maximum working pressure. Provide test certificates.
- .5 Type B: externally pressurized, constant volume, pressure balanced, designed to eliminate pressure thrust, factory tested to 1 times maximum working pressure. Provide test certificates.
- .6 Bellows:
  - .1 Multiple bellows, hydraulically formed, single ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.
- .7 Reinforcing or control rings:
  - .1 2 piece nickel iron.

- .8 Ends:
  - .1 For butt welding flanges to match pipe.
- .9 Liner:
  - .1 Austenitic stainless steel in direction of flow.
- .10 Shroud:
  - .1 Carbon steel, painted.

## **2.4 GROOVED END EXPANSION JOINTS**

- .1 Packless, Gasketed, Slip, Expansion Joints:
  - .1 2413 kPa maximum working pressure.
  - .2 Steel pipe fitting consisting of telescoping body and slip-pipe sections.
  - .3 PTFE modified polyphenylene sulfide coated slide section.
  - .4 Suitable for axial end movement to 75 mm.
- .2 Expansion joint consisting of series of grooved end pipe nipples joined in tandem with flexible couplings. Total joint movement dependent on number of couplings and nipples used.

## **2.5 FLEXIBLE CONNECTION**

- .1 Application: to suit motion.
- .2 Minimum length in accordance with manufacturer's recommendations to suit offset.
- .3 Inner hose: bronze corrugated.
- .4 Braided wire mesh bronze outer jacket.
- .5 Diameter and type of end connection: as indicated.
- .6 Operating conditions:
  - .1 Working pressure: 1034 kPa.
  - .2 Working temperature: 93 degrees C.
  - .3 To match system requirements.
- .7 Three flexible grooved couplings placed in close proximity to vibration source for vibration attenuation and stress relief.

## **2.6 ANCHORS AND GUIDES**

- .1 Anchors:
  - .1 Provide as indicated.
  - .2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.
  - .3 Reinforcement: to Section 03 20 00 - Concrete Reinforcing.

- .2 Alignment guides:
  - .1 By conduit manufacturer.
  - .2 To accommodate specified thickness of insulation.
  - .3 Vapour barriers, jackets to remain uninterrupted.

**Part 3 Execution**

**3.1 APPLICATION**

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

**3.2 INSTALLATION**

- .1 Install expansion joints with cold setting, as instructed by Departmental Representative. Make record of cold settings.
- .2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
- .3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.
- .4 Do welding in accordance with section 23 05 17 - Pipe Welding.

**3.3 PIPE CLEANING AND START-UP**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

**3.4 PERFORMANCE VERIFICATION**

- .1 In accordance with Section 23 08 01 - Performance Verification: Mechanical Piping Systems.

**3.5 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1, Power Piping.
  - .2 ANSI/ASME Boiler and Pressure Vessel Code:
    - .1 BPVC 2007 Section I: Power Boilers.
    - .2 BPVC 2007 Section V: Non-destructive Examination.
    - .3 BPVC 2007 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
  - .1 AWS C1.1M/C1.1, Recommended Practices for Resistance Welding.
  - .2 AWS Z49.1, Safety in Welding, Cutting and Allied Process.
  - .3 AWS W1, Welding Inspection Handbook..
- .4 Canadian Standards Association (CSA International)
  - .1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
  - .2 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
  - .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
  - .4 CSA-W117.2, Safety in Welding, Cutting and Allied Processes.
  - .5 CSA W178.1, Certification of Welding Inspection Organizations.
  - .6 CSA W178.2, Certification of Welding Inspectors.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Welders:
    - .1 Welding qualifications in accordance with CSA B51.
    - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
    - .3 Submit welder's qualifications to Departmental Representative.
    - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
    - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.



- .2 Inspectors:
  - .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
  - .1 Registration of welding procedures in accordance with CSA B51.
  - .2 Copy of welding procedures available for inspection.
  - .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

**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.

**Part 2 Products**

**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.

**2.2 ELECTRODES**

- .1 Electrodes: in accordance with CSA W48 Series.

**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 QUALITY OF WORK**

- .1 Welding: in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

**3.3 INSTALLATION REQUIREMENTS**

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
  - .1 Where used, fit to minimize gaps between ring and pipe bore.
  - .2 Do not install at orifice flanges.

- .3 Fittings:
  - .1 NPS 2 and smaller: install welding type sockets.
  - .2 Branch connections: install welding tees or forged branch outlet fittings.

### **3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS**

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

### **3.5 SPECIALIST EXAMINATIONS AND TESTS**

- .1 General:
  - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
  - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
  - .3 Inspect and test 5% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination magnetic particle (hereinafter referred to as "particle") tests.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
  - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10 particle tests.

### **3.6 DEFECTS CAUSING REJECTION**

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

### **3.7 REPAIR OF WELDS WHICH FAILED TESTS**

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

### **3.8 CLEANING**

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

**END OF SECTION**

**Part 1 General****1.1 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B40.100, Pressure Gauges and Gauge Attachments.
  - .2 ASME B40.200, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self-Indicating, Commercial/Industrial Type.
  - .2 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- .3 Efficiency Valuation Organization (EVO)
  - .1 International Performance Measurement and Verification Protocol (IPMVP)
    - .1 IPMVP Version.
- .4 Green Seal Environmental Standards (GS)
  - .1 GS-11, Standard for Paints and Coatings.
  - .2 GS-36, Standard for Commercial Adhesives.

**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 thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test and Evaluation Reports:
  - .1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

**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 thermometers and pressure gauges indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Design point to be at mid-point of scale or range.
- .2 Ranges: as indicated.

### **2.2 DIRECT READING THERMOMETERS**

- .1 Industrial, type, liquid filled, 125 mm scale length: to CAN/CGSB-14.4.
  - .1 Resistance to shock and vibration.

### **2.3 THERMOMETER WELLS**

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: stainless steel.

### **2.4 PRESSURE GAUGES**

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.
- .2 Provide:
  - .1 Siphon for steam service.
  - .2 Snubber for pulsating operation.
  - .3 Diaphragm assembly for corrosive service.
  - .4 Gasketed pressure relief back with solid front.
  - .5 Bronze stop cock.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

- .1 Install thermometers and gauges so they can be easily read from floor or platform.
  - .1 If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

**3.3 THERMOMETERS**

- .1 Install in wells on piping. Include heat conductive material inside well.
- .2 Install in locations as indicated and on inlet and outlet of:
  - .1 Water heating coils.
  - .2 Water boilers.
  - .3 DHW tanks.
- .3 Install wells as indicated for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

**3.4 PRESSURE GAUGES**

- .1 Install in locations as follows:
  - .1 Suction and discharge of pumps.
  - .2 Upstream and downstream of PRV's.
  - .3 Upstream and downstream of control valves.
  - .4 Inlet and outlet of coils.
  - .5 Outlet of boilers.
  - .6 In other locations as indicated.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.

**3.5 NAMEPLATES**

- .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01 - Mechanical Identification, identifying medium.

**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.

**3.7 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
  - .1 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B283, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  - .4 ASTM B505/B505M, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
  - .1 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS-SP-80, Bronze Gate Globe, Angle and Check Valves.
  - .3 MSS-SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

**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 for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .3 Shop Drawings:
  - .1 Submit data for valves specified in this Section.

**1.3 CLOSEOUT SUBMITTALS**

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

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
  - .1 Furnish following spare parts:
    - .1 Valve seats: one for every 10 valves each size, minimum 1.
    - .2 Discs: one for every 10 valves, each size. Minimum 1.

- .3 Stem packing: one for every 10 valves, each size. Minimum 1.
- .4 Valve handles: 2 of each size.
- .5 Gaskets for flanges: one for every 10 flanged joints.
- .2 Tools:
  - .1 Furnish special tools for maintenance of systems and equipment.
  - .2 Include following:
    - .1 Lubricant gun for expansion joints.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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, 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 Lockshield Keys:
  - .1 Where lockshield valves are specified, provide 2 keys of each size: malleable iron cadmium plated.
- .4 Gate Valves:
  - .1 Requirements common to gate valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
    - .5 Packing: non-asbestos.

- .6 Handwheel: non-ferrous.
      - .7 Handwheel Nut: bronze to ASTM B62.
    - .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
      - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
      - .2 Operator: Handwheel.
    - .3 NPS 2 and under, rising stem, split wedge disc, Class 125:
      - .1 Body: with long disc guides, screwed bonnet.
      - .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
      - .3 Operator: handwheel.
  - .5 Globe Valves:
    - .1 Requirements common to globe valves, unless specified otherwise:
      - .1 Standard specification: MSS SP-80.
      - .2 Bonnet: union with hexagonal shoulders.
      - .3 Connections: screwed with hexagonal shoulders.
      - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
      - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
      - .6 Handwheel: non-ferrous.
      - .7 Handwheel Nut: bronze to ASTM B62.
    - .1 NPS 2 and under, composition disc, Class 125:
      - .1 Body and bonnet: screwed bonnet.
      - .2 Disc and seat: renewable rotating PTFE disc, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
      - .3 Operator: handwheel.
  - .6 Check Valves:
    - .1 Requirements common to check valves, unless specified otherwise:
      - .1 Standard specification: MSS SP-80.
      - .2 Connections: screwed with hexagonal shoulders.
    - .2 NPS 2 and under, swing type, bronze disc, Class 125:
      - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
      - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
  - .7 Silent Check Valves:
    - .1 NPS 2 and under:
      - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
      - .2 Pressure rating: Class 125.
      - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
      - .4 Disc and seat: renewable rotating disc.
      - .5 Stainless steel spring, heavy duty.



- .6      Seat: regrindable.
- .8      Ball Valves:
  - .1      NPS 2 and under:
    - .1      Body and cap: cast high tensile bronze to ASTM B62.
    - .2      Pressure rating: Class125, 860 kPa steam.
    - .3      Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders.
    - .4      Stem: tamperproof ball drive.
    - .5      Stem packing nut: external to body.
    - .6      Ball and seat: replaceable stainless steel solid ball and Teflon seats.
    - .7      Stem seal: TFE with external packing nut.
    - .8      Operator: removable lever handle.
- .9      Butterfly Valves:
  - .1      NPS 2 1/2 through NPS 6, 2068 kPa, with grooved ends.
    - .1      Body: cast bronze, with copper-tube dimensioned grooved ends.
    - .2      Disc: elastomer coated ductile iron with integrally cast stem.
    - .3      Operator: handwheel.

### **Part 3      Execution**

#### **3.1      INSTALLATION**

- .1      Install rising stem valves in upright position with stem above horizontal.
- .2      Remove internal parts before soldering.
- .3      Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

#### **3.2      CLEANING**

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

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 ASTM International Inc.
  - .1 ASTM A49, Standard Specification for Heat-Treated Carbon Steel Joint Bars.
  - .2 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - .3 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
  - .5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .6 ASTM B85/B85M, Standard Specification for Aluminum-Alloy Die Castings.
  - .7 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
  - .1 MSS SP-61, Pressure Testing of Steel Valves.
  - .2 MSS SP-70, Grey Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS SP-82, Valve Pressure Testing Methods.
  - .5 MSS SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

**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 datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3                CLOSEOUT SUBMITTALS**

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

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
- .2 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.
- .3 Tools:
  - .1 Furnish special tools for maintenance of systems and equipment.
  - .2 Include following:
    - .1 Lubricant gun for expansion joints.

## **Part 2 Products**

### **2.1 MATERIAL**

- .1 Valves:
  - .1 Except for specialty valves, to be of single manufacturer.
- .2 Standard specifications:
  - .1 Gate valves: MSS SP-70.
  - .2 Globe valves: MSS SP-85.
  - .3 Check valves: MSS SP-71.
- .3 Requirements common to valves, unless specified otherwise:
  - .1 Body, bonnet: ductile iron to ASTM A536 Grade 65-45-12.
  - .2 Connections: flanged ends plain face to ANSI B16.1.
  - .3 Inspection and pressure testing: to MSS SP-82.
  - .4 Bonnet gasket: non-asbestos.
  - .5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
  - .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
  - .7 Gland packing: non-asbestos.
  - .8 Handwheel: die-cast aluminum alloy to ASTM B85/B85M or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
  - .9 Identification tag: with catalogue number, size, other pertinent data.
- .4 All products to have CRN registration numbers.

## 2.2 GATE VALVES

- .1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze trim, solid wedge disc:
  - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.
  - .2 Disc: solid offset taper wedge, bronze to ASTM B62.
  - .3 Seat rings: renewable bronze to ASTM B62, screwed into body.
  - .4 Stem: bronze to ASTM B62.
  - .5 Operator: handwheel.
- .2 NPS 2 1/2-8, outside screw and yoke (OS Y), bronze trim, solid wedge disc:
  - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.
  - .2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
  - .3 Seat rings: renewable bronze screwed into body.
  - .4 Stem: nickel-plated steel.
  - .5 Pressure-lubricated operating mechanism.
  - .6 Operator: handwheel.

## 2.3 GLOBE VALVES

- .1 NPS 2 1/2 - 10, OSY:
  - .1 Body: with multiple-bolted bonnet.
  - .2 WP: 860 kPa steam, 1.4 MPa CWP.
  - .3 Bonnet-yoke gasket: non-asbestos.
  - .4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
  - .5 Seat ring: renewable, regrindable, screwed into body.
  - .6 Stem: bronze to ASTM B62.
  - .7 Operator: handwheel.

## 2.4 VALVE OPERATORS

- .1 Install valve operators as follows:
  - .1 Handwheel: on valves except as specified.

## 2.5 CHECK VALVES

- .1 Swing check valves, Class 125:
  - .1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Grooved or flanged ends: plain faced with smooth finish.
    - .1 Up to NPS 16: ductile iron ASTM A536 Grade 65-45-12.

- .2 Ratings:
  - .1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.
- .3 Disc: rotating for extended life.
  - .1 Up to NPS 6: bronze to ASTM B62.
- .4 Seat rings: renewable bronze to ASTM B62 screwed into body.
- .5 Hinge pin, bushings: renewable bronze to ASTM B62.
- .6 Seat: cast iron, integral with body.
- .7 Hinge pin: exelloy; bushings: malleable iron.
- .8 Identification tag: fastened to cover.
- .9 Hinge: galvanized malleable iron.

## **2.6 SILENT CHECK VALVES**

- .1 Construction:
  - .1 Body: ductile iron with integral seat.
  - .2 Pressure rating: Class 125, WP = 860 kPa.
  - .3 Connections: grooved ends.
  - .4 Disc: bronze renewable rotating disc.
  - .5 Seat: renewable, EPDM.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.

### **3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Clean installed products in accordance to manufacturer's recommendation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.2M, Pipe Threads, 60 deg. General Purpose (Metric).
  - .2 ASME B16, Fittings and Valves Package.
  - .3 ANSI/ASME B16.1, Grey Iron Pipe Flanges and Flanged Fittings. Classes 25, 125, and 250.
  - .4 ANSI/ASME B16.10, Face-to-Face and End-to-End Dimensions Valves.
  - .5 ANSI/ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
  - .6 ANSI/ASME B16.25, Buttwelding Ends.
  - .7 ANSI/ASME B16.34, Valves Flanged, Threaded and Welding End. Includes Supplement.
- .2 ASTM International
  - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - .2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 Canadian Registration Number (CRN)
- .4 Efficiency Valuation Organization (EVO)
  - .1 International Performance Measurement and Verification Protocol (IPMVP)
    - .1 IPMVP Version.
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-78, Cast Iron Plug Valves, Flanged and Threaded Ends.

**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 each valve and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**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 valves - lubricated plug 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 valves from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Extra Stock Materials:
- .3 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.

### **Part 2 Products**

#### **2.1 MATERIAL**

- .1 Valves:
  - .1 To be of single manufacturer.
  - .2 Ensure products have CRN registration number.

#### **2.2 ECCENTRIC PLUG VALVES - SCREWED ENDS**

- .1 General:
  - .1 Dead-tight shut-off on liquids and gases at pressure differentials up to 1.2 MPa in forward direction, 520 kPa in reverse direction.
- .2 Up to NPS 2, screwed ends:
  - .1 Body: cast iron to ASTM B209 Class B.
  - .2 Plug:
    - .1 NPS 1/2 and 3/4: bronze to ASTM B62.
    - .2 NPS 1 to NPS 2: bronze to ASTM B62.

- .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
  - .1 Plastic seat coating between plug and body.
  - .2 Resilient seal moulded into groove in plug face.
  - .3 Seal materials: BUNA stem seals with HYCAR plug seals.
- .5 End connections: screwed.
- .6 Operators: lever.

## **2.3 LUBRICATED PLUG VALVES**

- .1 Principle of operation:
  - .1 Special sealing compound used to affect tight seal. When line pressure applied to valve in closed position, parallel plug forced against downstream side of valve. Metal-to-metal contact and sealing compound ensures leak-tight seal.
- .2 Testing: to MSS SP-78 for non-shock pressure as per manufacturers design.
- .3 End connections:
  - .1 NPS to 2: screwed ends.
  - .2 NPS 2 to 12: flanged ends.
- .4 Valve:
  - .1 Body: cast iron to ASTM A126 Class B semi-steel.
  - .2 Pressure rating: NPS to 12:
    - .1 Screwed end valves: screwed to NPT standards.
    - .2 Flanged end valves: flanged to ANSI B16.1 Class 125, 125 psig at 232 degrees C. Flanged valves NPS 2-8 face dimensions in accordance with ANSI B16.10 short pattern, making them interchangeable with Class 125 flanged cast iron gate valves.
    - .3 Hydrostatic tests: body 300 psig. Seat: 100 psig.
  - .3 Plug: tapered, with regular, venturi pattern port - 90 degrees from full open to full closed, complete with PFTE thrust ring: 100% full port.
  - .4 Number of ports: as indicated.
  - .5 Ends: with butt welding to ANSI B16.25.
  - .6 Lubrication system, nickel-plated.
  - .7 Lubricant: to suit type, temperature and pressure of contained fluid.
  - .8 Include sealing compound injection gun designed for use with pre-packed sealing compound cartridges and valve fitted with button head nipples and combination sealing screws.



- .9 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leak proof operation, and corrosion preventing film.
  - .1 Ensure lubricant receptacle can hold additional lubricant.
  - .2 Include lubricant screw for lubrication.
  - .3 Include check valve to prevent reverse flow of lubricant.
  - .4 Include O-rings between body and plug.
- .5 Operator:
  - .1 Up to NPS 5: manual lever.
- .6 3-port and 4 port valves:
  - .1 Supply with transflow pattern.
  - .2 Include limit stops.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of 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 OF LUBRICATED PLUG VALVES**

- .1 Install with line pressure acting to hold plug against body ports.
  - .1 Cut off from higher pressure.

#### **3.3 COMMISSIONING OF LUBRICATED PLUG VALVES**

- .1 Determine type of sealing compound for particular application.
- .2 Ensure even distribution of sealing compound and tight shut-off by opening and closing valve 3 times minimum.
- .3 Ensure that plug is free to float when operating valve by easing valve off body.
- .4 Determine frequency of re-lubrication during commissioning of remainder of system.

#### **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 plug valve installation.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1, Power Piping.
- .2 ASTM International
  - .1 ASTM A125, Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP58, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 MSS SP69, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 Underwriter's 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 and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit shop drawings for:
    - .1 Bases, hangers and supports.
    - .2 Connections to equipment and structure.
    - .3 Structural assemblies.
- .4 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

**1.3                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      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.

**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.

**2.2                      SUSTAINABLE REQUIREMENTS**

- .1      Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.3                      GENERAL**

- .1      Fabricate hangers, supports and sway braces in accordance with MSS SP58.

**2.4                      PIPE HANGERS**

- .1      Finishes:
  - .1      Pipe hangers and supports: galvanized after manufacture.
  - .2      Use hot dipped galvanizing process.
  - .3      Ensure steel hangers in contact with copper piping are epoxy coated.
- .2      Upper attachment structural: suspension from lower flange of I-Beam:
  - .1      Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut carbon steel retaining clip.
    - .1      Rod: 9 mm UL listed.
  - .2      Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58.

- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:
  - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.
- .5 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 22 mm or 28 mm rod.
- .6 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel black.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .9 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: black.
  - .2 Finishes for copper, glass, brass or aluminum pipework: epoxy coated, with formed portion plastic coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

## **2.5 RISER CLAMPS**

- .1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

**2.6            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.

**2.7            CONSTANT SUPPORT SPRING HANGERS**

- .1    Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2    Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3    Provide upper and lower factory set travel stops.
- .4    Provide load adjustment scale for field adjustments.
- .5    Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6    Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

**2.8            VARIABLE SUPPORT SPRING HANGERS**

- .1    Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2    Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3    Variable spring hanger complete with factory calibrated travel stops.
- .4    Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

**2.9            EQUIPMENT SUPPORTS**

- .1    Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

**2.10          EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1    Provide templates to ensure accurate location of anchor bolts.

**2.11            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.

**2.12            OTHER EQUIPMENT SUPPORTS**

- .1      Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
- .2      Submit structural calculations with shop drawings.

**Part 3           Execution****3.1            MANUFACTURER'S INSTRUCTIONS**

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

**3.2            INSTALLATION**

- .1      Install in accordance with:
  - .1          Manufacturer's instructions and recommendations.
- .2      Vibration Control Devices:
  - .1          Install on piping systems at pumps, boilers, and as indicated.
- .3      Clamps on riser piping:
  - .1          Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2          Bolt-tightening torques to industry standards.
  - .3          Steel pipes: install below coupling or shear lugs welded to pipe.
  - .4          Cast iron pipes: install below joint.
- .4      Clevis plates:
  - .1          Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5      Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6      Use approved constant support type hangers where:
  - .1          Vertical movement of pipework is 13 mm or more,
  - .2          Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7      Use variable support spring hangers where:
  - .1          Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2          Variation in supporting effect does not exceed 25 % of total load.

**3.3 HANGER SPACING**

- .1 Plumbing piping: to Canadian Plumbing Code and authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .6 Within 300 mm of each elbow.

| 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                  |
| 3                       | 3.7 m                 | 3.0 m                  |
| 3-1/2                   | 3.7 m                 | 3.3 m                  |
| 4                       | 3.7 m                 | 3.6 m                  |
| 5                       | 4.3 m                 |                        |
| 6                       | 4.3 m                 |                        |
| 8                       | 4.3 m                 |                        |
| 10                      | 4.9 m                 |                        |
| 12                      | 4.9 m                 |                        |

- .7 Pipework greater than NPS 12: to MSS SP69.

**3.4 HANGER INSTALLATION**

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

**3.5 HORIZONTAL MOVEMENT**

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

**3.6 FINAL ADJUSTMENT**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.



- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

### **3.7 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .2 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

### **3.8 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 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, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC)

**1.2 ACTION AND INFORMATIONAL 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 Provide system shop drawings complete with performance and product data.
  - .2 Provide detailed drawings of seismic control measures for equipment and piping.
- .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.

**1.3 QUALITY ASSURANCE**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**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.

**Part 2 Products****2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.2 GENERAL**

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

**2.3 ELASTOMERIC PADS**

- .1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading [350] kPa.
- .2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

**2.4 ELASTOMERIC MOUNTS**

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

**2.5 SPRINGS**

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Colour code springs.

**2.6 SPRING MOUNT**

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
- .6 Performance: as indicated.

## **2.7 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 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with precompression washer and nut.
- .6 Performance: as indicated.

## **2.8 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES**

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

## **2.9 HORIZONTAL THRUST RESTRAINT**

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

## **2.10 STRUCTURAL BASES**

- .1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.
- .2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.
- .3 Bases to clear housekeeping pads by 25 mm minimum.

**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 vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm 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.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to 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 after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

- .2 Take vibration measurements for equipment as indicated.
- .3 Provide Departmental Representative with notice 24 h in advance of commencement of tests.
- .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
- .5 Submit complete report of test results including sound curves.
- .3 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

#### **3.4 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 REFERENCES**

- .1 Canadian Gas Association (CGA)
  - .1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

**1.3 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**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 & recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Dispose of unused paint & coating material at official hazardous material collections site approved by Departmental Representative.

- .3 Do not dispose of unused paint & coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

## **Part 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

### **2.2 MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
  - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
  - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

### **2.3 SYSTEM NAMEPLATES**

- .1 Colours:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
  - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

| Size # mm | Sizes (mm) | No. of Lines | Height of Letters (mm) |
|-----------|------------|--------------|------------------------|
| 1         | 10 x 50    | 1            | 3                      |
| 2         | 13 x 75    | 1            | 5                      |
| 3         | 13 x 75    | 2            | 3                      |
| 4         | 20 x 100   | 1            | 8                      |
| 5         | 20 x 100   | 2            | 5                      |
| 6         | 20 x 200   | 1            | 8                      |
| 7         | 25 x 125   | 1            | 12                     |
| 8         | 25 x 125   | 2            | 8                      |
| 9         | 35 x 200   | 1            | 20                     |

- .2 Use maximum of 25 letters/numbers per line.



- .4 Identification for PWGSC Preventive Maintenance Support System (PMSS):
  - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
  - .2 Equipment in Mechanical Room:
    - .1 Main identifier: size #9.
    - .2 Source and Destination identifiers: size #6.
    - .3 Terminal cabinets, control panels: size #5.
  - .3 Equipment elsewhere: sizes as appropriate.

## **2.4 PIPING SYSTEMS GOVERNED BY CODES**

- .1 Identification:
  - .1 Natural gas: to CSA/CGA B149.1.
  - .2 Sprinklers: to NFPA 13.

## **2.5 IDENTIFICATION OF PIPING SYSTEMS**

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Departmental Representative.

- .2 Colours for legends, arrows: to following table:

| Background colour: | Legend, arrows: |
|--------------------|-----------------|
| Yellow             | BLACK           |
| Green              | WHITE           |
| Red                | WHITE           |

- .3 Background colour marking and legends for piping systems:

| Contents                   | Background colour marking | Legend         |
|----------------------------|---------------------------|----------------|
| City water                 | Green                     | CITY WATER     |
| Hot water heating supply   | Yellow                    | HEATING SUPPLY |
| Hot water heating return   | Yellow                    | HEATING RETURN |
| Make-up water              | Yellow                    | MAKE-UP WTR    |
| Domestic hot water supply  | Green                     | DOM. HW SUPPLY |
| Dom. HWS recirculation     | Green                     | DOM. HW CIRC   |
| Domestic cold water supply | Green                     | DOM. CWS       |
| Storm water                | Green                     | STORM          |
| Sanitary                   | Green                     | SAN            |
| Plumbing vent              | Green                     | SAN. VENT      |
| Natural gas                | to Codes                  |                |
| Gas regulator vents        | to Codes                  |                |
| Fire protection water      | Red                       | FIRE PROT. WTR |
| Sprinklers                 | Red                       | SPRINKLERS     |
|                            |                           |                |

## 2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

## 2.7 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

## 2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

## 2.9 LANGUAGE

- .1 Identification in English & French.
- .2 Use one nameplate and label for both languages.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 TIMING**

- .1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

**3.3 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC/CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

**3.4 NAMEPLATES**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
  - .1 Do not paint, insulate or cover.

**3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

- .9 Identification easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### **3.6 VALVES, CONTROLLERS**

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

### **3.7 FIELD QUALITY CONTROL**

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

### **3.8 CLEANING**

- .1 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 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.
  - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

**1.2 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

**1.3 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

**1.4 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

**1.5 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started 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.

**1.6 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

**1.7 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

**1.8 START OF TAB**

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
  - .3 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .4 Application of weatherstripping, sealing, and caulking.
  - .5 Pressure, leakage, other tests specified elsewhere Division 23.
  - .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  - .1 Proper thermal overload protection in place for electrical equipment.
  - .2 Air systems:
    - .1 Filters in place, clean.
    - .2 Duct systems clean.

- .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
- .4 Correct fan rotation.
- .5 Fire, smoke, volume control dampers installed and open.
- .6 Coil fins combed, clean.
- .7 Access doors, installed, closed.
- .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

#### **1.9 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 10 %, minus 10 %.
  - .2 Hydronic systems: plus or minus 10 %.

#### **1.10 ACCURACY TOLERANCES**

- .1 Measured values accurate to within plus or minus 2 % of actual values.

#### **1.11 INSTRUMENTS**

- .1 Prior to TAB, submit to 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.

#### **1.12 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

#### **1.13 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of 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.

**1.14 TAB REPORT**

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

**1.15 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.

**1.16 SETTINGS**

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

**1.17 COMPLETION OF TAB**

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

**1.18 AIR SYSTEMS**

- .1 Standard: TAB to most stringent of this section and TAB standards of AABC, NEBB and SMACNA.
- .2 Do TAB of systems, equipment, components for the following systems, equipment, components, controls:
  - .1 All Air systems.
  - .2 All Water/Glycol Systems.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.



- .6 Locations of equipment measurements: to include as appropriate:
  - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
  - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                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, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
  - .2    ASTM International Inc.
    - .1    ASTM B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
    - .2    ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
    - .3    ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
    - .4    ASTM C547, Standard Specification for Mineral Fiber Pipe Insulation.
    - .5    ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
    - .6    ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - .3    Canadian General Standards Board (CGSB)
    - .1    CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .4    Green Seal Environmental Standards (GSES)
    - .1    Standard GS-36, Commercial Adhesives.
  - .5    South Coast Air Quality Management District (SCAQMD), California State
    - .1    SCAQMD Rule 1168, Adhesive and Sealant Applications.
  - .6    Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

- .7 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

## **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 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 Manufacturers' Instructions:
  - .1 Provide manufacture's written duct insulation jointing recommendations and special handling criteria, installation sequence, cleaning procedures.

## **1.3 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, member of TIAC.

## **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 and ULC markings.

## **Part 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.

### **2.2 FIRE AND SMOKE RATING**

- .1 To CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

**2.3 INSULATION**

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-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.

**2.4 JACKETS**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
  - .1 Maximum VOC limit 50 g/L GSES GS-36.

**2.5 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
    - .1 Maximum VOC limit 50 g/L GSES GS-36.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
- .6 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.
- .7 Contact adhesive: quick-setting
  - .1 Maximum VOC limit 50 g/L to GSES GS-36.
- .8 Canvas adhesive: washable.
  - .1 Maximum VOC limit 50 g/L to GSES GS-36.

- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on other face of insulation.
- .12 Fasteners: 2 mm 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, 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 warm air ducts                                     | C-1             | 25             |
| Round warm air ducts   | C-1             | 25             |
| Supply, return and exhaust ducts exposed in space being served | none            |                |
| Outside air ducts  | C-1             | 50             |
| Exhaust duct between dampers and louvres                       | C-1             | 25             |
| Acoustically lined ducts                                       | none            |                |

- .2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

- .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

- .1 Finishes: conform to following table:

|  | TIAC Code   |       |
|--|-------------|-------|
|  | Rectangular | Round |
| Indoor, concealed                      | none        | none  |
| Indoor, exposed within mechanical room | CRF/1       | CRD/2 |
| Indoor, exposed elsewhere              | CRF/2       | CRD/3 |

### 3.5 CLEANING

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .2 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .3 ASTM C547, Standard Specification for Mineral Fiber Pipe Insulation.
  - .4 ASTM C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .5 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .6 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52MA, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2 CAN/CGSB 51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.
- .5 Thermal Insulation Association of Canada (TIAC)
  - .1 National Insulation Standards.
- .6 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

**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 datasheets for insulation and adhesives, include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.
- .3 Manufacturer's Instructions:

- .1 Include procedures to be used and installation standards to be achieved.
- .4 Qualifications:
  - .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

### **1.3 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 Store at temperatures and conditions recommended by manufacturer.

## **Part 2 Products**

### **2.1 COMPONENTS**

- .1 Sustainable Requirements:
  - .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

### **2.2 FIRE AND SMOKE RATING**

- .1 Fire and smoke ratings to CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### **2.3 INSULATION**

- .1 Mineral fibre: 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: ASTM C547.
  - .2 Maximum "k" factor: ASTM C547.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52MA.
  - .3 Maximum "k" factor: ASTM C547.



- .5 TIAC Code C-1: rigid mineral fibre board, unfaced.
  - .1 Mineral fibre: ASTM C612.
  - .2 Maximum "k" factor: ASTM C612.
- .6 TIAC Code C-4: rigid mineral fibre board faced with factory applied vapour retarder jacket.
  - .1 Mineral fibre: ASTM C612.
  - .2 Jacket: to CGSB 51-GP-52MA.
  - .3 Maximum "k" factor: ASTM C612.
- .7 TIAC Code C-2: mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52MA.
  - .3 Maximum "k" factor: ASTM C553.
- .8 TIAC Code A.6: flexible unicellular tubular elastomer.
  - .1 Insulation: with vapour retarder jacket.
  - .2 Jacket: to CGSB 51-GP-52MA.
  - .3 Maximum "k" factor.
  - .4 Certified by manufacturer free of potential stress corrosion cracking corrodents.
- .9 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: ASTM C533.
  - .2 Maximum "k" factor: ASTM C533.
  - .3 Design to permit periodic removal and re-installation.

## **2.4 CEMENT**

- .1 Thermal insulating and finish
  - .1 To: ASTM C449/C449M.
  - .2 Air drying on mineral wool, to ASTM C449.

## **2.5 JACKETS**

- .1 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: smooth.
  - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
  - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
  - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

## **2.6 INSULATION SECUREMENTS**

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
  - .1 Maximum VOC limit 30 g/L to GSES GS-36 and in accordance with Section 01 35 21 - LEED Requirements.
- .3 Tie wire: 1.5 mm diameter stainless steel.
- .4 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.
- .5 Facing: 25 mm galvanized steel hexagonal wire mesh on one face of insulation with expanded metal lath on other face of insulation.
- .6 Fasteners: 2 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

## **2.7 VAPOUR RETARDER LAP ADHESIVE**

- .1 Water based, fire retardant type, compatible with insulation.
  - .1 Maximum VOC limit 30 g/L to GSES GS-36 and in accordance with Section 01 35 21 - LEED Requirements.

## **2.8 INDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with 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 testing of equipment and adjacent piping systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

### **3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards
  - .1 Hot equipment: To TIAC code 1503-H.
  - .2 Cold equipment: to TIAC code 1503-C.
- .2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.
- .3 Provide vapour retarder as recommended by manufacturer.

- .4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.
- .5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports outside vapour retarder jacket.
- .7 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 EQUIPMENT INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 Breechings, engine exhausts and mufflers:
  - .1 TIAC code A-2 with 25 mm air gap, mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.
- .3 Finishes:
  - .1 Equipment in mechanical rooms: TIAC code CEF/1 with aluminum jacket.

### **3.5 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .2 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .3 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .4 ASTM C547, Mineral Fiber Pipe Insulation.
  - .5 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
  - .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

**1.2 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.

**1.3 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.
- .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.

**1.4 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, member of TIAC.
- .3 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**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 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.

## **Part 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

### **2.2 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC-S102.
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### **2.3 INSULATION**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
  - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C547.
- .5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C547.

### **2.4 INSULATION SECUREMENT**

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.

- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

## **2.5 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

## **2.6 VAPOUR RETARDER LAP ADHESIVE**

- .1 Water based, fire retardant type, compatible with insulation.

## **2.7 INDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.

## **2.8 JACKETS**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: compatible with insulation.

## **Part 3 Execution**

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

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

### **3.2 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

### **3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

**3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: at expansion joints, valves, primary flow measuring elements, flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: high temperature fabric.

**3.5 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: Tape at 300 mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
  - .1 Securements: Tape at 300 mm on centre.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: C-2 with vapour retarder jacket.
  - .1 Insulation securements: SS bands at 300 mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 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<br>degrees C | TIAC<br>code | Pipe sizes<br>(NPS) and<br>insulation<br>thickness<br>(mm) |            |            |        |    |
|--|-------------------|--------------|--|------------|------------|--------|----|
|  |                   |              | to 1   | 1 1/4 to 2 | 2 1/2 to 4 | 5 to 6 | 8  |
| Glycol<br>Heating                          | 60 - 94           | A-1          | 25   | 38         | 38         | 38     | 38 |
| Domestic<br>HWS and<br>Recirc              |                   | A-1          | 25   | 25         | 38         | 38     | 38 |
| Domestic<br>CWS with<br>vapour<br>retarder |                   | C-2          | 25   | 25         | 25         | 25     | 25 |
| RWL and<br>RWP                             |                   | C-2          | 25   | 25         | 25         | 25     | 25 |

.6 Finishes:

- .1 Exposed indoors: canvas jacket.
- .2 Exposed in mechanical rooms: canvas jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.
- .6 Installation: to appropriate TIAC code CRF/1 through CPF/5.

**3.6 FIELD QUALITY CONTROL**

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

**3.7 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 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

**1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

**1.3 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)**

- .1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.
- .2 When systems are operational, perform following tests:
  - .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
  - .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
    - .1 Pump operation.
    - .2 Boiler operation.
    - .3 Pressure bypass open/closed.
    - .4 Control pressure failure.
    - .5 Maximum heating demand.
    - .6 Maximum cooling demand.
    - .7 Boiler failure.
    - .8 Outdoor reset. Re-check output supply temperature at 100% and 50% reset, maximum water temperature.

**1.4 HYDRONIC SYSTEM CAPACITY TEST**

- .1 Perform hydronic system capacity tests after:
  - .1 TAB has been completed
  - .2 Verification of operating, limit, safety controls.
  - .3 Verification of primary and secondary pump flow rates.
  - .4 Verification of accuracy of temperature and pressure sensors and gauges.
- .2 Calculate system capacity at test conditions.
- .3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.
- .4 When capacity test is completed, return controls and equipment status to normal operating conditions.

- .5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.
- .6 Heating system capacity test:
  - .1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:
    - .1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures to ensure that coils are not subjected to freezing conditions) or
    - .2 Reducing space temperature by turning of heating system for sufficient period of time before starting testing.
  - .2 Test procedures:
    - .1 Open fully heating coil and radiation control valves.
    - .2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.
    - .3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

## **1.5 GLYCOL SYSTEMS**

- .1 Test to prove concentration will prevent freezing to minus 40 degrees C Test inhibitor strength and include in procedural report. Refer to ASTM E202.

## **1.6 POTABLE WATER SYSTEMS**

- .1 When cleaning is completed and system filled:
  - .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
  - .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
  - .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

## **1.7 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS**

- .1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.
- .2 Verification of controls, detection devices, alarm devices is specified Division 26.
- .3 Verify operation of interlocks between HVAC systems and fire alarm systems.

## **1.8 SANITARY AND STORM DRAINAGE SYSTEMS**

- .1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.
- .2 Ensure that traps are fully and permanently primed.

- .3 Ensure that fixtures are properly anchored, connected to system.
- .4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.
- .5 Cleanouts: refer to Section 22 42 00 - Plumbing Fixtures.

**1.9 REPORTS**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.

**1.10 TRAINING**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified herein.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1      American Society for Testing and Materials International (ASTM)
  - .1          ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2      Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1          Material Safety Data Sheets (MSDS).

**1.2                ACTION AND INFORMATIONAL 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.
- .2      Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1          Instructions: submit manufacturer's installation instructions.
    - .1              Departmental Representative will make available 1 copy of systems supplier's installation instructions.

**1.3                QUALITY ASSURANCE**

- .1      Health and Safety:
  - .1          Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**1.4                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.

**Part 2            Products**

**2.1                SUSTAINABLE REQUIREMENTS**

- .1      Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

**2.2                CLEANING SOLUTIONS**

- .1      Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2      Sodium carbonate: 0.40 kg per 100 L water in system.
- .3      Low-foaming detergent: 0.01 kg per 100 L water in system.

**Part 3 Execution****3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 CLEANING HYDRONIC SYSTEMS**

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
  - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
- .4 Cleaning procedures:
  - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
    - .1 Cleaning procedures, flow rates, elapsed time.
    - .2 Chemicals and concentrations used.
    - .3 Inhibitors and concentrations.
    - .4 Specific requirements for completion of work.
    - .5 Special precautions for protecting piping system materials and components.
    - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
  - .1 Systems: free from construction debris, dirt and other foreign material.
  - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
  - .3 Strainers: clean prior to initial fill.
  - .4 Install temporary filters on pumps not equipped with permanent filters.
  - .5 Install pressure gauges on strainers to detect plugging.
- .6 Report on Completion of Cleaning:
  - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .7 Hydronic Systems:
  - .1 Fill system with water, ensure air is vented from system.
  - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
  - .3 Use water metre to record volume of water in system to +/- 0.5%.

- .4 Add chemicals under direct supervision of chemical treatment supplier.
- .5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
- .6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
- .7 Add chemical solution to system.
- .8 Establish circulation, raise temperature slowly to maximum design. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 hours at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).
- .8 Glycol Systems:
  - .1 In addition to procedures specified above perform specified procedures.
  - .2 Test to prove concentration will prevent freezing to minus 40 degrees C. Test inhibitor strength and include in procedural report. Refer to ASTM E202.

### **3.3      START-UP OF HYDRONIC SYSTEMS**

- .1 After cleaning is completed and system is filled:
  - .1 Establish circulation and expansion tank level, set pressure controls.
  - .2 Ensure air is removed.
  - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
  - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
  - .5 Clean out strainers repeatedly until system is clean.
  - .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.
  - .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
  - .8 Repeat with water at design temperature.
  - .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
  - .10 Bring system up to design temperature and pressure slowly over a 48 hour period.
  - .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .12 Adjust pipe supports, hangers, springs as necessary.
  - .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.



- .14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.
- .15 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .16 Check operation of drain valves.
- .17 Adjust valve stem packings as systems settle down.
- .18 Fully open balancing valves (except those that are factory-set).
- .19 Check operation of over-temperature protection devices on circulating pumps.
- .20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

### **3.4      FIELD QUALITY CONTROL**

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

### **3.5      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 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 electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**1.2 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect electric and electronic control systems from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products****2.1 THERMOSTAT (LINE VOLTAGE-HEATING)**

- .1 Line voltage, wall-mounted thermostat, for heating with:
  - .1 Full load rating: 16 A at 120 V.
  - .2 Temperature setting range: 5 degrees C to 30 degrees C.
  - .3 Thermometer range: 5 degrees C to 30 degrees C.
  - .4 Markings in 5 degree increments.
  - .5 Differential temperature fixed at 1.1 degrees C.

**2.2 THERMOSTAT (LOW VOLTAGE)**

- .1 Low voltage wall thermostat:
  - .1 For use on 24 V circuit at 1.5 A capacity.
  - .2 With heat anticipator adjustable 0.1 to 1.2 A.
  - .3 Temperature setting range: 10 degrees C to 25 degrees C.
  - .4 Without sub-base.

**2.3 THERMOSTAT (REMOTE BULB)**

- .1 Line voltage remote bulb type thermostat with:
  - .1 30 A rating on 120 V.
  - .2 3 m copper capillary tube nylon coated.
  - .3 Moisture and dust-resistant enclosure.

**2.4 LOW LIMIT TEMPERATURE ALARM**

- .1 Low limit temperature alarm with:
  - .1 Rating: 10.2 A at 120 V.
  - .2 Sensing bulb and 1.5 m long capillary tube.
  - .3 Switching action: manual.
  - .4 Temperature setting range: 0 degrees C to 15 degrees C.

**2.5 HIGH LIMIT TEMPERATURE ALARM**

- .1 High limit temperature alarm with:
  - .1 Rating: 10 A at 120 V.
  - .2 Positive lock-out.
  - .3 Manual reset only after 14 degrees C drop-in temperature.
  - .4 Cutout setting: 50 degrees C.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems 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.
- .2 Allow 3 hours for systems demonstration.

**3.2 INSTALLATION**

- .1 Install control devices.
- .2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.
- .3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

**3.3 GLYCOL HEATING SYSTEM CONTROL**

- .1 The heating system is a primary/secondary heating system. The boiler plant consists of two boilers where one boiler will act as standby. Boilers will be cycled annually for even wear. The boilers will operate on a lead-lag basis. If one of the lead/lag boilers fail the standby boiler will start automatically and an alarm will be generated.
- .2 The hot water heating pump with the lowest runtime will automatically start when the outside air temperature falls below the system enable setpoint of 18 °C (adjustable). When the outside air temperature rises above this setpoint, the hot water heating pump will turn off. When enabled, the lead pump will start and run continuously. If for any reason its status does not match its commanded value an alarm will be generated. The lag pump will start if the lead pump is in alarm. Whenever the system is commanded off, the lead hot water heating pump will run for a period of time to dissipate the heat in the system. The hot water heating pump will be controlled by the variable speed drive associated with that pump to ease balancing. A pressure bypass valve will be used to ensure minimum flow at times of no demand.
- .3 The boiler control sequence will begin when either one of the hot water heating pumps has a status of on. The hot water heating boiler with the lowest runtime will operate as lead. When a boiler enable command is sent, the lead boiler and the associated constant flow circulator will turn on and the boiler will modulate the burner through its multiple stages of firing to maintain the hot water supply temperature at a setpoint that is reset inversely to the outside air temperature. The lag boiler and associated circulator will also be enabled if system load requires the second boiler. The boilers have integral controllers to modulate the burner to maintain setpoint once signaled to run. The boilers safeties circuit will be monitored and the system will report a general alarm condition if a safety is tripped. A manual reset of the boiler safety will be required before the boiler can be restarted.
- .4 The hot water supply temperature setpoint will be based on the following outdoor air temperature schedule; OAT = -20 °C then HWST = 87.8 °C, OAT = 10 °C then 71.1 °C. Monitor the hot water return temperature and ensure it does not drop below 60 °C by raising the hot water supply temperature accordingly.
- .5 Provide a pressure differential sensor on the heating system that will shut down the main distribution pumps, boiler circulator pumps and boilers should a significant loss of pressure occur in the system suggestive of a catastrophic leak within the heating distribution system.

**3.4 VENTILATION SYSTEM CONTROL**

- .1 The make-up unit MUA-1 is a 100% outdoor air unit consisting of inlet damper, summer pre-filter section, glycol heating coil, winter pre-filter, final filter and blower/motor section.
- .2 Provide connection of the following control points and the necessary programming within the Building Management System (BMS):
  1. Stop/Start/Status (Supply fan)
  2. Pre-filter and final filter alarm indication
  3. Discharge temperature adjustment
  4. Low temperature alarm
- .3 The make-up unit shall operate as scheduled by the time clock. On unit start-up the inlet damper shall open. The unit will not start until the damper end switch has been proven open. On unit failure the inlet damper will close.
- .4 The glycol heating coil control valve shall modulate as required to maintain a 18 °C discharge air temperature (adjustable).
- .6 The unit shall shut-down in a fire alarm condition. Refer to the electrical specifications.
- .7 A low limit supply air temperature sensor shall shut-down the make-up air unit and close the inlet damper should the discharge air temperature drop below 10 °C. Provide a hard wired interlock between the low limit temperature sensor and air system. Provide a manual reset.
- .8 Interlock basement general exhaust fan EF-1, and janitor rooms exhaust fans EF-B to make-up air unit MUA-1 operation.

**3.5 ELECTRICAL ROOM COOLING SYSTEM CONTROL**

- .1 A reverse-acting thermostat will activate the transfer air fan when the space temperature reaches 27°C (adjustable). The fan will stop once setpoint is satisfied.

**3.6 DOMESTIC HOT WATER HEATING SYSTEM CONTROL**

- .1 The domestic hot water heaters will have integral controls to deliver hot water at 60 °C.
- .2 The domestic hot water recirculation pump shall operate as scheduled by the time clock. Provide pump failure alarms on the BMS should the pump fail.

**3.7 UNIT HEATER SYSTEM CONTROL**

- .1 Electric line-voltage thermostats complete with guards will cycle unit motor and 2-way 2-position control valves to maintain space temperature setpoint.

**3.8 FORCE FLOW HEATER SYSTEM CONTROL**

- .1 Electric line-voltage thermostats complete with guards will cycle unit motor and 2-way 2-position control valves to maintain space temperature setpoint.

**3.9 RADIATION CABINET HEATING SYSTEM CONTROL**

- .1 Electric low-voltage programmable thermostats will modulate 2-way 2-position control valves to maintain space temperature setpoint.

**3.10 WEEPING TILE AND SANITARY SUMP PUMP SYSTEMS CONTROL**

- .1 The duplex sump pumps will come complete with integral floats and control panel. The pumps will operate as primary and secondary where both pumps will operate as required to satisfy demand. Cycle the operation of the lead pump every 200 hours to provide even wear on both pumps.
- .2 Indicate the following points on the BMS and alarm panel complete with required initiating equipment for the following conditions:
  - 1. Pump status
  - 2. Pump failure
  - 3. High level alarm
  - 4. Low level alarm

**3.11 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.5, Pipe Flanges and Flanged Fittings.
  - .2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
  - .4 ASME B18.2.1, Square and Hex Bolts and Screws Inch Series.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  - .3 ASTM B75M, Standard Specification for Seamless Copper Tube [Metric].
  - .4 ASTM B837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- .4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
  - .1 CAN/CSA B149.1, Natural Gas and Propane Installation Code Handbook.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
  - .2 Indicate on manufacturer's catalogue literature following: valves.
  - .3 Submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.
- .4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .6 Instructions: submit manufacturer's installation instructions.
- .7 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.3 QUALITY ASSURANCE**

- .1 Pre-Installation Meeting:
  - .1 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).
    - .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.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .4 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

### **2.2 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
  - .1 NPS 1/2 to 2, screwed.
  - .2 NPS 2 1/2 and over, plain end.
- .2 Copper tube: to ASTM B837.

### **2.3 JOINTING MATERIAL**

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: nonmetallic flat.
- .4 Brazing: to ASTM B837.



## **2.4 FITTINGS**

- .1 Steel pipe fittings, screwed, flanged or welded:
  - .1 Malleable iron: screwed, banded, Class 150.
  - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
  - .3 Welding: butt-welding fittings.
  - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
  - .5 Bolts and nuts: to ASME B18.2.1.
  - .6 Nipples: schedule 40, to ASTM A53/A53M.
- .2 Copper pipe fittings, screwed, flanged or soldered:
  - .1 Cast copper fittings: to ASME B16.18.
  - .2 Wrought copper fittings: to ASME B16.22.

## **2.5 VALVES**

- .1 Provincial Code approved, lubricated plug type.

## **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 PIPING**

- .1 Install in accordance with Section 23 05 05 - Installation of Pipework, applicable Provincial/Territorial Codes, CAN/CSA B149.1, supplemented as specified.
- .2 Install drip points:
  - .1 At low points in piping system.
  - .2 At connections to equipment.

### **3.3 VALVES**

- .1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

### **3.4 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

- .2 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
  - .2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
  - .3 Schedule site visits to review work at stages listed:
    - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
    - .2 Twice during progress of work at 25% and 60% complete.
    - .3 Upon completion of work, after cleaning is carried out.
- .3 Obtain reports within 3 days of review and submit immediately to Departmental Representative.
- .4 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.
- .5 Performance Verification:
  - .1 Refer to Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

### **3.5 ADJUSTING**

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1.
- .2 Pre-Start-Up Inspections:
  - .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
  - .2 Check gas trains, entire installation is approved by authority having jurisdiction.

**3.6 CLEANING**

- .1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems, CAN/CSA B149.1, supplemented as specified.
- .2 Perform cleaning operations in accordance with manufacturer's recommendations.
- .3 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 American National Standards Institute (ANSI)/American Welding Society (AWS)
  - .1 ANSI/AWS A5.8/A5.8M, AMD1 Specification Filler Metals for Brazing and Braze Welding.
- .2 ASME
  - .1 ANSI/ASME B16.4, Gray-Iron Threaded Fittings Classes 125 and 250.
  - .2 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings Classes 125 and 250.
  - .3 ANSI B16.18, Cast Copper Alloy, Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.22, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.
- .3 ASTM International
  - .1 ASTM B32, Standard Specification for Solder Metal.
  - .2 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
  - .3 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .4 ASTM B88M, Standard Specification for Seamless Copper Water Tube - Metric.
  - .5 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturers Standardization Society (MSS)
  - .1 MSS SP67, Butterfly Valves.
  - .2 MSS SP70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS SP71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS SP80, Bronze Gate, Globe, Angle and Check Valves.
  - .5 MSS SP85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

**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 hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

- .3 Shop Drawings:
  - .1 Indicate on manufacturer's catalogue literature the following: valves.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

### **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 hydronic systems for incorporation into manual.
- .3 Submit 3 copies of operation and maintenance manual.

### **1.4 MAINTENANCE MATERIALS SUBMITTALS**

- .1 Extra Materials:
  - .1 Furnish following spare parts:
    - .1 Valve seats: one for every ten valves, each size. Minimum one.
    - .2 Discs: one for every ten valves, each size. Minimum one.
    - .3 Stem packing: one for every ten valves, each size. Minimum one.
    - .4 Valve handles: two of each size.
    - .5 Gaskets for flanges: one for every ten flanges.

### **1.5 QUALITY ASSURANCE**

- .1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial /Territorial regulations.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements & 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 hydronic systems from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 FITTINGS**

- .1 Cast bronze threaded fittings: to ANSI/ASME B16.15.
- .2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.

- .3 Cast iron threaded fittings: to ANSI/ASME B16.4.
- .4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

## **2.2 FLANGES**

- .1 Brass or bronze: threaded.
- .2 Cast iron: threaded.
- .3 Orifice flanges: slip-on, raised face, 2100 kPa.

## **2.3 JOINTS**

- .1 Solder, tin-antimony, 95:5: to ASTM B32.
- .2 Silver solder BCUP: to ANSI/AWS A5.8.
- .3 Brazing: as indicated.

## **2.4 VALVES**

- .1 Connections:
  - .1 NPS 2 and smaller: ends for soldering.
  - .2 NPS 2 1/2 and larger: flanged ends.
- .2 Gate Valves: application: isolating equipment, control valves, pipelines:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2 1/2 and over:
    - .1 Mechanical Rooms: rising stem, split wedge disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
    - .2 Elsewhere: Non-rising stem, solid wedge disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .3 Globe valves: application: throttling, flow control, emergency bypass:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2 1/2 and over:
    - .1 With bronze disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .4 Balancing, for TAB:
  - .1 NPS 2 and under:

- .1 Mechanical rooms: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 Elsewhere: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
- .5 Drain valves: gate, Class 125 as specified Section 23 05 23.01 - Valves - Bronze.
- .6 Swing check valves:
  - .1 NPS 2 and under:
    - .1 Class 125, swing, with bronze disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 NPS 2 1/2 and over:
      - .1 Flanged ends: as specified Section 23 05 23.02 - Valves - Cast Iron.
- .7 Silent check valves:
  - .1 NPS 2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2 1/2 and over:
    - .1 Flanged ends: as specified Section 23 05 23.02 - Valves - Cast Iron.
- .8 Ball valves:
  - .1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.
- .9 Lubricated Plug Valves:
  - .1 NPS 2 and under: as specified Section 23 05 23.02 - Valves - Cast Iron.
  - .2 NPS 2 1/2 and over: as specified Section 23 05 23.02 - Valves - Cast Iron.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic systems 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 MANUFACTURER'S INSTRUCTIONS**

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

**3.3 PIPING INSTALLATION**

- .1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.
- .3 Slope piping in direction of drainage and for positive venting.
- .4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .6 Assemble piping using fittings manufactured to ANSI standards.

**3.4 VALVE INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Install ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .3 Install globe valves for balancing and in by-pass around control valves as indicated.
- .4 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .5 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Mechanical Equipment Rooms.
- .6 Install ball valves for glycol service.

**3.5 CIRCUIT BALANCING VALVES**

- .1 Install flow measuring stations and flow balancing valves as indicated.
- .2 Remove handwheel after installation and TAB is complete.

**3.6 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 & 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 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .2 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
  - .2 ASME B16.3, Malleable Iron Threaded Fittings: Classes 150 and 300.
  - .3 ASME B16.5, Pipe Flanges and Flanged Fittings: NPS through NPS 24 Metric/Inch Standard.
  - .4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.
  - .5 ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
- .3 ASTM International
  - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
  - .3 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .4 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .5 ASTM E202, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .4 CSA International
  - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
  - .2 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)
  - .1 MSS-SP-67, Butterfly Valves.
  - .2 MSS-SP-70, Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71, Gray Iron Swing Check Valves Flanged and Threaded Ends.
  - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
  - .5 MSS-SP-85, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

**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 hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 Components and accessories.

### **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 hydronic systems for incorporation into manual.
  - .1 Include special servicing requirements.

### **1.4 EXTRA STOCK MATERIALS**

- .1 Supply spare parts as follows:
  - .1 Valve seats: 1 minimum for every ten valves, each size. Minimum one.
  - .2 Discs: 1 minimum for every ten valves, each size. Minimum one.
  - .3 Stem packing: 1 minimum for every ten valves, each size. Minimum one.
  - .4 Valve handles: 2 minimum of each size.
  - .5 Gaskets for flanges: 1 minimum for every ten flanges.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 hydronic systems from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
  - .1 To NPS 6: Schedule 40.

### **2.2 PIPE JOINTS**

- .1 NPS 2 and under: screwed fittings with PTFE tape.

- .2 NPS 2-1/2 and over: welding fittings and flanges to CSA W48.
- .3 Flanges: raised face, weld neck to ANSI/AWWA C111/ A21.11.
- .4 Orifice flanges: slip-on raised face, 2100 kPa.
- .5 Flange gaskets: to ANSI/AWWA C111/ A21.11.
- .6 Pipe thread: taper.
- .7 Bolts and nuts: to ASME B18.2.2.

## **2.3 FITTINGS**

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
  - .1 Cast iron: to ASME B16.1, Class 125.
  - .2 Steel: to ASME B16.5.
- .3 Butt-welding fittings: steel, to ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M.

## **2.4 VALVES**

- .1 Connections:
  - .1 NPS 2 and smaller: screwed ends.
  - .2 NPS 2-1/2 and larger: flanged ends.
- .2 Gate valves: to MSS-SP-70 application: isolating equipment, control valves, pipelines:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: Class 125, rising stem, split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: Class 125, non- rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2-1/2 and over:
    - .1 Mechanical Rooms: rising stem, split wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
      - .1 Operators: manual.
    - .2 Elsewhere: non-rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .3 Globe valves: to MSS-SP- 80 application: throttling, flow control, emergency bypass:
  - .1 NPS 2 and under:
    - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with bronze disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2-1/2 and over:

- .1 With bronze disc, lead free bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron.
- .4 Balancing, for TAB:
  - .1 Sizes: calibrated balancing valves, as specified this section.
  - .2 NPS 2 and under:
    - .1 Mechanical Rooms: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
    - .2 Elsewhere: globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.
- .5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .6 Swing check valves: to MSS-SP-71.
  - .1 NPS 2 and under:
    - .1 Class 125, swing, with bronze disc, as specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS 2-1/2 and over:
    - .1 Flanged ends: as specified Section 23 05 23.02 - Valves - Cast Iron.
- .7 Ball valves:
  - .1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.
- .8 Lubricated Plug Valves
  - .1 All Sizes:
    - .1 As specified Section 23 05 23.02 - Valves - Cast Iron.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic systems 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 PIPING INSTALLATION**

- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

#### **3.3 CIRCUIT BALANCING VALVES**

- .1 Install flow measuring stations and flow balancing valves as indicated.

- .2 Remove handwheel after installation and when TAB is complete.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

**3.4 CLEANING, FLUSHING AND START-UP**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

**3.5 TESTING**

- .1 Test system in accordance with Section 21 05 01 - Common Work Results for Mechanical.
- .2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

**3.6 BALANCING**

- .1 Balance water systems to within plus or minus 5 % of design output.
- .2 In accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

**3.7 GLYCOL CHARGING**

- .1 Include mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.

**3.8 PERFORMANCE VERIFICATION**

- .1 In accordance with Section 23 08 01 - Performance Verification Mechanical Piping Systems.

**3.9 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.

**3.10 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASME
  - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII.
- .2 ASTM International
  - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A278/A278M, Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
  - .3 ASTM A516/A516M, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  - .4 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 CSA Group
  - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

**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 expansion tanks, air vents, separators, valves, and strainers 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 hydronic specialties for incorporation into manual.
- .3 Submit two copies of operation and maintenance 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect hydronic specialties from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2            Products**

**2.1                DIAPHRAGM TYPE EXPANSION TANK**

- .1      Vertical steel pressurized diaphragm type expansion tank.
- .2      Capacity: as indicated.
- .3      Size: as indicated.
- .4      Diaphragm sealed in EPDM suitable for 115 degrees C operating temperature.
- .5      Working pressure: 860 kPa with ASME stamp and certification.
- .6      Air precharged to 84 kPa (initial fill pressure of system).
- .7      Base mount for vertical installation.
- .8      Supports: provide supports with hold down bolts and installation templates.

**2.2                AUTOMATIC AIR VENT**

- .1      Standard float vent: brass body and NPS 1/8 connection and rated at 310 kPa working pressure.
- .2      Float: solid material suitable for 115 degrees C working temperature.

**2.3                AIR SEPARATOR - BOILER MOUNTED**

- .1      Complete with dip tube.
- .2      Working pressure: 860 kPa.

**2.4                AIR SEPARATOR - EXPANSION TANK FITTING**

- .1      Complete with adjustable vent tube and built-in manual vent valve.
- .2      Working pressure: 860 kPa.

**2.5                AIR SEPARATOR - IN-LINE**

- .1      Working pressure: 860 kPa.
- .2      Size: NPS 1 1/2.

**2.6                COMBINATION SEPARATORS/STRAINERS**

- .1      Steel, tested and stamped in accordance with ASME BPVC, for 860 kPa operating pressure, with galvanized steel integral strainer with 5 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

**2.7                COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE**

- .1      Adjustable pressure setting: 206 kPa relief, 55 to 172 kPa reducing.
- .2      Low inlet pressure check valve.
- .3      Removable strainer.



**2.8 PIPE LINE STRAINER**

- .1 NPS 1/2 to 2: bronze body to ASTM B62, screwed connections, Y pattern.
- .2 NPS 2 1/2 to 12: cast steel body to ASTM A278/A278M, Class 30, flanged connections.
- .3 NPS 2 to 12: T type with ductile iron body to ASTM A536, grooved ends.
- .4 Blowdown connection: NPS 1.
- .5 Screen: stainless steel with 1.19 mm perforations.
- .6 Working pressure: 860 kPa.

**2.9 SUCTION DIFFUSER**

- .1 Body: cast iron with flanged connections.
- .2 Strainer: with built-in, disposable 1.19 mm mesh, low pressure drop screen and NPS 1 blowdown connection.
- .3 Permanent magnet particle trap.
- .4 Full length straightening vanes.
- .5 Pressure gauge tapping.
- .6 Adjustable support leg.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic specialties installation in accordance with manufacturer's written instructions.
  - .1 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 APPLICATION**

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

**3.3 GENERAL**

- .1 Run drain lines to terminate above nearest drain.
- .2 Maintain adequate clearance to permit service and maintenance.

- .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Check shop drawings for conformance of tapping for ancillaries and for equipment operating weights.

**3.4 STRAINERS**

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.
- .4 Install ahead of each automatic control valve larger than NPS 1 and as indicated.

**3.5 AIR VENTS**

- .1 Install at high points of systems.
- .2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

**3.6 EXPANSION TANKS**

- .1 Adjust expansion tank pressure as indicated.
- .2 Install lockshield type valve at inlet to tank.

**3.7 PRESSURE SAFETY RELIEF VALVES**

- .1 Run discharge pipe to terminate above nearest drain.

**3.8 SUCTION DIFFUSERS**

- .1 Install on inlet to pumps having suction size greater than 50.

**3.9 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE/IES Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 CSA Group
  - .1 CAN/CSA-B214, Installation Code for Hydronic Heating Systems.
- .3 Electrical Equipment Manufacturers Association of Canada (EEMAC)
- .4 National Electrical Manufacturers' Association (NEMA)
  - .1 NEMA MG 1, Motors and Generators.

**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 pump, circulator, and equipment and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.
- .3 Shop Drawings:
  - .1 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for hydronic pumps for incorporation into manual.
- .3 Submit two copies of operation and maintenance 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect hydronic pumps from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Size and select components to: CAN/CSA-B214.

**2.2 VERTICAL IN-LINE CIRCULATORS**

- .1 Volute: cast iron radially split, with tapped openings for venting, draining and gauge connections, with screwed or flanged suction and discharge connections.
- .2 Impeller: corrosion resistant steel.
- .3 Shaft: alloy steel with bronze sleeve bearing, integral thrust collar.
- .4 Seal assembly: mechanical for service to 135 degrees C.
- .5 Coupling: flexible self-aligning.
- .6 Motor: to NEMA MG 1 resilient mounted, drip proof, sleeve bearing.
- .7 Capacity: as indicated.
- .8 Design pressure: 1200 kPa.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic pump 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 APPLICATION**

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

**3.3 INSTALLATION**

- .1 Install hydronic pumps to: CAN/CSA-B214.
- .2 In line circulators: install as indicated by flow arrows.
  - .1 Support at inlet and outlet flanges or unions.
  - .2 Install with bearing lubrication points accessible.
- .3 Ensure that pump body does not support piping or equipment.

- .1 Provide stanchions or hangers for this purpose.
- .2 Refer to manufacturer's installation instructions for details.
- .4 Pipe drain tapping to floor drain.
- .5 Install volute venting pet cock in accessible location.
- .6 Check rotation prior to start-up.
- .7 Install pressure gauge test cocks.

### **3.4 START-UP**

- .1 General:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements; supplemented as specified herein.
  - .2 In accordance with manufacturer's recommendations.
- .2 Procedures:
  - .1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.
  - .2 After starting pump, check for proper, safe operation.
  - .3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
  - .4 Check base for free-floating, no obstructions under base.
  - .5 Run-in pumps for 12 continuous hours minimum.
  - .6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
  - .7 Eliminate air from scroll casing.
  - .8 Adjust water flow rate through water-cooled bearings.
  - .9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.
  - .10 Adjust alignment of piping and conduit to ensure true flexibility.
  - .11 Eliminate cavitation, flashing and air entrainment.
  - .12 Adjust pump shaft seals, stuffing boxes, glands.
  - .13 Measure pressure drop across strainer when clean and with flow rates as finally set.
  - .14 Replace seals if pump used to degrease system or if pump used for temporary heat.
  - .15 Verify lubricating oil levels.

### **3.5 PERFORMANCE VERIFICATION (PV)**

- .1 General:
  - .1 Verify performance in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified herein.
- .2 Verify that manufacturer's performance curves are accurate.

- .3 Ensure valves on pump suction and discharge provide tight shut-off.
- .4 Net Positive Suction Head (NPSH):
  - .1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.
  - .2 Measure using procedures prescribed in Section 01 91 13 - General Commissioning (Cx) Requirements.
  - .3 Where procedures do not exist, discontinue PV, report to Departmental Representative and await instructions.
- .5 Multiple Pump Installations - Series and Parallel:
  - .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.
- .6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.
- .7 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements reports supplemented as specified herein. Reports to include:
  - .1 Record of points of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
  - .2 Use Report Forms specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.
  - .3 Pump performance curves (family of curves).

### **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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASME
  - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII.
- .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 HVAC water treatment systems and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**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 HVAC water treatment systems for incorporation into manual.
- .3 Include following:
  - .1 Log sheets as recommended by manufacturer and Departmental Representative.

**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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect HVAC water treatment systems from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MANUFACTURER**

- .1 Equipment, chemicals, and service provided by one supplier.

**2.2 POT FEEDER**

- .1 Welded steel, pressure rating 1200 kPa. Temperature rating: 90 degrees C.

**2.3 CHEMICAL FEED PIPING**

- .1 Resistant to chemicals employed. Pressure rating: 1200 kPa.

**2.4 CHEMICAL FEED PUMPS**

- .1 Top-mounted electronic metering diaphragm type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with pressure relief valve, check valve, foot valve, injection fitting.

**2.5 SHIPPING/FEEDING CHEMICAL CONTAINERS**

- .1 High density moulded polyethylene, with liquid level graduations, cover.

**2.6 CONDUCTIVITY CONTROLLER**

- .1 Fully transistorized, suitable for wall or flush panel mounting, linear over full measuring range of 0-5000 microhms.
- .2 Insensitive to phase angle shifts, capable of operating on 95-130 Volts without affecting accuracy, power, bleedoff status lights.

**2.7 CONDUCTIVITY PROBES**

- .1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

**2.8 WATER TREATMENT FOR HYDRONIC SYSTEMS**

- .1 Glycol system: pot feeder, 19 L.
- .2 Micron filter for each pot feeder:
  - .1 Capacity 2% of pump recirculating rate at operating pressure.
  - .2 Six (6) sets of filter cartridges for each type, size of micron filter.

**2.9 CHEMICALS**

- .1 Provide 1 years supply.

**2.10 TEST EQUIPMENT**

- .1 Provide one set of test equipment for each system to verify performance.
- .2 Complete with carrying case, reagents for chemicals, specialized or supplementary equipment.



**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC water treatment systems 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 MANUFACTURER'S INSTRUCTIONS**

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

**3.3 INSTALLATION**

- .1 Install HVAC water treatment systems in accordance with ASME Boiler and Pressure Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

**3.4 CHEMICAL FEED PIPING**

- .1 Install crosses at changes in direction. Install plugs in unused connections.

**3.5 CLEANING OF MECHANICAL SYSTEM**

- .1 Provide copy of recommended cleaning procedures and chemicals for approval by Departmental Representative.
- .2 Flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Use chemicals to inhibit corrosion of various system materials that are safe to handle and use.
- .3 Examine and clean filters and screens, periodically during circulation of cleaning solution, and monitor changes in pressure drop across equipment.
- .4 Drain and flush system until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .5 Disposal of cleaning solutions approved by authority having jurisdiction.

**3.6 WATER TREATMENT SERVICES**

- .1 Provide water treatment monitoring and consulting services for period of 1 year after system start-up. Service to include:
  - .1 Initial water analysis and treatment recommendations.
  - .2 System start-up assistance.
  - .3 Operating staff training.
  - .4 Visit plant every 5 days during period of operation and as required until system stabilizes, and advise on treatment system performance.
  - .5 Provide necessary recording charts and log sheets for 1 year operation.
  - .6 Provide necessary laboratory and technical assistance.
  - .7 Provide clear, concise, written instructions and advice to operating staff.

**3.7 FIELD QUALITY CONTROL**

- .1 Start-up:
  - .1 Start up water treatment systems in accordance with manufacturer's instructions.
- .2 Commissioning:
  - .1 Commissioning Agency: to be installing water treatment sub-contractor.
  - .2 Timing:
    - .1 After start-up deficiencies rectified.
    - .2 After start-up and before TAB of connected systems.
  - .3 Pre-commissioning Inspections: verify:
    - .1 Presence of test equipment, reagents, chemicals, details of specific tests performed, and operating instructions.
    - .2 Suitability of log book.
    - .3 Currency and accuracy of initial water analysis.
    - .4 Required quality of treated water.
  - .4 Commissioning procedures - applicable to Water Treatment Systems:
    - .1 Establish, adjust as necessary and record automatic controls and chemical feed rates.
    - .2 Monitor performance continuously during commissioning of connected systems and until acceptance of project.
    - .3 Establish test intervals, regeneration intervals.
    - .4 Record on approved report forms commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
    - .5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.

- .6 Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).
- .7 Advise Departmental Representative in writing on matters regarding installed water treatment systems.
- .5 Commissioning procedures - Closed Circuit Hydronic Systems:
  - .1 Analyze water in system.
  - .2 Based upon an assumed rate of loss approved by Departmental Representative, establish rate of chemical feed.
  - .3 Record types, quantities of chemicals applied.
- .6 Training:
  - .1 Commission systems, perform tests in presence of, and using assistance of, assigned O M personnel.
- .7 Certificates:
  - .1 Upon completion, furnish certificates confirming satisfactory installation and performance.
- .8 Commissioning Reports:
  - .1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, other data required by Departmental Representative.
- .9 Commissioning activities during Warranty Period:
  - .1 Check out water treatment systems on regular basis and submit written report to Departmental Representative.

### **3.8 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
  - .1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
  - .3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS)
  - .1 GS-36, Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
  - .2 SMACNA HVAC Air Duct Leakage Test Manual.
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.

**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 metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test and Evaluation Reports:
  - .1 Certification of Ratings:
    - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 metal ducts from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products****2.1 SEAL CLASSIFICATION**

- .1 Classification as follows:

| Maximum Pressure Pa | SMACNA Seal Class |
|---------------------|-------------------|
| 500                 | C                 |
| 250                 | C                 |
| 125                 | C                 |

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
  - .3 Class C: transverse joints and connections made air tight with sealant. Longitudinal seams unsealed.
  - .4 Unsealed seams and joints.

**2.2 SEALANT**

- .1 Sustainability Characteristics:
  - .1 Adhesives and sealants: in accordance with Section 07 92 00 - Joint Sealants.
  - .2 Adhesives and sealants: VOC limit 30 g/L maximum to GS-36.
- .2 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 short radius with single thickness turning vanes centreline radius: 1.5 times width of duct.
  - .2 Round: smooth radius, centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm: with single thickness turning vanes.
  - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with 45 degrees entry on branch.
  - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
  - .1 As indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
  - .1 Maximum included angles: as for transitions.

## 2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .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.
- .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.
  - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
    - .1 Maximum size duct supported by strap hanger: 500.

- .2 Hanger configuration: to SMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA
- .4 Upper hanger attachments:
  - .1 For steel joist: manufactured joist clamp.
  - .2 For steel beams: manufactured beam clamps:

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.
  - .1 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 GENERAL**

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE & SMACNA as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

**3.3 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA.

**3.4 WATERTIGHT DUCT**

- .1 Provide watertight duct for:
  - .1 Fresh air intake.
  - .2 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams.
  - .1 Weld joints of bottom and side sheets.
  - .2 Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards hoods served.
  - .1 Slope header ducts down toward risers.
- .4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve and discharging to open funnel drain.

**3.5 SEALING AND TAPING**

- .1 Apply sealant in accordance with SMACNA & to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

**3.6 LEAKAGE TESTS**

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Do not install additional ductwork until trial test has been passed.
- .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .7 Complete test before performance insulation or concealment Work.

**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.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

**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 air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate:
    - .1 Flexible connections.
    - .2 Duct access doors.
    - .3 Turning vanes.
    - .4 Instrument test ports.

**1.3 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 materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect air duct accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 GENERAL**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

**2.2 FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
  - .1 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: foam rubber.
- .4 Hardware:
  - .1 Up to 300 x 300 mm: two sash locks.
  - .2 301 to 450 mm: four sash locks complete with safety chain.
  - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
  - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
  - .5 Hold open devices.

## **2.4 TURNING VANES**

- .1 Factory or shop fabricated single thickness without trailing edge, to recommendations of SMACNA and as indicated.

## **2.5 INSTRUMENT TEST**

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

## **2.6 SPIN-IN COLLARS**

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories 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 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:
    - .1 900 x 900 mm for person size entry.
    - .2 300 x 300 mm for servicing entry.
  - .2 Locations:
    - .1 Fire and smoke dampers.
    - .2 Control dampers.
    - .3 Devices requiring maintenance.
    - .4 Required by code.
    - .5 Reheat coils.
    - .6 Elsewhere as indicated.
- .3 Instrument Test Ports:
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .3 Install insulation port extensions as required.
  - .4 Locations:
    - .1 For traverse readings:
      - .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 At inlet and outlet of coils.
      - .3 And as indicated.

- .4 Turning Vanes:
  - .1 Install in accordance with recommendations of SMACNA and as indicated.

**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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

**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 dampers 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 dampers 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect dampers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2 SINGLE BLADE DAMPERS**

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height as indicated.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon end bearings.

- .5 Channel frame of same material as adjacent duct, complete with angle stop.

### **2.3 MULTI-BLADED DAMPERS**

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.
  - .1 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 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.
- .7 Corrections and adjustments conducted by Departmental Representative.

### **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.

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**DAMPERS - BALANCING**  
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**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

**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 dampers 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 dampers 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect dampers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MULTI-LEAF DAMPERS**

- .1 Opposed blade type as indicated.
- .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: to Section 23 09 33 - Electronic Control System for HVAC.



- .6 Performance:
  - .1 Leakage: in closed position less than 2% of rated air flow.
- .7 Insulated aluminum dampers:
  - .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
  - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

## **2.2 BACK DRAFT DAMPERS**

- .1 Automatic gravity operated, single leaf, aluminum construction with nylon bearings, counterweighted.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.
  - .1 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 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

### **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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S112, Standard Test Method of Fire Test of Fire Damper Assemblies.
  - .2 ULC-S505, Standard for Fusible Links for Fire Protection Service.

**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 fire dampers and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate the following:
    - .1 Fire dampers.
    - .2 Operators.
    - .3 Fusible links.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**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 fire for incorporation into manual.

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide:
    - .1 6 fusible links of each type.

**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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect fire dampers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 FIRE DAMPERS**

- .1 Fire dampers: arrangement Type B, listed bear label of ULC, meet requirements of authorities having jurisdiction and NFPA 90A. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
  - .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.
  - .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
- .3 Top hinged: offset single damper, round or square; guillotine type; sized to maintain full duct cross section as indicated.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke damper 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 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Co-ordinate with installer of fire stopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

**3.3 CLEANING**

- .1 Progress Cleaning: 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
  - .1 ANSI/AMCA Standard 99, Standards Handbook.
  - .2 ANSI/AMCA Standard 210/(ANSI/ASHRAE 51), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
  - .4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.
    - .1 MPI #18, Primer, Zinc Rich, Organic.

**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 HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Provide:
    - .1 Fan performance curves showing point of operation, bhp and efficiency.
    - .2 Sound rating data at point of operation.
  - .2 Indicate:
    - .1 Motors, sheaves, bearings, shaft details.
    - .2 Minimum performance achievable as appropriate.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
    - .1 Provide:
      - .1 Matched sets of belts.

**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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect HVAC fans from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
  - .2 Capacity: flow rate, total static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
  - .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
  - .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.
  - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal.

**2.2 FANS GENERAL**

- .1 Motors:
  - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
  - .2 Sizes as indicated.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable motor bases, belt guards, coupling guards fan inlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment, inlet/outlet dampers and vanes and as indicated.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

**2.3 CABINET FANS - GENERAL PURPOSE**

- .1 Fan characteristics and construction: as centrifugal fans.
- .2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, V-belt drive and guard inside casing.
- .3 Fabricate casing of zinc coated or phosphate treated steel of thickness as indicated reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to MPI #18. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 50 mm thick rigid acoustic insulation, pinned and cemented, complete with metal nosings on exposed edges.

**2.4 AXIAL FLOW FANS (TUBE-AXIAL OR VANE-AXIAL)**

- .1 Casings: welded steel with welded motor support, hinged access plates, streamlined inlet cone and discharge bell sections and integral silencer casing.
- .2 Blade material: aluminum. Hub material: aluminum.
- .3 Supports:
  - .1 Floor mounted units: reinforced legs.
  - .2 Ceiling suspended units: support brackets welded to side of casing. Extend grease lubrication facilities to outside of casing.
- .4 Bearings: ball or roller with extension tubes to outside of casing.
- .5 Belt drive:
  - .1 Drive adjustable blades by externally mounted motors through V-belt drive. Provide internal belt fairing, external belt guards and adjustable motor mounts.
  - .2 Adjust blades for varying range of volume and pressure. Hubs to facilitate indexing of blade angle. Provide automatic adjustment stops to avoid overloading motor.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fans 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 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 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.

**END OF SECTION**



**Part 1 General**

**1.1 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 diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following:
    - .1 Capacity.
    - .2 Throw and terminal velocity.
    - .3 Noise criteria.
    - .4 Pressure drop.
    - .5 Neck velocity.

**1.2 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Include:
    - .1 Keys for volume control adjustment.
    - .2 Keys for air flow pattern adjustment.

**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 materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

**2.2 GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames where set into plaster or gypsum board.
  - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: standard.

**2.3 MANUFACTURED UNITS**

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

**2.4 SUPPLY GRILLES AND REGISTERS**

- .1 Type SA: steel, 25 mm border, double deflection with airfoil shape, horizontal face and vertical rear bars. Finish: B1. Model: S-1.

**2.5 RETURN AND EXHAUST GRILLES AND REGISTERS**

- .1 Type RA: steel, 19 mm border, single 0 degrees deflection, horizontal face bars. Finish: B1. Model: E-1/T-1.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions.
  - .1 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 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 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .3 Society of Automotive Engineers (SAE)

**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 louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following:
    - .1 Pressure drop.
    - .2 Face area.
    - .3 Free area.
    - .4 Beginning point of water penetration.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

**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 materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect louvers, intakes and vents from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 SYSTEM DESCRIPTION**

.1 Performance Requirements:

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

**2.2 GOOSENECK HOODS**

- .1 Thickness: to SMACNA.
- .2 Fabrication: to SMACNA.
- .3 Joints: to SMACNA.
- .4 Supports: as indicated.
- .5 Complete with integral birdscreen of 2.7 mm diameter aluminum wire. Use 12 mm mesh on exhaust and 19 mm mesh on intake.

**2.3 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: 150 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 and 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: factory applied enamel. Colour: to Departmental Representative's approval.

**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 louvres, intakes and vents 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 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 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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-115.10, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.
  - .2 CAN/CGSB-115.14, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.
- .3 Underwriters' Laboratories of Canada (ULC)
  - .1 ULC -S111, Standard Method of Fire Tests for Air Filter Units.

**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 HVAC filters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply 1 complete set of filters for each.

**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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect HVAC filters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 GENERAL**

- .1 Media: suitable for air at 100% RH and air temperatures between -40 and 50 degrees C.
- .2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.
- .3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

**2.2 ACCESSORIES**

- .1 Holding frames: permanent channel section construction of same material as casing/hood, 1.6 mm thick, except where specified.
- .2 Seals: to ensure leakproof operation.
- .3 Blank-off plates: as required, to fit all openings and of same material as holding frames.
- .4 Access and servicing: through doors/panels on each side.

**2.3 FIBROUS GLASS PANEL FILTERS**

- .1 Disposable fibrous glass media: to CAN/CGSB-115.10 with adhesive.
- .2 Holding frame: 1.2 mm minimum thick galvanized steel with 3 mm diameter hinged wire mesh screen.
- .3 Performance: to ANSI/ASHRAE 52.2.
- .4 Fire rated: to ULC -S111.
- .5 Nominal thickness: 50 mm.

**2.4 CARTRIDGE TYPE FILTERS, 89-90% EFFICIENCY**

- .1 Media: deep pleated, disposable, high efficiency, to CAN/CGSB-115.14.
- .2 Holding frame: galvanized steel with bracing.
- .3 Media support: welded wire grid.
- .4 Performance: average atmospheric dust spot efficiency 89-90% to ANSI/ASHRAE 52.2.
- .5 Fire rated: to ULC -S111.

**2.5 FILTER GAUGES - DIAL TYPE**

- .1 Diaphragm actuated, direct reading.
- .2 Range: 0 to 250 Pa.



**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 filter 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 in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

**3.3                REPLACEMENT MEDIA**

- .1      Replace media with new upon acceptance.
- .2      Filter media new and clean, as indicated by pressure gauge, at time of acceptance.

**3.4                FILTER GAUGES**

- .1      Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.
- .2      Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

**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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)

**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 chimneys and stacks and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following:
    - .1 Methods of sealing sections.
    - .2 Methods of expansion.
    - .3 Details of thimbles.
    - .4 Bases/Foundations.
    - .5 Supports.
    - .6 Guy details.
    - .7 Rain caps.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**1.3 QUALITY ASSURANCE**

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial/Territorial regulations.
- .2 Certifications:
  - .1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 chimneys and stacks from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 BREECHINGS**

- .1 Shop fabricated 1.6 mm thick mild steel, welded, with sweep bends from boiler outlet to thimble or chimney as indicated.

**2.2 TYPE B GAS VENT**

- .1 ULC labelled, 288 degrees C rating maximum, atmospheric gas vent only.
- .2 Sectional, prefabricated, double wall with 13 mm air space. Aluminum inner wall. Galvanized steel outer wall. Mated fittings and couplings.

**2.3 STEEL CHIMNEY REFRACTORY LINED**

- .1 Material:
  - .1 Prefabricated sections with 90 mm thick high temperature impervious insulating refractory lining, centrifugally spun into 3.5 mm thick circular casing.
- .2 Construction:
  - .1 Prefabricated sections, welded at factory. Use high temperature insulating cement at joints in refractory lining.
- .3 Welding:
  - .1 To full thickness; grind welds smooth.
- .4 Supports:
  - .1 Welded gussets, cleats and bolts for installation on concrete base.
  - .2 Chimney laterally braced, as indicated.
  - .3 Concrete base by Section 03 30 00 - Cast-in-Place Concrete.
- .5 Breeching entry:
  - .1 Tee section with 150 mm minimum refractory lined projection.
- .6 Access door: in bottom section.
- .7 Drain connection: at base of stack.
- .8 Dimensions: as indicated.

**2.4 ACCESSORIES**

- .1 Cleanouts: bolted, gasketed type, full size of breeching, as indicated.
- .2 Barometric dampers: double acting, 70% of full size of breeching area.
- .3 Hangers and supports: in accordance with recommendations SMACNA as indicated.
- .4 Rain cap.
- .5 Expansion sleeves with heat resistant caulking, held in place as indicated.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for chimney and stack 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 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at 1.5 m centres and at each joint.
- .3 Support chimneys at bottom, roof and intermediate levels as indicated.
- .4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.
- .5 Install flashings on chimneys penetrating roofs, as indicated.
- .6 Install rain caps and cleanouts, as indicated.

**3.3 INSTALLATION - REFRACTORY LINED STEEL CHIMNEY**

- .1 Grind welds smooth to form appearance of single tube.
- .2 Seal insulating refractory at top of stack.
- .3 Pack annular space around breeching at entry tee with heat resistant caulking.
- .4 Run drain line from drain connection to floor drain.
- .5 On completion, paint one coat of rust inhibitive primer and two coats of heat resisting paint of colour, make and quality approved by Departmental Representative.

**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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Boiler Manufacturers Association (ABMA)
- .2 ASME
  - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII.
- .3 CSA Group
  - .1 CAN1-3.1, Industrial and Commercial Gas-Fired Package Boilers.
  - .2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
  - .3 CSA B149.1, Natural Gas and Propane Installation Code.
- .4 Electrical and Electronic Manufacturers Association of Canada (EEMAC)

**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 heating boilers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 General arrangement showing terminal points, instrumentation test connections.
    - .2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.
    - .3 Foundations with loadings, anchor bolt arrangements.
    - .4 Piping hook-ups.
    - .5 Equipment electrical drawings.
    - .6 Burners and controls.
    - .7 All miscellaneous equipment.
    - .8 Flame safety control system.
    - .9 Breeching and stack configuration.
    - .10 Stack emission continuous monitoring system to measure CO, O, NOx, SO, stack temperature and smoke density of flue gases.
  - .2 Engineering data to include:
    - .1 Boiler efficiency at 25%, 50%, 75%, 100%, of design capacity.
    - .2 Radiant heat loss at 100% design capacity.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**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 heating boilers for incorporation into manual.

**1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial regulations.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra materials:
  - .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
    - .1 Special tools for burners, access opening, handholes and Operation and Maintenance.
    - .2 Spare parts for 1 year of operation.
    - .3 Spare gaskets.
    - .4 Spare gauge glass inserts.
    - .5 Probes and sealants for electronic indication.
    - .6 Spare burner tips.
    - .7 Spare burner gun.
    - .8 Safety valve test gauge.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 boiler and equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 GENERAL**

- .1 Packaged boiler:
  - .1 Complete with burner and necessary accessories and controls.

- .2 Factory tested at rated capacity to, and bearing seal or nameplate certifying compliance with, CAN1-3.1, witnessed and certified by Departmental Representative.
- .3 Ready for attachment to piping, electrical power, controls, flue gases exhaust.
- .4 Designed and constructed to ASME Boiler and Pressure vessel Code.
- .5 CRN (Canadian Registration Number), to CSA B51.
- .6 Boiler/burner package to bear ULC label.
- .2 Performance:
  - .1 In accordance with American Boiler Manufacturers Association (ABMA), testing procedures.
  - .2 Firing rate: 28.3 m<sup>3</sup> /h natural gas; gas pressure at metre outlet: 14 kPa.
  - .3 Boiler efficiency: 85% minimum at 30% to 100% firing rates.
  - .4 Flue gas temperature leaving boiler:
    - .1 Not to exceed 260 degrees C.
    - .2 Above dewpoint conditions at minimum firing rate.
- .3 Electrical:
  - .1 Power: 120 V, 1 phase, 60 Hz.
  - .2 Controls: 120 V, 1 phase, 60 Hz.
  - .3 Electrical components: CSA approved.
- .4 Controls: factory wired. Enclosed in EEMAC [1] steel cabinet.
- .5 Thermal insulation:
  - .1 50 mm thick mineral fibre. Seal insulation at handholes, access opening, mudholes, piping connections with insulating cement or asphaltic paint. Finish with heat resisting paint.
- .6 Jackets: heavy gauge metal, finished with heat resisting paint.
- .7 Mounting:
  - .1 Structural steel base, lifting lugs.
- .8 Anchor bolts and templates:
  - .1 Supply for installation by other Divisions. Anchor bolts to be sized to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .9 Start-up, instruction, on-site performance tests: 3 days per boiler.
- .10 Trial usage:
  - .1 Departmental Representative may use boilers for test purposes prior to acceptance and commencement of warranty period.
  - .2 Supply labour, materials and instruments required for tests.
- .11 Temporary use by contractor:
  - .1 Contractor may use boilers only after written approval from Departmental Representative.

- .2 Monitor and record performance continuously. Keep log of maintenance activities carried out.
- .3 Refurbish to as-new condition before final inspection and acceptance.

## **2.2 COIL TUBE HOT WATER BOILER**

- .1 Packaged, forced circulation, water tube, employing multiple coiled copper tubes, refractory combustion chamber, and forced draft combustion.
- .2 Heating surface: 10.78 m<sup>2</sup>.
- .3 Fluid Volume: 17 L.

## **2.3 AUXILIARIES**

- .1 Provide auxiliaries for each boiler and to meet ASME requirements.
- .2 Hot water boilers:
  - .1 Relief valve: ASME rated, set at 344 kPa.
  - .2 Pressure gauge: 90 mm diameter complete with shut-off cock.
  - .3 Thermometer: 115 mm diameter range 10 to 150 degrees C.
  - .4 Low water cut-off: with visual and audible alarms.
  - .5 Auxiliary low water cut-off: with separate cold water connection to boiler.
  - .6 Isolating gate valves: on supply and return connections.
  - .7 Drain valves: Two NPS 3/4.
  - .8 Stack thermometer: range 65 to 400 degrees C.
  - .9 Outdoor controller: to reset operating temperature controller.
  - .10 1 set of cleaning tools.

## **2.4 GAS BURNERS**

- .1 General:
  - .1 Forced draft with:
    - .1 Built-in blower to supply combustion air, complete with motor, silencer and damper.
    - .2 High voltage ignition transformer.
    - .3 Flame observation port.
    - .4 Easy access to nozzles and electrodes.
- .2 Gas pilot:
  - .1 To building code and provincial regulations including solenoid gas valve, pressure regulator, pressure gauge, manual shut-off valve.
- .3 Main gas train:
  - .1 To building code and provincial regulations including main shut-off valve, pressure regulator, motorized electric shut-off valve, downstream block-test valve with test connection and pressure gauge.



- .4 Controls:
  - .1 Electronic combustion control relay with flame rod flame detector for combustion control and flame supervision.
  - .2 Control to shut off fuel within 5 seconds upon pilot flame or main flame failure or upon signal of safety interlock and to ensure, when restarted, in sequence:
    - .1 Pre-purge.
    - .2 Pilot ignition and supervision.
    - .3 Main gas valve opening.
    - .4 Pilot cut-off. Pilot-proving period not to exceed 10 seconds.
    - .5 Burner operation.
    - .6 Post-purge burner shut-down.
  - .3 Static pressure interlock. To shut off burner upon loss of combustion air pressure.
  - .4 Fuel-air mixture: control through:
    - .1 Modulating motor with end switch to provide for low-fire start and fully modulating operation down to 20% of design capacity.
  - .5 Immersion controllers:
    - .1 Operating: to start and stop burner, and operating between adjustable setpoints.
    - .2 Modulating: to modulate burner output.
  - .6 Visual and audible alarms: to indicate burner shutdown due to flame failure, low water level, high temperature, low air pressure, low gas pressure.
  - .7 Selector switch: to permit manual and automatic firing at any rate between low and high fire.
  - .8 Pilot lights: to indicate:
    - .1 Normal burner operation.
    - .2 All stages of burner operation.
  - .9 Burner to start up in low fire position.

### **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 heating boiler 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 MANUFACTURER'S INSTRUCTIONS**

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

**3.3 INSTALLATION**

- .1 Install in accordance with ASME Boiler and Pressure Vessels Code, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.
- .2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.
- .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.
- .4 Mount unit level using specified vibration isolation in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .5 Pipe hot water relief valves full size to nearest drain.
- .6 Natural gas fired installations: in accordance with CSA B149.1.

**3.4 MOUNTINGS AND ACCESSORIES**

- .1 Safety valves and relief valves:
  - .1 Run separate discharge from each valve.
  - .2 Terminate discharge pipe as indicated.
  - .3 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.

**3.5 FIELD QUALITY CONTROL**

- .1 Commissioning:
  - .1 Manufacturer to:
    - .1 Certify installation.
    - .2 Start up and commission installation.
    - .3 Carry out on-site performance verification tests.
    - .4 Demonstrate operation and maintenance.
  - .2 Provide Departmental Representative at least 24 hours notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

**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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/American Society of Heating, Refrigeration and Air Condition Engineers/Illuminating Engineering Society (ANSI/ASHRAE/IES)
  - .1 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
  - .2 ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings except Low-Rise Residential Buildings.
- .2 Green Seal (GS)
  - .1 GS-11, Standard for Paints and Coatings.
  - .2 GS-36, Standard for Adhesives for Commercial Use.
- .3 Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.
    - .1 MPI #18.
- .4 South Coast Air Quality Management District (SCAQMD)
  - .1 SCAQMD Rule 1113, Architectural Coatings.
  - .2 SCAQMD Rule 1168, Adhesives and Sealants.

**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 insulation, filters, adhesives, and paints and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings: fan, fan curves showing point of operation, motor drive, bearings, filters, dampers, coil; include performance data.

**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 air handling equipment for incorporation into manual.
- .3 Include following: fan, bearings, motor, damper, air volume, EDB, EWB, OAT.

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide 1 spare set of filters.

- .3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.
- .4 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply 1 complete set of filters for each filter unit or filter bank.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 air handling equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Factory assembled components to form unit supplying air at designed conditions, as indicated.
- .2 Certify ratings: to ANSI/AHRI 430 with AHRI seal.
- .3 Horizontal type, as indicated, having air tight modular components, consisting of casing, fan section with motor and drive, filter section, dampers, heating coil.

### **2.2 CASINGS**

- .1 Galvanized steel 1.3 mm thickness reinforced and braced for rigidity.
  - .1 Inspection doors: provide access for maintenance of internal parts.
  - .2 Paint steel parts, where not galvanized, with corrosion resistant paint to MPI #18.
    - .1 Paint: maximum VOC limit 250 g/L to GS-11.
  - .3 Finish unit, inside and out, with rust resistant enamel.
    - .1 Enamel Finish: maximum VOC limit 250 g/L to Standard GS-11.
- .2 Line casing with solid steel liner. Fan section to be provided with perforated liner.

### **2.3 ACOUSTIC LINER**

- .1 Ensure that expanded polystyrene and polyurethane insulation materials were not produced with ozone depleting substances.
- .2 Insulate internal surface of panels with 50 mm neoprene coated rigid duct liner of 24 kg/m<sup>3</sup> density.

- .1 Apply with 100% coverage of adhesive with clip pins.
  - .1 Adhesives: maximum VOC limit 80 g/L to GS-36.
- .2 Cover with 0.8 mm thick perforated galvanized sheet metal.
- .3 Cover leading and trailing edges with sheet metal nosing and at edges around access doors and panels complete with 15 mm overlap.

## **2.4 FANS**

- .1 AMCA-rated for sound and performance centrifugal fans with backward inclined wheels, selected to operate in stable part of performance curve at times and 100,000 hours service self-aligning split pillow block bearings.
  - .1 Provide internally mounted motor as indicated complete with adjustable V-belt drive and guard.
  - .2 Motor: to ANSI/ASHRAE/IES 90.1, 7.5hp, 2112 r/min.
- .2 Maximum sound power levels, as indicated.
- .3 Internally mounted motor and fan.

## **2.5 VIBRATION ISOLATION**

- .1 Flexible connections at inlet and outlet of fan: to Section 23 33 00 - Air Duct Accessories.
- .2 Vibration isolators on fan section as indicated complete with seismic restraints: in accordance with Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

## **2.6 FILTER BOX**

- .1 Material to match casing. For flat type filter arrangement: as indicated.
  - .1 Provide access to filter through hinged door removable panels with suitable hardware.
- .2 Provide blank-off plates and gaskets to prevent air bypass.
- .3 Filters: in accordance with Section 23 44 00 - HVAC Air Filtration.
  - .1 Minimum Efficiency Reporting Value MERV value 8 filtration media to ANSI/ASHRAE 52.2, to be used on return air section of air handling unit.
  - .2 Immediately prior to occupancy, replace filtration media with new filtration media with Minimum Efficiency Reporting Value MERV of 13 in accordance with ANSI/ASHRAE 52.2.

## **2.7 COILS**

- .1 Capacity: as indicated.
- .2 Ratings: AHRI certified.
- .3 Construction:
  - .1 Casings: 1.3 mm thick galvanized sheet steel.
    - .1 Supports of galvanized steel channel frames.

- .2 Blank-off plates. Insulated sandwich construction.
- .2 Hot water coils: cleanable fins.
  - .1 Tubes: copper.
  - .2 Fins: aluminum.
  - .3 Headers: steel.
  - .4 Pressure tests: 2 MPa.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air handling 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.
- .2 Allow 2 hours for systems demonstration.

#### **3.2 INSTALLATION**

- .1 Provide appropriate protection apparatus.
- .2 Install units in accordance with manufacturer's instructions and as indicated.
- .3 Ensure adequate clearance for servicing and maintenance.

#### **3.3 FANS**

- .1 Install fan sheaves required for final air balance.
- .2 Install flexible connections at fan inlet and fan outlets.
- .3 Install vibration isolators.

#### **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.

**END OF SECTION**

**Part 1 General**

**1.1 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 forced air heaters and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

**1.2 CLOSEOUT SUBMITTALS**

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

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 forced air heaters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 FORCED AIR HEATERS**

- .1 Forced air heaters, wall mounted commercial type as follows:
  - .1 Enclosure:
    - .1 Steel, 1.2 mm thick.
    - .2 Knockouts for 12 mm diameter conduit left, right, bottom and rear.
    - .3 Grill and frame finished, colour by architect.
  - .2 Elements and Fan:
    - .1 Mineral insulated, Nickel chromium alloy.
    - .2 Motor: totally enclosed, shaded pole, impedance protected motor.
- .2 Controls:
  - .1 Wall mounted low voltage thermostat: to Section 23 09 33 - Electric and Electronic Control System for HVAC.

- .3 Built-in tamperproof controls. 'On-Off-Fan Only' selector switch and temperature control knob.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install heaters in accordance with manufacturer's written recommendations.
- .2 Make power and control connections.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

**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 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 forced air heaters installation.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Institute of Boiler and Radiator Manufacturers (IBR)
- .2 US Department of Commerce
  - .1 CS 140-47, Commercial Standard.

**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 finned tube radiation heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 Equipment, capacity, piping, and connections.
    - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
    - .3 Special enclosures.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

**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 finned tube radiation heaters 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 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 finned tube radiation heaters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 CAPACITY**

- .1 As indicated, based on 77 degrees C average water temperature, 22 degrees C temperature drop and 20 degrees C at entering air temperature.

**2.2 FINNED TUBE RADIATION**

- .1 Heating elements: NPS ¾ seamless copper tubing, 1.2 mm minimum wall thickness, mechanically expanded into flanged collars of evenly spaced aluminum fins, 64 x 83 mm nominal, 196 fins per metre suitable for sweat fittings.
- .2 Element hangers: ball bearings cradle type providing unrestricted longitudinal movement on enclosure brackets. Space brackets 900 mm centres maximum.
- .3 Standard enclosures: 1.5 mm thick steel complete with components for wall-to-wall or complete with die formed end caps having no knock-outs, with inside corners, outside corners, as indicated. Provide full length channel and sealer strip at top of wall edge. Height as indicated. Joints and filler pieces flush with cabinet. Support rigidly top and bottom, on wall mounted brackets. Joints and filler pieces clear of grilles located to provide easy access to valves and vents. Provide access doors for valves and vents. Finish cabinet with factory applied baked primer coat.
- .4 Special enclosures: as indicated.
- .5 Dimensions for enclosures: measure site conditions. Do not scale from drawing.
- .6 Provide for noiseless expansion of components.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for finned tube radiation convector heater 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 Install in accordance with manufacturer's instructions.
- .2 Install in accordance with piping layout and reviewed shop drawings.
- .3 Provide for pipe movement during normal operation.
- .4 Maintain sufficient clearance to permit performance of service maintenance.

- .5 Check final location with Departmental Representative if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .6 Valves:
  - .1 Install valves with stems upright or horizontal unless approved otherwise.
  - .2 Install isolating gate valves on inlet and lock shield globe balancing valves on outlet of each unit.
- .7 Venting:
  - .1 Install screwdriver vent on cabinet convector, terminating flush with surface of cabinet.
  - .2 Install automatic air vent on continuous finned tube radiation.
- .8 Clean finned tubes and comb straight.
- .9 Install flexible expansion compensators as required.

### **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.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .2 ASTM C916, Standard Specification for Adhesives for Duct Thermal Insulation.
  - .3 ASTM C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
  - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).

**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 unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .4 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 Equipment, capacity and piping connections.
    - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

**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 unit heaters 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 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 unit heaters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 UNIT HEATERS**

- .1 Cabinet Unit Heaters: to UL 2021.
- .2 Cabinet: type as indicated, 1.5 mm thick steel with rounded exposed corners and edges, removable panels, glass fibre insulation and integral air outlet and inlet.
  - .1 Insulation Materials: to ASTM C1071; ensure surfaces exposed to airstream have aluminum-foil facing to prevent erosion of glass fibres.
    - .1 Thickness: 25 mm.
    - .2 Thermal conductivity (k-Value): 0.037 W/m x K at 24 degrees C mean temperature.
    - .3 Fire-hazard classification flame-spread index of 25 maximum and smoke-developed index of 50 maximum to ASTM E 84.
- .3 Finish with factory applied primer coat.
- .4 Hydronic coils: hydrostatically tested to 2 MPa.
  - .1 Hot water coil: copper tube, mechanically bonded aluminum fins spaced 25 mm maximum rated 1378 kPa minimum working pressure and 104 degrees C maximum entering-water temperature. Include manual air vent and drain.
- .5 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.
- .6 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .7 Capacity: as indicated.
- .8 Control:
  - .1 Control thermostat: room electric, low voltage, Energy Star Certified, rating to suit cabinet unit heater, locking cover, set point locking device, concealed adjustment, plastic cover and guard, thermometer in cover.

**2.2 HORIZONTAL UNIT HEATERS**

- .1 Horizontal Unit Heaters: to UL 2021.
- .2 Casing: 1.2 mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

- .3 Coils: hydrostatically test to 2 MPa.
  - .1 Hot water coil: copper tube, mechanically bonded aluminum fins spaced 25 mm maximum rated 1378 kPa minimum working pressure and 93 degrees C maximum entering-water temperature. Include manual air vent and drain.
- .4 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.
- .5 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor explosion proof supports.
- .6 Air outlet: two-way adjustable louvres.
- .7 Capacity: as indicated base hot water heating capacity on 77 degrees C average temperature & 22 degrees C temperature drop.
- .8 Control room thermostat: electric, low voltage, electronic, Energy Star Certified, locking cover, set point locking device, concealed adjustment, plastic cover and guard, thermometer in cover.

### **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 unit heaters 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 Install in accordance with manufacturer's instructions.
- .2 Include double swing pipe joints as indicated.
- .3 Check final location with Departmental Representative if different from that indicated prior to installation.
  - .1 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Hot water units: for each unit, install gate valve on inlet and lockshield globe [calibrated] balancing valve on outlet of each unit. Install drain valve at low point.
  - .1 Install manual air vent at high point.
- .5 Clean finned tubes and comb straight.
- .6 Provide supplementary suspension steel as required.

- .7 Install thermostats in locations indicated.
- .8 Before acceptance, set discharge patterns and fan speeds to suit requirements.

**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.

**3.4 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 27 - Communications.
- .2 Section 28 – Electronic Safety and Security

**1.2 REFERENCES**

- .1 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.
- .2 Reference Standards:
  - .1 CSA Group
    - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
    - .2 CAN/CSA-C22.3 No.1-10, Overhead Systems.
    - .3 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
  - .2 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.

**1.3 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 as specified and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review single line electrical diagrams in glazed frames and locate as indicated.
  - .1 Electrical distribution system in main electrical room.
- .4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames at fire alarm control panel and annunciator.
- .5 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
  - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
  - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.



- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Submit two (2) copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.
- .6 If changes are required, notify Departmental Representative of these changes before they are made.
- .6 Certificates:
  - .1 Provide CSA certified equipment.
  - .2 Where CSA certified equipment is not available, submit such equipment to authority having jurisdiction for special approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
  - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .7 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

#### **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 incorporation into manual.
  - .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.
  - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
  - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 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 labels for control items in English.

**2.2 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 authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

**2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, with mechanical controls contractor.

**2.4 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

## 2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

## 2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with labels as follows:
  - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, matt white finish face, black 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 6 mm high letters unless specified otherwise.
- .3 Wording on labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

## 2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, 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.

## 2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

- .3 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       |        |
| Emergency Voice             | Red       | Blue   |
| Other Security Systems      | Red       | Yellow |

## **2.9 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of 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 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

### **3.3 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### **3.4 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.

### 3.5 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.

### 3.6 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: 1400 mm.
  - .2 Wall receptacles:
    - .1 General: 300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Telephone and interphone outlets: 300 mm.
  - .5 Wall mounted telephone and interphone outlets: 1500 mm.
  - .6 Fire alarm stations: 1500 mm.
  - .7 Fire alarm bells: 2100 mm.
  - .8 Television outlets: 300 mm.

### 3.7 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### 3.8 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 - ACTION AND INFORMATIONAL 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 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: fire alarm and communications.
  - .6 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 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.
- .5 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.

### **3.9 SYSTEM STARTUP**

- .1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

### **3.10 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 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.

**3.11 CONTRACT BREAK DOWN**

- .1 Within thirty days of the award of the contract, forward to the Consultant a breakdown of the tendered electrical price into the divisions of work. This breakdown shall be in the form of a lump sum figure for each division, broken down into material costs and labour costs, with the aggregate of these division prices totalling to the tendered price.

**3.12 PRICING**

- .1 Pricing shall be based on Drawings and Specifications as issued by MPE Engineering and deviations from same will not be approved.

**3.13 COST SAVINGS**

- .1 After tenders have closed and Contractor selected, all proposed changes to design shall be submitted through the proper channels along with credits offered, broken down into Materials and Labour for final approval by Owner and Consultant. Changes to design/installation will not be approved unless the above procedure has been followed, and all unapproved changed will be removed at no additional cost to the contract.

**3.14 SUBSTITUTIONS**

- .1 Substitutions of material or equipment from the specified may only be made providing written approval is obtained before the close of tenders. Make application for substitutions in duplicate at least ten (10) days before electrical tenders close, giving a complete technical description and illustrations of the equipment it is proposed to substitute and an itemization of the points of deviation from the specified equipment. Where alternate equipment requires installation or connection in addition to those required by the equipment specified, such costs shall be allowed for in the tender.
- .2 Within thirty (30) days of the award of the contract, ascertain the delivery dates of all equipment and apply for substitutions on those items which cannot be delivered in time for completion of the project on schedule. If such application for substitution has not been made, it will be assumed that delivery dates have been verified and delivery of materials or equipment will not delay completion of the project on schedule.
- .3 In the event materials specified do not bear appropriate approval or meet the Inspection Authority requirements, then this shall be made known in writing and application made for substitution of alternate material within thirty (30) days of the award of the contract. After this period, assume full responsibility for obtaining the approval of the local Inspection Authority and pay all charges levied, and make any modifications required.

**3.15 PRODUCT OPTIONS LIST**

- .1 Identify equipment, system and sub trades proposed to be used from among those approved for the project. Deliver the completed list to the Consultant not later than twenty-four (24) hours after the award of the electrical contract. Failure to comply with these requirements shall mean the Contractor loses the option of choosing equipment, systems and sub trades and shall use those as may be directed by the Consultant. This list shall give the name of the manufacturer (and sub trade where applicable) for each type of material, equipment or system proposed and be set out as follows:

|     | <u>Division of Work</u>   | <u>Manufacturer / Sub-Trade</u> |
|-----|---|---------------------------------|
| .1  | Distribution of Equipment/TVVS/Panelboards  | _____                           |
| .2  | Motor Controls  | _____                           |
| .3  | Fire Alarm System/Devices   | _____                           |
| .4  | Access Security System  | _____                           |
| .5  | Building Entrance Control System  | _____                           |
| .6  | Television System   | _____                           |
| .7  | Wiring Devices/Cover Plates   | _____                           |
| .8  | Voice/Data Cabling  | _____                           |
| .9  | Exit and Emergency Lighting   | _____                           |
| .10 | Lamps (All types)   | _____                           |
| .11 | Lighting Fixtures<br>(Attach complete list indicating manufacturer catalogue number for each fixture type.) | _____                           |

Submitted by: \_\_\_\_\_

Date: \_\_\_\_\_ 20 \_\_\_\_\_ Per: \_\_\_\_\_

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 00 10 - Common Work Results for Electrical

**1.2 REFERENCES**

- .1 Canadian Standards Associations (CSA)
- .1 CAN/CSA C22.2 No. 48-M90 Nonmetallic Sheathed Cable
  - .2 CSA C22.2 No. 51-09 Armoured Cables
  - .3 CSA C22.2 No. 52-96 (R2005) Underground Service-Entrance Cables
  - .4 CSA C22.2 No. 75-08 Thermoplastic-Insulated Wire and Cables
  - .5 CAN/CSA-C22.2 No 131-07 Type TECK 90 Cable
  - .6 CSA C22.2 No. 0.3-09 Test Methods for Electrical Wires and Cables
  - .7 CSA C22.2 No. 38-05 Thermoset-Insulated Wires and Cables
  - .8 CSA C22.2 No. 188-04 Splicing Wire Connectors
  - .9 CSA C22.2 No. 198.2-05 Sealed Wire Connector Systems
  - .10 CSA C22.2 No. 38-05 Thermoset
  - .11 CSA C22.2 No. 188-04 Splicing
- .2 American National Standards Institute/Insulated Cable Engineers Association (ANSI/ICEA)
- .1 ICEA S-70-547 Weather-Resistant Polyolefin-Covered Wire and Cable
  - .2 ANSI/ICEA S-97-682 Utility Shielded Power Cables Rated 5 through 46 kV
  - .3 ICEA S-19-81 Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
  - .4 ANSI/ICEA S-97-682 Utility Shielded Power Cables Rated 5 Through 46 kV
- .3 American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA)
- .1 ANSI/NEMA WC 70-2009/ICEA S-95-658-2009 Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy
  - .2 ANSI/NEMA WC 71-1999/ICEA S-96-659-199 Standard for Non-Shielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy

**1.3 PRODUCT DATA**

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

**Part 2 Products**

**2.1 BUILDING WIRES**

- .1 Conductors: stranded for 8 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.

**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 Ethylene propylene rubber EP.
  - .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 malleable iron 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 MINERAL-INSULATED CABLES**

- .1 Conductors: solid bare soft-annealed copper, size as indicated.
- .2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.
- .3 Outer covering: annealed seamless copper sheath, Type LWMI rated 300 V, 250 degrees C.
- .4 Overall jacket: PVC applied over the sheath and compliant to applicable Building Code classification for this project.

- .5 Two hour fire rating.
- .6 Connectors: watertight, field installed approved for MI cable.
- .7 Termination kits: field installed approved for MI cable

## **2.4 ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Type: ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.
- .5 Connectors: anti short connectors.

## **2.5 CONTROL CABLES**

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
  - .1 Insulation: thermoplastic.
  - .2 Sheath : thermoplastic jacket.
- .2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:
  - .1 Insulation: PVC
  - .2 Shielding: tape coated with paramagnetic material over each conductor.
  - .3 Overall covering: PVC jackets.

## **2.6 NON-METALLIC SHEATHED CABLE**

- .1 Non-metallic sheathed copper cable type: NMD90XLPE, size as indicated.

## **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 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

### **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 in all other areas.

### **3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)**

- .1 Group cables wherever possible on channels.
- .2 Install cable concealed, securely supported by straps and hangers.

### **3.5 INSTALLATION OF MINERAL-INSULATED CABLES**

- .1 Install cable concealed, securely supported by straps and hangers.
- .2 Support 2 hour fire rated cables at 1 m intervals.
- .3 Make cable terminations by using factory-made kits.
- .4 Cable terminations: use thermoplastic sleeving over bare conductors.
- .5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.
- .6 Do not splice cables unless indicated.

### **3.6 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible on channels.

### **3.7 INSTALLATION OF CONTROL CABLES**

- .1 Install control cables conduit surface in basement and concealed above grade
- .2 Ground control cable shield.

### **3.8 INSTALLATION OF NON-METALLIC SHEATHED CABLE**

- .1 Cable is permitted to be used only within suites for suite devices excluding fire alarm system devices
- .2 Install cables
- .3 Install straps and box connectors to cables as required.

**Contract Number: 5P420-15-5067**  
**Asset Number: FII 945**

**Section 26 05 21**  
**WIRES AND CABLES (0-1000 V)**  
**Page 5 of 5**

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical

**1.2 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No. 0.4-04 Bonding Electrical Equipment (Protective Grounding)
  - .2 CSA C22.2 No. 41-07 Grounding and Bonding Equipment
  - .3 CSA T527-94 (R1999) Grounding and Bonding for Telecommunications in Commercial Buildings

**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 grounding equipment 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 grounding equipment for incorporation into manual.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials 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.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.
- .3 Rod electrodes: galvanized steel 21 mm diameter by minimum 3 m long.
- .4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated or as per the Canadian Electrical Code.
- .5 Insulated grounding conductors: green, copper conductors, size as indicated or as per the Canadian Electrical Code.
- .6 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .7 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, electrodes, conductors, connectors, accessories.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper burndy connector or equal.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.

- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .10 Bond single conductor, metallic armoured cables to cabinet at supply end.

### **3.3 MAINTENANCE HOLES**

- .1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each maintenance hole.
- .2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

### **3.4 ELECTRODES**

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod electrodes and make grounding connections.
- .5 Bond separate, multiple electrodes together.
- .6 Use minimum size 6 AWG copper conductors for connections to electrodes, or as per CEC.

### **3.5 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral of secondary 120/208 V system.

### **3.6 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, switchgear, duct systems, frames of motors, starters, control panels, building steel work, distribution panels, outdoor lighting.

### **3.7 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 electrical equipment room to ground bus with individual bare stranded copper connections size 2 AWG.



**3.8 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 Fire alarm, security systems, intercommunication systems as indicated.

**3.9 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.

**3.10 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.

**END OF SECTION**

**Part 1 General****1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 21 – Wires and Cables
- .3 Section 26 05 32 – Outlet Boxes, Conduit Boxes, and Fittings
- .4 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

**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 hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products****2.1 SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

**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 hangers and supports 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 Secure equipment to poured concrete with expandable inserts.
- .2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .3 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole malleable iron 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.
- .4 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.
- .5 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .6 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .7 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .8 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .9 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .10 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

### **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.

**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, 20th Edition.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

**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.
- .5 Extension and plaster rings for flush mounting devices in finished plaster walls.

**2.3 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

**2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE**

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

**2.5 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 35mm 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 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 21 – Wires and Cables (0-1000V)
- .3 Section 26 05 29 – Hangers and Supports for Electrical Systems
- .4 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings

**1.2 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. 45-M1981(R2003), Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
  - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
  - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
  - .1 Test reports: submit certified test reports.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Instructions: submit manufacturer's installation instructions.

**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.

**2.2 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

**2.3 CONDUIT FASTENINGS**

- .1 One hole malleable iron 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 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

**2.6 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 rigid galvanized steel threaded conduit where required by code and where subject to damage.
- .4 Use electrical metallic tubing (EMT) except where specified otherwise or in cast concrete.
- .5 Use rigid PVC conduit underground.
- .6 Use flexible metal conduit for connection to motors in dry areas and connection to surface or recessed fluorescent fixtures.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight in accordance with CEC.
- .12 Install fish cord in empty conduits.
- .13 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each recessed panel excluding individual suite panels.
  - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .14 Dry conduits out before installing wire.
- .15 Install all conduit in mechanical room in conduit for mechanical protection.

**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 in flanged portion of structural steel.
- .4 Group conduits wherever possible on 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 CONDUITS UNDERGROUND**

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

**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 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 27 16 – Electrical Cabinets and Enclosures

**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 metering equipment and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Include outline dimensions, panel drilling dimensions and installation cutout template.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 METER SOCKET**

- .1 Meter socket to suit Fortis installed meter
- .2 Coordinate socket with Fortis prior to ordering

**2.2 METERING INSTRUMENT TRANSFORMER CABINET**

- .1 Sheet steel CSA enclosure to accommodate current transformers.
- .2 Coordinate cabinet size with Fortis prior to ordering.

**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 metering and switchboard instruments 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 METERING INSTALLATION**

- .1 Install sockets and cabinets in location free from vibration and shock.
- .2 Make connections in accordance with diagrams.
- .3 If applicable, ensure power factor corrective equipment connected on load side of meter.
- .4 Connect meter and instrument transformer cabinets to ground.
- .5 Locate meters within 9 m of instrument transformers.
  - .1 Use 32 mm conduit for interconnections.
  - .2 Use separate conduit for each set of current transformer connections, exclusive for metering.

**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.

**3.4 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 09 23.01 – Metering and Switchboard Instruments
- .3 Section 26 24 16.01 – Panelboards Breaker Type
- .4 Section 26 28 16.02 – Moulded Case Circuit Breakers

**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 service equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect service equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused, rating as indicated.
- .2 Enclosed circuit breaker: in accordance with Section 26 28 16.02 - Moulded Case Circuit Breakers, rating as indicated.
- .3 Panelboard breaker type: in accordance with Section 26 24 16.01 - Panelboards Breaker Type, rating as indicated.
- .4 Transient Voltage Surge Suppressors (TVSS) carrying a UL Listing or recognized status to ANSI/UL 1449 3rd edition as follows:
  - .1 Metal Oxide Varistor (MOV) suppression
  - .2 Surge Capacity 160kA per phase and 80kA per mode

- .3 Monitoring: status indicator lights on each phase, form 'c' contacts, audible alarm, enable/disable, transient counter for sag, swell, outage, and surge, voltage meter

**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 service 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**

- .1 Install service equipment.
- .2 Connect to incoming service.
- .3 Connect to outgoing load circuits.
- .4 Make grounding connections in accordance with Section 26 05 28 - Grounding – Secondary.
- .5 Make provision for power supply authority's metering.

**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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 28 16.02 – Moulded Case Circuit Breakers

**1.2 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

**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 panelboards 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 Alberta, Canada.
  - .2 Include on drawings:
    - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**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 panelboards for incorporation into manual.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials 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.

**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 250V panelboards: bus and breakers rated for 225A or 400A (symmetrical) interrupting capacity, as indicated on drawings.
- .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
- .11 Minimum interrupting capacity as indicated on drawings

**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.

**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.
- .3 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 with fire retardant paint coating. 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.

**3.4 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 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 09 23.01 – Metering and Switchboard Instruments

**1.2 REFERENCES**

- .1 CSA International
  - .1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .3 The Munsell System of Colour Notation

**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 electrical cabinets and enclosures 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 Alberta, Canada.

**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 electrical cabinets and enclosures for incorporation into manual.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5/1.5, size as indicated.
- .2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m<sup>2</sup> area without rupture of material.
- .3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.
- .4 Equip enclosure with hot dipped galvanized mounting rails 1 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.
  - .1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
  - .2 Holes in side panel flanges in 60 mm increments for vertical adjustment.
- .5 Cover: tamperproof, bolt-on, domed to shed water.
- .6 Door: 3 point latching, with padlocking means.
- .7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.
- .8 Enclosure construction such as to allow configuration of single or ganged enclosures.
- .9 Enclosure capable of being shipped in knocked-down condition.

**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 electrical cabinet and enclosure 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 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.
- .2 Mount equipment in enclosure.
- .3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

**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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 21 – Wires and Cables (0-1000V)
- .3 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.

**1.2 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(R2008), Special Use Switches.

**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 wiring devices 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 Alberta, Canada.

**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 wiring devices for incorporation into manual.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 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.

**Part 2            Products**

**2.1                SWITCHES**

- .1      15A or 20A as determined by connected circuit, 120 V, single pole, three-way, four-way switches to: CSA C22.2 No.55.
- .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 standard style.
- .3      Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads 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, standard style.
  - .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      Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
  - .1          White urea moulded housing, standard style.
  - .2          Suitable for No. 10 AWG for back and side wiring.
  - .3          Four back wired entrances, 2 side wiring screws.
- .3      Other receptacles with ampacity and voltage as indicated.
- .4      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      Plastic ivory cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .4      Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5      Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles and in-use protected cover as per CEC.

- .6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches and in-use protected cover as per CEC.

## **2.4 SOURCE QUALITY CONTROL**

- .1 Cover plates from one manufacturer throughout project.

## **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 wiring devices 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 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.
- .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.
  - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
  - .4 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.

### **3.3 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.

**3.4 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 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 24 16.01 – Panelboards Breaker Type
- .3 Section 26 27 16 – Electrical Cabinets and Enclosures

**1.2 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 NMX-J-266-ANCE-2010).

**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 circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.
- .4 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 approval.
  - .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: Staff Housing Waterton Lakes National Park Phase 1

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store 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.

### **Part 2 Products**

#### **2.1 BREAKERS GENERAL**

- .1 Moulded-case circuit breakers, Circuit breakers, ground-fault circuit-interrupters: 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 10,000 symmetrical RMS interrupting capacity rating, or as indicated on drawings.

#### **2.2 THERMAL MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

#### **2.3 ENCLOSURE**

- .1 Main 400A moulded case circuit breaker to be complete with NEMA 1 rated enclosure.
- .2 Breaker and enclosure to be assembled in factory by same manufacturer prior to installation and interconnection onsite.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1      Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1      Visually inspect substrate in presence of 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      Install circuit breakers as indicated.

**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.

**END OF SECTION**

**Part 1 General****1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 27 16 – Electrical Cabinets and Enclosures

**1.2 REFERENCES**

- .1 CSA Group
  - .1 CAN/CSA-C22.2 No.4-04(R2009 ), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
  - .2 CSA C22.2 No.39-13, Fuseholder Assemblies.

**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 disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products****2.1 DISCONNECT SWITCHES**

- .1 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 3 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 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused 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 Install disconnect switches complete with fuses if applicable.

### **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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical

**1.2 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No.14-10, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

**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 contactors 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 contactors for incorporation into manual.
- .3 Include operating information required for start-up, synchronizing and shut-down of generating units.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect contactors from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 CONTACTORS**

- .1 Contactors: to CSA C22.2 No.14.
- .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled.
- .3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .4 Mount in NEMA 1 Enclosure unless otherwise indicated.
- .5 Include following options in cover:
  - .1 Green indicating lamp.
- .6 Control transformer: in accordance with mechanical equipment requirements, factory wired and installed in contactor enclosure.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Size 4 nameplate indicating name of load controlled.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install contactors and connect power wires and auxiliary control devices.
- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00 - Common Work Results for Electrical.

**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.

**3.3 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 22 10 10 – Plumbing Pumps.
- .2 Section 26 05 00 – Common Work Results for Electrical.
- .3 Section 26 05 21 – Wires and Cables (0-1000V)
- .4 Section 26 29 01 – Contactors

**1.2 REFERENCES**

- .1 International Electrotechnical Commission (IEC)
  - .1 IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.

**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.
- .3 Shop Drawings:
  - .1 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 the Province of Alberta, Canada.
    - .2 Provide shop drawings for each type of starter to indicate:
      - .1 Mounting method and dimensions.
      - .2 Starter size and type.
      - .3 Layout and components.
      - .4 Enclosure types.
      - .5 Wiring diagram.
      - .6 Interconnection diagrams.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.
- .3 Extra Materials:
  - .1 Provide listed spare parts for each different size and type of starter.
    - .1 3 contacts, stationary.
    - .2 1 control transformer.

- .3 1 operating coil.
- .4 2 fuses.
- .5 10% indicating lamp bulbs used.

**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.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Starters: to IEC 947-4 with AC4 utilization category.

**2.2 MANUAL MOTOR STARTERS**

- .1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  - .1 Switching mechanism, quick make and break.
  - .2 One overload heater, manual reset, trip indicating handle.
- .2 Accessories:
  - .1 Toggle Key switch: standard labelled as indicated.
  - .2 Indicating light: standard type and colour as indicated.
  - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

**2.3 FULL VOLTAGE MAGNETIC STARTERS**

- .1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3 Wiring and schematic diagram inside starter enclosure in visible location.
  - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Independent locking of enclosure door.
  - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:



- .1 Selector switches: standard labelled as indicated.
- .2 Indicating lights: standard type and color as indicated.
- .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

**2.4 CONTROL TRANSFORMER**

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 24VDC secondary, complete with secondary fuse, installed in with starter as required.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

**2.5 ACCESSORIES**

- .1 Pushbutton: heavy duty, oil tight as required.
- .2 Selector switches: heavy duty, oil tight as required.
- .3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

**2.6 FINISHES**

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results for Electrical.

**2.7 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install starters and control devices in accordance with manufacturer's instructions and mechanical controls requirements.
- .2 Install and wire starters and controls as indicated.
- .3 Ensure correct fuses installed.
- .4 Confirm motor nameplate and adjust overload device to suit.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and manufacturer's instructions.
- .2 Operate switches and contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

**3.3 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 27 26 – Wiring Devices

**1.2 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 C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 Canadian Standards Association (CSA International)
- .4 Underwriters' 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, 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 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.

**1.4 QUALITY ASSURANCE**

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

**1.5 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 Divert unused metal materials from landfill to metal recycling facility.
- .4 Disposal and recycling of fluorescent lamps as per local regulations.

**Part 2 Products**

**2.1 LAMPS**

- .1 Incandescent lamps not to be used within the project scope.
- .2 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80; or as indicated.
- .3 LED Lamps, CRI 80, 50,000 hour lamp life LM 70 Rated, Colour temperature as noted on fixture schedule.

**2.2 BALLASTS**

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.
  - .1 Rating: 120V, 60 Hz, 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 Ballast factor: greater than 0.90.
  - .8 Sound rated: Class A.
  - .9 Mounting: integral with luminaire.
- .2 LED ballast:
  - .1 Rating: voltage as indicated 120 V, 60 Hz, matched to LED Lamp wattage.
  - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
  - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
  - .4 Harmonics, 10% maximum THD.
  - .5 Input voltage range: plus or minus 10% of nominal.
  - .6 Minimum starting temperature: minus 30 degrees Celsius at 90% line voltage.
  - .7 Mounting: integral with luminaire.
  - .8 Current crest factor: 1.7 maximum current.

**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**

- .1 As indicated in luminaire schedule on drawings.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Locate and install luminaires as indicated.
- .2        Provide adequate support to suit ceiling system.

**3.2                WIRING**

- .1        Connect luminaires to lighting circuits:
  - .1        Install flexible or rigid conduit for luminaires as required.

**3.3                LUMINAIRE ALIGNMENT**

- .1        Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2        Align luminaires mounted individually parallel or perpendicular to building grid lines.

**3.4                CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 27 26 – Wiring Devices

**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 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.

**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: 12V 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'.
- .10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 6 W, minimum 400 lumen minimum output.
- .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 Test switch.

**2.2 WIRING OF REMOTE HEADS**

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized in accordance with manufacturer's recommendations for appropriate voltage drop and amperage.

**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 emergency lighting 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 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.

**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.

**3.4 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**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 21 – Wires and Cables (0-1000V)
- .3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
  - .2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 101-2006, Life Safety Code.

**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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures

**Part 2 Products**

**2.1 STANDARD UNITS**

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.
- .3 Face, back plates: cast aluminum alloy.
- .4 Lamps: LED-2W, over 50,000 hours with lumen output as required by local codes.
- .5 Operation: designed for over 100,000 hours of continuous operation without relamping.
- .6 Pictograph: 150 mm high x 300 mm, white on green glass, with directional arrows as indicated
- .7 Face plate to remain captive for relamping.
- .8 Mounting as indicated on drawings.

**2.2 SELF-POWERED UNITS**

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.
- .3 Face, back plates: cast aluminum alloy.
- .4 Lamps: LED-2W, over 50,000 hours with lumen output as required by local codes.
- .5 Operation: designed for over 100,000 hours of continuous operation without relamping.
- .6 Pictograph: 150 mm high x 300 mm, white on green glass, with directional arrows as indicated
- .7 Face plate to remain captive for relamping.
- .8 Mounting as indicated on drawings.
- .9 Supply voltage: 120 V, ac.
- .10 Output voltage: 12 V dc.
- .11 Operating time: 30 minutes minimum.
- .12 Recharge time: 12 hours
- .13 Battery: sealed, maintenance free.
- .14 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
- .15 Solid state transfer circuit.
- .16 Signal lights: solid state, for 'AC Power ON' condition.
- .17 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.
  - .1 Removable or hinged front panel for easy access to batteries.
- .18 Cabinet: finish: white
- .19 Auxiliary equipment:
  - .1 Test switch.

**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 exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

**3.3 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 RELATED REQUIREMENTS**

- .1 Section 26 05 28 – Grounding - Secondary

**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 communications equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect communications equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 TELEPHONE SYSTEMS**

- .1 Ground wire: 1 No. 6 AWG stranded annealed copper conductor with polyvinyl chloride insulation designed for ground connections to protect cable terminals and protectors.

**2.2 COAXIAL CABLES FOR TELEVISION CABLE SYSTEMS**

- .1 Foam-dielectric coaxial cable designed for distribution cable in CATV system: center conductor No. 10 AWG solid copper, insulation of foam (expanded) polyethylene and outer conductor of aluminum without protective covering.
- .2 Coaxial drop wire: centre conductor No. 16 AWG copper-covered steel, polypropylene foam insulation, medium density polyethylene skin, two longitudinal drain wires for shielding continuity, outer conductor and shield of polyolefin-coated aluminum tape, and outer jacket of polyvinyl chloride, designed for use between distribution cables.

**2.3 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communications 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.

**2.4 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.

**2.5 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 27 05 13 – Communication Services
- .3 Section 27 10 05 – Structured Cabling for Communication Systems

**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 communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect communication raceway systems from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 SYSTEM DESCRIPTION**

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, distribution cabinets, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

**2.2 MATERIAL**

- .1 Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Underground cable ducts: PVC DB2 type
- .3 Outlet boxes FS type, off-white plastic faceplate, conduit box sizes as required, and fittings: in accordance with Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
- .4 Fish wire: polypropylene type.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems 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 Departmental Representative.

**3.2 INSTALLATION**

- .1 Install empty raceway system, including overhead distribution system, fish wire, terminal cabinets, outlet boxes, pull boxes, cover plates, conduit, sleeves and caps, miscellaneous and positioning material to constitute complete system.

**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.

**3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

**END OF SECTION**

**Part 1 General****1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 28 – Grounding - Secondary

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).

**1.3 DEFINITIONS**

- .1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: copper interconnect, distribution, and breakout cables.

**1.4 SYSTEM DESCRIPTION**

- .1 Structured telecommunications wiring system consist of unshielded-twisted-pair and UTP cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.
- .2 Installed in physical star configuration with separate horizontal and backbone sub-systems.
  - .1 Horizontal cables link suites to electrical closet located on main floor.
  - .2 Electrical closet links to main electrical room by backbone cables.

**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 As-built Records and Drawings:
  - .1 Provide electronic drawings in AutoCAD 2004 format depicting all construction.
  - .2 Provide two (2) bound complete hard-copy sets of as-built records to the Departmental Representative.
    - .1 Provide and place one hard copy of as-built records for each telecommunications room in plan holder in each telecommunications room.

**1.6 QUALITY ASSURANCE**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.



**Part 2 Products****2.1 FOUR-PAIR 100  $\Omega$  BALANCED TWISTED PAIR CABLE**

- .1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT4 to: CSA-C22.2 No. 214, Enhanced Category 5 (Cat 5e) to: TIA/EIA-568-B.2.

**2.2 MULTI-PAIR 100  $\Omega$  BALANCED TWISTED PAIR CABLE**

- .1 100 ohm, 50 pairs, sheath consists of thermoplastic jacket with underlying metallic shield, Category 3 to: TIA/EIA-568-B.2, flame test classification FT4 to: CSA-C22.2 No. 214.

**2.3 SUITE UTP 4-PAIR MODULAR JACK**

- .1 Eight-position modular jack ("RJ-45"), type T568A Category 5e to: TIA/EIA-568- B.2:
  - .1 Mounted in compatible single gang faceplate, flush entry, jacks as indicated

**2.4 TERMINATION AND CROSS-CONNECTION HARDWARE FOR UTP**

- .1 IDC Terminal strips, 25 pair, for terminating 4 pair 100  $\Omega$  balanced twisted pair cables and supporting cross-connections using jumper wires or compatible plug-ended patch cords: Category 5e to: TIA/EIA-568-B.2.
- .2 Mount or block for housing 10 IDC terminal strips, mounted on wall.

**Part 3 Execution****3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE**

- .1 Install termination and cross-connect hardware on wall in electrical closet as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-A.

**3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES**

- .1 Install horizontal cables as indicated in conduit from electrical closet to suite data junction box locations as indicated. Identify and label as indicated to: TIA/EIA-606-A.
- .2 Support horizontal cables at intervals not exceeding 2 metres.
  - .1 Where raceways are used to distribute cables to each zone, provide supplementary "J" hooks to support cables at intervals not exceeding 2 metres.
- .3 Terminate horizontal cables in suite data junction box room and at suite jacks as indicated.
  - .1 Identify and label as indicated to: TIA/EIA-606-A.

**3.3 FIELD QUALITY CONTROL**

- .1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as electronic record on USB.

- .1 Perform tests for Permanent Link on installed cables, including spares:
  - .1 Category 5e using certified level IIe tester to: TIA/EIA-568-B.1.
- .2 Perform tests for Channel on 20% of cross-connected data horizontal cabling installed from the electrical closet, including shortest and longest drops: should more than 5% of tested cables fail, test remaining cross-connected data cables.
  - .1 Category 5e using certified level IIe tester to: TIA/EIA-568-B.1.

**END OF SECTION**

**Part 1 General**

**1.1 INTENT**

- .1 Provide a complete door access control system with door position sensors, magnetic readers to sense door open positions, FOB card access, wiring for electric lock door handles, and a central system on all exterior access doors. This system will restrict access to the interior of the building utilizing FOB card access or remote trigger. Additionally, it will dial out in the case of intruders accessing the building without permission.

**1.2 RELATED REQUIREMENTS**

- .1 Section 08 16 13 – Fiberglass Doors
- .2 Section 08 71 00 – Door Hardware
- .3 Section 26 05 00 – Common Work Results for Electrical
- .4 Section 26 05 21 – Wires and Cables (0-1000V)
- .5 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
- .6 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings
- .7 Section 28 13 28 – Building Entrance Control System
- .8 Section 28 31 00 – Fire Detection and Alarm

**1.3 REFERENCES**

- .1 Abbreviations:
  - .1 Electronic Access Control (EAC): control of people through entrances and exits of controlled area. Security utilizing hardware systems and specialized procedures to control and monitor movements within a controlled area.
- .2 Reference Standards:
  - .1 Underwriters' Laboratories (UL)
    - .1 UL 294-2009, Access Control System Units.

**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 access controls and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit:
    - .1 Functional description of equipment.
    - .2 Technical data for all devices.
    - .3 Device location plans and cable lists.
    - .4 Devices mounting location detail drawings.
    - .5 Typical devices connection detail drawings.

- .3 Shop Drawings:
  - .1 Shop drawings to indicate project layout, including details.
    - .1 Shop drawings to indicate, mounting heights and locations, wiring diagrams.
    - .2 Submit zone layout drawing indicating number and location of zones and areas covered.
    - .3 Submit wiring diagrams.
    - .4 Submit complete equipment list.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .1 Submit ULC/UL Product Safety Certificates.
  - .2 Submit verification Certificate that service company is ULC/UL List alarm service company.
  - .3 Submit verification Certificate that monitoring facility is ULC/UL "Listed central station".
  - .4 Submit verification Certificate that security access system is "Certified alarm system".
- .5 Test and Evaluation Reports:
  - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .7 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

## **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 access controls and equipment for incorporation into manual.
  - .1 Include:
    - .1 System configuration and equipment physical layout.
    - .2 Functional description of equipment.
    - .3 Instructions of operation of equipment.
    - .4 Illustrations and diagrams to supplement procedures.
    - .5 Operation instructions provided by manufacturer.
    - .6 Cleaning instructions.

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

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

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect access controls and equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **1.7 WARRANTY**

- .1 For access control equipment, the 12 month warranty period prescribed in subsection GC 32.1 of General Conditions is extended to 60 months.
- .2 Manufacturer's Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Design Criteria:
  - .1 Design access control and security access systems using only ULC/UL listed products.
  - .2 Design system as type: central.
  - .3 Design access control systems to meet safety requirements to UL 294.
  - .4 Design system to provide door manual and automatic control functions from locations indicated to central monitoring system.
  - .5 Design system to consist of homed run control to activation unit connections.
  - .6 Each activation unit must have door panel control function/equipment item located as indicated.
  - .7 Design system to provide ease of operation, servicing, maintenance, testing and expansion of additional services.
  - .8 Door activation units:
    - .1 Fully complement and function and match door manufacturer's magnetic controls and hardware.
    - .2 Fully function with OEM supplied door controls and hardware to activate system in routine and emergency conditions.
    - .3 Fully function within supplied electrical supervision circuits as specified.
  - .9 Control Panel:
    - .1 Fully compatible, compliment and operate door magnets provided by door manufacturer of system or OEM supplied door operating hardware.
    - .2 Complete with push button or electronic key pad to release and secure each door.

- .3 Identify each door control function with lamp electronically identified on panel or associated display unit.
- .4 Permanently label (paper labels are not acceptable) or electronically identified each door location on panel or associated display unit.
- .5 Fully function within supplied electrical supervision circuits as specified.
- .10 Control Signal Standards:
  - .1 Input and Output Signal: 0.0 dBmV + 1.0 dBmV Level.
  - .2 Input and Output Signals: terminated on each control unit.
  - .3 Input and Output Impedance: 120 Ohms, BAL.
  - .4 Channel Bandwidth:
    - .1 Data: 300 Hz to 3.5 kHz (9.6 kilo bits per second rate).
    - .2 DC: 0.5 Hz to 100 Hz, + 5.0%, MIN.
  - .5 S/N Ratio: 60 dBmV + 1.0 dBmV.
- .11 Intercom System:
  - .1 Interconnected to building entrance control system, as described in section 28 13 28.
- .2 Door controls items and panels:
  - .1 Include standard "off the shelf" equipment items to form a complete and operating DRS system.
  - .2 Include: equipment cabinet, AC power strips, system power supply, junction box, door activation units, electronic supervising master panel, system connectors, and system cables.
- .3 Provide system cables including coaxial cable, multiconductor control cable, audio and AC power cable required.
- .4 Power supplies: to CAN/ULC-S318.
- .5 Connectors and switches: to ULC-C634.
- .6 Basic System Criteria:
  - .1 Card readers:
    - .1 Type: proximity.
    - .2 Quantity of card readers required: 2.
    - .3 Proximity technology.
    - .4 Fitted with LED indicator light.
    - .5 Reading distance 50 - 200 mm.
    - .6 Compatible with access card model.
  - .2 Cards: key tag, plastic, credit card size, sealed and highly resistant to normal handling and weather, fitted with vertical slot punched hole.
    - .1 Quantity of cards required: 200.
    - .2 Guaranteed for 5 years against all defects and protected against:
      - .1 Magnetic encoded cards.
      - .2 Metal objects including coins and keys.

- .3 Retail shoplifting detection equipment.
      - .4 Communication equipment.
    - .3 Coding:
      - .1 Designed with highly secure codification of card information.
      - .2 Card life: minimum period of 10 years for cards in same family.
      - .3 Use 1 series of cards for all areas protected by access control system.
  - .3 Quantity of alarm monitoring points required: 5
  - .4 Quantity of outputs required: 2.
  - .5 Number of access levels (assigned to cardholders): 1
  - .6 Operating system: Windows 7
  - .7 Connection: networked
  - .8 Language: Bilingual.
  - .9 Off-site monitoring of alarm conditions.
- .7 Accessory Software Features:
  - .1 Time and attendance reporting.
  - .2 Features:
    - .1 CCTV integration.
    - .2 Intrusion integration.
    - .3 Building entrance control system integration.
    - .4 Fire Detection integration. In the case of a stage 1 alarm, all doors to be released until alarm subsides.
- .8 System Accessories:
  - .1 Door position switches:
    - .1 19 mm diameter suitable for mounting in residential fiberglass door and frame
    - .2 Normally closed switch (SPST) suitable for 24 VDC
    - .3 Sensing range of 12 to 18 mm
  - .2 Power supplies:
    - .1 Continuous low-voltage operation output.
    - .2 Equipped with secondary protection for each output.
    - .3 Individual outputs for connection of devices.
    - .4 AC power failure output.
    - .5 DC power failure output and low battery output.
    - .6 Fitted with tamper contact.
    - .7 Wall mounted cabinet with locked door complete with 2 keys.
  - .3 Voltage: 24 volt DC.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1      Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for access control system 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: SECURITY ACCESS**

- .1      Install security access systems and components in accordance with CAN/ULC-S302.
- .2      Install components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .3      Install and interconnect electric door hardware for secure doors as provided by other areas of this contract.
- .4      Install components secure to walls, ceilings or other substrates.
- .5      Install required boxes in inconspicuous accessible locations.
- .6      Install two (2) category 5e cables from the security access panel to the main telephone demark for phone and remote access.
- .7      Conceal conduit and wiring.

**3.3                SITE TEST AND INSPECTION**

- .1      Perform verification inspections and test in presence of Departmental Representative.
  - .1      Provide all necessary tools, ladders and equipment.
  - .2      Ensure appropriate subcontractors , and manufacturer's representatives are present for verification.
- .2      Pretesting procedure:
  - .1      Verify (utilizing an approved spectrum analyzer and test equipment) that system is fully operational and meets all system performance requirements of this specification.
  - .2      Measure and record, control (and/or voice) carrier levels of every system channel at each of following points in the system:
    - .1      Door control panel functions.
    - .2      Electronic supervisory control units inputs and outputs.
    - .3      Distribution system input and output.
    - .4      Telephone system interface input and output.



- .3 Submit to Departmental Representative 2 copies of recorded system pretest measurements, along with pretest certification.
- .3 Performance testing:
  - .1 Test procedure: perform test on a "go-no-go" basis.
    - .1 Make only operator adjustments required to show proof of performance.
    - .2 Test to demonstrate and verify that installed system complies with installation and technical requirements of this specification under operating conditions.
    - .3 Test results to be evaluated by Departmental Representative as either acceptable or unacceptable using following procedures.
  - .2 Documentation review:
    - .1 This review will determine if information provided is sufficient to meet requirements of this specification.
    - .2 Provide for review all System manuals, as installed drawings, pretest forms, equipment cabinet pictorial, video and audio equipment details.
  - .3 Mechanical inspection:
    - .1 Departmental Representative and Contractor to tour areas to insure that Systems and Subsystems are installed in place for proof of performance testing.
    - .2 Take system inventory at this time. Verify following items before beginning proof of performance tests:
      - .1 Electrical power circuits designated for system equipment are properly labeled, wired, phased, protected and grounded.
      - .2 Conductor ends are protected by heat shrink wrap; audio spade lugs, barrier strips and punch blocks are used.
      - .3 Dust, debris, solder splatter, etc. are cleaned and removed from site.
      - .4 Equipment is properly labelled.
      - .5 Equipment identified in system's equipment lists are in-place and properly installed.
      - .6 Each lightning and System ground method are installed in accordance with manufacturer's instructions and this specification.
- .4 Subsystem functional test:
  - .1 Conduct operational testing after review of documentation and mechanical inspection completed. Proceed as follows.
    - .1 Perform operational test of each Subsystem to verify that all equipment is properly connected, interfaced and is functionally operational to meet requirements of this specification.
  - .2 Control units:
    - .1 Take S/N readings from control unit's input and output in manual (and/or automatic) mode. Check output of DC/Data converter for S/N. Evaluate

- entire signal quality at baseband connector output of control unit and remote equipment.
- .3 Distribution (or interface) system:
  - .1 Check each door utilizing a volt/ohm (or signal level) meter to confirm each function and to insure that system meets all performance requirements.
  - .2 Test each interconnection point (i.e.: door unit, junction box "cross connection", control unit, etc.) to ensure compliance with this specification.
- .4 Total system test:
  - .1 Proceed with testing when system and subsystems are functionally tested and accepted. Total system tests to verify that requirements have been met for DC (and/or audio), sub carrier, and control signals in accordance with this specification.
- .5 Safety:
  - .1 Demonstrate with documentation that access control system meets safety requirements specified in UL 294.
- .5 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
  - .1 Sturdiness of equipment fastening.
  - .2 Non-existence of installation related damages.
  - .3 Compliance of device locations with reviewed shop drawings.
  - .4 Compatibility of equipment installation with physical environment.
  - .5 Inclusion of all accessories.
  - .6 Device and cabling identification.
  - .7 Application and location of ULC approval decals.
- .6 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
  - .1 Validate sensitivity of readers and applicability and application of cards.
  - .2 Connecting joints and equipment fastening.
  - .3 Compliance with manufacturer's specification, product literature and installation instructions.
- .7 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
  - .1 Operation of each device individually and within its environment.
  - .2 Operation of each device in relation with programmable schedule and or/specific functions.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer Services:
  - .1 Manufacturer of products, supplied under this Section, to review Work involved in the 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:
  - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.
  - .2 Submit 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 Ensure manufacturer's representative is present before and during testing.
  - .4 Schedule site visits to review Work at stages listed:
    - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
    - .2 Twice during progress of Work at 25% and 60% complete.
    - .3 Upon completion of Work, after cleaning is carried out.

### **3.5 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.
  - .1 Remove protective coverings from accessories and components.
  - .2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.
  - .3 Clean components free from dirt and fingerprints.

### **3.6 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 INTENT**

- .1 Provide a complete intercom entrance system to allow guests to call up to tenants for permission to enter through the secure door access into the secure interior of the estate. The intercom system will allow for select tenant calling to a designated phone number in the addition to allowing the tenant to select a key press sequence to unlock the front entrance.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 27 10 05 – Structured Cabling for Communication Systems
- .3 Section 28 13 00 – Access Control

**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 building entrance control systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings and schematics stamped and signed by professional engineer registered or licensed in the Province of Alberta, Canada.

**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 building entrance control systems for incorporation into manual.
- .3 Include description of system operation.
- .4 Include parts list, using component identification numbers standard to electronics industry.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect building entrance control systems from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 SYSTEM DESCRIPTION**

- .1 Building entrance control system:
  - .1 Caller pushes button on building entrance panel to call tenant based on identification number on panel directory.
  - .2 Identification number links to a programmable phone number for the applicable tenant.
  - .3 Intercom dialer calls the number (cellphone or landline) and the tenant may answer the call to converse with the caller.
  - .4 Tenant may operate button on phone to release building entrance door magnetic lock to admit caller.

### **2.2 BUILDING ENTRANCE PANEL**

- .1 Control and communication panel at building entrance location as indicated.
  - .1 Enclosed, flush mounting.
  - .2 25 pushbuttons, engraved nameplates behind vandal proof transparent cover, quantity and engraving as provided by the Departmental Representative.
  - .3 Buzzer.
  - .4 Adjustable volume control.
  - .5 Solid state controls.
  - .6 Power supply: input 120 V, output 24 V.
  - .7 Amplifier.
  - .8 Integral type handset
  - .9 Panel finish: stainless steel
  - .10 Dialer
- .2 Tenant directory to be paper or touch screen.

### **2.3 DOOR OPENER**

- .1 Door unlock indication: buzzer.
- .2 Electric strike door opener front and rear for controlled building entrance doors, reversible for left or right hand doors. Materials: compatible with door load.

### **2.4 SUITE STATIONS**

- .1 Tenants personal telephone units.

**2.5 ADDITIONAL FEATURES**

- .1 Post office lock door operation.
- .2 Video feed to site cable system
- .3 Superintendent calling.
- .4 Door open indicating buzzer.
- .5 Voice switching.
- .6 Emergency paging.
- .7 Security alarm.
- .8 Panel alarm.
- .9 Signalling to office.
- .10 Off site property management/superintendent calling.
- .11 Keyless entry codes.
- .12 Programmable door unlock timer on main entry panel.
- .13 Distinctive ring in suites.
- .14 System/readers.

**2.6 COMMUNICATION CONDUCTORS**

- .1 Type RW90, in accordance with Section 26 05 00 - Common Work Results for Electrical.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for building entrance control system 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 Install system in accordance with manufacturer's instructions.
- .2 Connect system to emergency power.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

- .2 Perform intelligibility tests.

**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 building entrance control system installation.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for fire alarm systems.
  - .2 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
  - .3 Trouble signal devices.
  - .4 Power supply facilities.
  - .5 Manual alarm stations.
  - .6 Automatic alarm initiating devices.
  - .7 Audible signal devices.
  - .8 End-of-line devices.
  - .9 Visual alarm signal devices.
  - .10 Ancillary devices.
- .2 Related Requirements
  - .1 Section 26 05 00 – Common Work Results for Electrical
  - .2 Section 26 05 21 – Wires and Cables (0-1000V)
  - .3 Section 26 05 28 – Grounding – Secondary
  - .4 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
  - .5 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

**1.2 REFERENCES**

- .1 Government of Canada
  - .1 TB OSH Chapter 3-03, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
  - .2 TB OSH Chapter 3-04, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems.
  - .2 CAN/ULC-S525, Audible Signal Device for Fire Alarm Systems.
  - .3 CAN/ULC-S526, Visual Signal Devices for Fire Alarm Systems.
  - .4 CAN/ULC-S528, Manual Pull Stations for Fire Alarm Systems.
  - .5 CAN/ULC-S529, Smoke Detectors for Fire Alarm Systems.
  - .6 CAN/ULC-S530, Heat Actuated Fire Detectors for Fire Alarm Systems.
  - .7 CAN/ULC-S531, Standard for Smoke Alarms.



- .3 National Fire Protection Agency
  - .1 NFPA 72-2002, National Fire Alarm Code.

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

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.
    - .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 Shop drawings: stamped and signed by professional engineer registered or licensed in the Province of Alberta, Canada.
    - .2 Include:
      - .1 Layout of equipment.
      - .2 Zoning.
      - .3 Complete wiring diagram, including schematics of modules.
- .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.
  - .3 Manufacturer's Field Reports: manufacturer's field reports specified.
- .4 Closeout Submittals:
  - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.
  - .2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.
  - .3 Submit to Authority of Jurisdiction 2 sets of approved submittals and drawings immediately after approval but no later than 15 working days to prior to final inspection.
  - .4 Submit following:
    - .1 Manufacturer's Data for:
      - .1 Control panel and modules.
      - .2 Storage batteries.
      - .3 Battery charger.
      - .4 Manual pull stations.
      - .5 Heat detectors.
      - .6 Open-area smoke detectors.

- .7 Duct smoke detectors.
- .8 Alarm horns.
- .9 Visible appliances.
- .10 Main annunciator.
- .11 Valve tamper switches.
- .12 Wiring.
- .13 Ground rods.
- .14 Conduit.
- .15 Outlet boxes.
- .16 Fittings for conduit and outlet boxes.
- .17 Trouble buzzer.
- .18 Surge suppression devices.
- .19 Mark data which describe more than one type of item to indicate which type will be provided.
- .20 Submit 1 original for each item and clear, legible, first-generation photocopies for remainder of specified copies.
- .2 System wiring diagrams:
  - .1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.
  - .2 Show modules, relays, switches and lamps in control panel.
- .3 Design data: Power Calculations:
  - .1 Submit design calculations new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.
  - .2 Show comparison of detector power requirements per zone versus control panel smoke detector power output per zone in both standby and alarm modes.
  - .3 Show comparison of notification appliance circuit alarm power requirements with rated circuit power output.
- .4 Schedules:
  - .1 Conductor wire marker schedule.
- .5 Test Reports:
  - .1 Open-area 2-wire smoke detectors.
  - .2 Preliminary testing:
    - .1 Final acceptance testing.
    - .2 Submit for inspections and tests specified under Field Quality Control.

## **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: company or person specializing in fire alarm system installations approved by manufacturer with 3 documented experience.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
- .3 System:
  - .1 To TB OSH Chapter 3-04.
  - .2 Subject to Fire Commissioner of Canada (FC) approval.
  - .3 Subject to FC inspection for final acceptance.
- .4 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .5 Maintenance Service:
  - .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

## **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.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Power supply: to CAN/ULC-S524.
- .3 Audible signal devices: to CAN/ULC-S525.
- .4 Visual signal devices: to CAN/ULC-S526.
- .5 Control unit: to CAN/ULC-S527.
- .6 Manual pull stations: to CAN/ULC-S528.
- .7 Thermal detectors: to CAN/ULC-S530.

- .8 Smoke detectors: to CAN/ULC-S529.
- .9 Smoke alarms: to CAN/ULC-S531.

## **2.2 SYSTEM OPERATION**

- .1 Provide complete, electrically supervised, code 3 temporal common coded, manual and automatic, zoned, annunciated, fire alarm system.
- .2 Provide separate circuits from control panel to each zone of initiating devices. Transmission of signals from more than one zone over common circuit to control panel is prohibited.
- .3 Single stage operation. Operation to actuation following:
  - .1 Manual station.
  - .2 Heat detector.
  - .3 Smoke detector.
  - .4 Automatic fire sprinkler system.
  - .5 Fire standpipe system.
- .4 Actuation of single operation device to initiate following:
  - .1 Building evacuation alarm devices to operate continuously.
  - .2 Transmit signal to fire department via fire alarm transmitter via telecommunications.
  - .3 Zone of alarm device to be indicated on control panel.
  - .4 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.
  - .5 Electro-magnetic security door holders to de-energize.
  - .6 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.
- .5 Capability to program smoke detector status change confirmation on any or zones in accordance with CAN/ULC-S527, Appendix C.

## **2.3 CONTROL PANEL**

- .1 Class A.
- .2 Single stage operation.
- .3 Zoned.
- .4 Coded.
- .5 Enclosure:
  - .1 CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.
  - .2 Provide modular type panel installed in flush mounted steel cabinet with hinged door and cylinder lock.
  - .3 Mount with panel centerline 1.5 m above finished floor elevation.
  - .4 Switches and other controls: not accessible without use of key.

- .5 Design of control panel: neat, compact assembly containing parts and equipment required to provide specified operating and supervisory functions of system.
- .6 Control panel components: CSA approved and approved by control panel manufacturer for use in control panel.
- .7 Panel cabinet: finished on inside and outside with factory-applied enamel finish.
- .8 Provide main annunciator located on exterior of cabinet door or visible through cabinet door.
- .9 Provide audible trouble signal.
- .10 Provide rigid plastic identification plates, silk-screened labels attached to rear face of panel viewing window, for lamps and switches.
- .11 Provide 1 set of Form C dry alarm contacts per zone, common system Form C dry alarm contact, and common system Form C dry trouble contact.
- .12 Permanently label switches.
- .13 Provide panel with following switches:
  - .1 Trouble silencing switch which silences audible trouble signals including remote trouble device without extinguishing trouble indicating lamp(s).
    - .1 For non-self-resetting type switch: Upon correction of trouble condition, audible signals will again sound until switch is returned to its normal position.
    - .2 For silencing switch of momentary action self-resetting type: trouble signal circuit automatically restored to normal upon correction of trouble condition.
  - .2 Evacuation alarm silencing switch which when activated will silence alarm notification appliances without resetting panel, and cause operation of system trouble signals. Subsequent alarm(s) from additional zone(s) not originally in alarm to cause activation of notification appliances even with alarm silencing switch in "silenced" position.
  - .3 Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of system and zone trouble signals.
  - .4 Reset switch which when activated will restore the system to normal standby status after cause of alarm has been corrected, and activated initiating devices reset.
    - .1 Operation of reset switch to restore activated smoke detectors to normal standby status.
  - .5 Lamp test switch.
  - .6 Drill switch which will enable test of notification appliances and restoration to normal without tripping master box.
  - .7 Master box disconnect switch which when activated will disconnect coded device and cause operation of system trouble signal.
  - .8 HVAC shutdown bypass switch. Operation of the switch to allow HVAC system to operate with detectors in alarm and cause operation of system trouble signals.

- .6 Supervised, modular design with plug-in modules:
  - .1 Alarm receiver with trouble and alarm indications for class A initiating circuit.
  - .2 Spare zones: compatible with smoke detectors and open circuit devices.
  - .3 Space for future modules.
  - .4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.
- .7 Components:
  - .1 Coded alarm receiver panel with trouble and alarm indications for class A initiating circuit.
  - .2 Single stage alarm pulse rate panels:
    - .1 Single stroke control type for output to signal control panel continuously.
  - .3 Audible signal control panel with control circuits complete with terminals for wiring and plug-in modules for dc signals up to 2.0 A load with trouble indication with class A connections.
  - .4 Common control and power units:
    - .1 Control panel containing following indications and controls:
      - .1 "Power on" LED (green) to monitor primary source of power to system.
      - .2 "Power trouble" indication.
      - .3 "Ground trouble" indication.
      - .4 "Remote annunciator trouble" indication.
      - .5 "System trouble" indication.
      - .6 "System trouble" buzzer and silence switch c/w trouble resound feature.
      - .7 System reset switch.
      - .8 "LED test" switch if applicable.
      - .9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.
      - .10 "Signals silenced" indication.
    - .2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.
    - .3 Fire department connections:
      - .1 Plug-in module for tripper type municipal box.
      - .2 Fire department bypass switch c/w indicator for trouble at panel.
  - .5 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.
    - .1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.
    - .2 Contact terminal size: capable of accepting 22-12 AWG wire.
  - .6 Passive monitoring to ULC standards: one telephone hard line dialer and one cellular dialer

**2.4 POWER SUPPLY**

- .1 120 V, ac, 60 Hz input, 24 V dc output from rectifier to operate alarm and signal circuits, with standby power of gell cell batteries minimum expected life of 4 years, sized in accordance with NBC.

**2.5 MANUAL ALARM STATIONS**

- .1 Provide non-coded single action type with mechanical reset features.
  - .1 Non-coded single pole normally open contact for single stage.
  - .2 General alarm key switch for two stage system.
- .2 Stations: semi-flush mounted and interior type as indicated.
  - .1 For surface mounting provide station manufacturer's approved back box.
  - .2 Back box finish to match station finish.
- .3 Equip each station with terminal strip with contacts of proper number and type to perform functions required.
- .4 Stations: type not subject to operation by jarring or vibration.
  - .1 Break-glass-front stations are not permitted
- .5 Station colour: red.
- .6 Provide station with visible indication of operation.
- .7 Restoration to require use of key.
  - .1 Keys: identical throughout system for stations and control panel(s).
- .8 Mount stations with operating lever not more than 1.2 m above finished floor.

**2.6 AUTOMATIC ALARM INITIATING DEVICES**

- .1 Heat detectors: provide heat detectors designed for detection of fire by combination fixed temperature rate-of-rise principle.
- .2 Combination Fixed Temperature Rate-Of-Rise Detectors (Spot Type): designed for semi-flush outlet box mounting and supported independently of conduit, tubing or wiring connections.
  - .1 Contacts: self-resetting after response to rate-of-rise actuation
  - .2 Operation under fixed temperature actuation to result in external indication.
  - .3 Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes to operate on fixed temperature principle only.
- .3 Open-Area Smoke Detectors: provide detectors designed for detection of abnormal smoke densities by photoelectric principle.
  - .1 Detectors: 2-wire type.
  - .2 Provide necessary control and power modules required for operation integral with control panel.
  - .3 Detectors and associated modules: compatible with control panel and suitable for use in supervised circuit.

- .4 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.
- .5 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.
- .6 Provide remote indicator lamps for each detector that is concealed from view.
- .7 Each detector: plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.
- .8 Detector head: removable from its base without disconnecting wires. Removal of detector head from its base to cause activation of system trouble signals.
- .9 Screen each detector to prevent entrance of insects into detection chamber(s).
- .4 2-Wire Smoke Detectors: detector circuits of 2-wire type capable of transmitting detector operating power over initiating circuit are permitted, provided detectors used are approved by control panel manufacturer for use with control panel provided and are ULC listed as being compatible with control panel.
  - .1 Total number of detectors on any detection circuit: not exceed 80% of maximum number of detectors allowed by control panel manufacturer for that circuit. Provide additional zones if required to meet this requirement.
- .5 Photoelectric Detectors: operate on light scattering principle using LED light source.
  - .1 Detector: respond to both flaming and smoldering fires.
- .6 Locate detectors in accordance with their listing by ULC and the requirements of NFPA 72, except provide at least 2 detectors in rooms of 54 square meters or larger in area.
- .7 Mount detectors at underside of ceiling or deck above unless otherwise indicated.
  - .1 For mounting heights greater than 3 m above floor level, reduce actual detector linear spacing from listed spacing as required by NFPA 72.
  - .2 For heights greater than 9 m space detectors no farther apart than 34% of their listed spacing.
- .8 Temperature rating of detectors: in accordance with NFPA 72.
- .9 Locate detectors minimum 300 mm to lighting fixtures and not closer than 600 mm to air supply or return diffuser.
- .10 Ensure detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, are approved for such locations.
- .11 Provide detectors with terminal screw type connections.
- .12 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.

## **2.7 ALARM INITIATING DEVICE SPACING AND LOCATION**

- .1 Detector spacing and location: in accordance with manufacturer's recommendations and requirements of NFPA 72.
- .2 Provide at least 2 detectors in rooms of 54 square meters or larger.



- .3 Spacing: not to exceed 9 m by 9 m per detector, and 9 linear m per detector along corridors.
- .4 Locate detectors minimum 0.9 m from air discharge or return grille, and not closer than 300 mm to lighting fixtures.
- .5 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.
- .6 Mount detectors installed beneath raised floors with base within 50 mm of underside of raised floor, with detector facing downward.
  - .1 Where space under raised floor is less than 300 mm in height, mount detectors with their bases either horizontal or vertical, with detection chamber(s) located in upper half of underfloor space.
  - .2 Do not mount detectors facing upward.

## **2.8 DUCT SMOKE DETECTORS**

- .1 Provide detectors installed in ducts of photoelectric type and listed by ULC duct installation.
- .2 Provide integral control and power modules required for operation with main control panel.
- .3 Ensure detectors and associated modules are compatible with main control panel and suitable for use in supervised circuit.
- .4 Detector circuits: 4-wire type where detector operating power is transmitted over conductors separate from initiating circuit. Malfunction of electrical circuits to detector or its control or power modules to cause operation of system trouble signals.
- .5 Provide a separate, fused power circuit for each smoke detection initiating circuit.
- .6 Failure of power circuit: indicated as a trouble condition on corresponding initiating circuit.
- .7 Provide duct detectors in accordance with NFPA 90A.
- .8 Provide duct detectors with approved duct housing, mounted exterior to duct, with perforated sampling tubes extending across width of duct.
- .9 Activation of duct detectors to cause shutdown of associated air handling unit annunciation at control panel and tripping of master box and sounding of building evacuation alarms.
- .10 Provide detectors with visible indicator lamp that flashes when detector is in normal standby mode and glows continuously when detector is activated.
- .11 Provide remote indicator lamp for each detector.
- .12 Permanently label remote indicator with description of associated air handling unit(s).
- .13 Provide each detector with remote test switch. Mount switch not more than 1.8 m above finished floor.
- .14 Permanently label test switch with description of associated air handling unit(s).

## **2.9 AUDIBLE SIGNAL DEVICES**

- .1 Provide remote system trouble buzzer arranged to operate in conjunction with panel's integral trouble signal.
- .2 Locate remote trouble buzzer as indicated.
  - .1 Provide external trouble buzzer at control panel arranged to operate in conjunction with panel's integral trouble signal.
  - .2 Provide trouble buzzer with rigid plastic white on red engraved identification sign which reads "FIRE ALARM SYSTEM TROUBLE".
  - .3 Lettering on identification sign: minimum 25 mm high.
- .3 Audible device(s):
  - .1 Horns: 91 db, interior flush mounting, 24 V dc.
  - .2 Mini-horns: 91 db, flush mounting, white colour, 24 V dc.
- .4 Do not exceed 80 percent of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown if required to meet this requirement.
- .5 Provide appliances specifically listed for outdoor use in locations exposed to weather.
- .6 Finish appliances in red enamel.
- .7 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

## **2.10 END-OF-LINE DEVICES**

- .1 End-of-line devices to control supervisory current in signalling circuits, sized to ensure correct supervisory current for each circuit. Open , short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel.

## **2.11 VISUAL ALARM SIGNAL DEVICES**

- .1 Flush-mounted assembly of stroboscopic type suitable for use in electrically supervised circuit and powered from notification appliance circuits.
- .2 Appliances: minimum of 15 candela measured as approved by ULC, but not less than effective intensity required by National Building Code of Canada for appliance spacing and location shown.
- .3 Protect lamps with thermoplastic lens and labelled "FIRE" in letters at least 12 mm high.
- .4 Provide visible appliances integral of each audible appliance as indicated.
- .5 Visible appliances may be part of audio-visual assembly, where more than two appliances are located in same room or corridor.

## **2.12 VALVE TAMPER SWITCHES**

- .1 Provide switches to monitor open position of valves controlling water supply to sprinkler systems.

- .2 Switch contacts to transfer from normal position to off-normal position during first two revolutions of hand wheel or when stem of valve has moved not more than one-fifth of distance from its normal position.
- .3 Provide switch with tamper resistant cover.
- .4 Removal of the cover to cause switch to operate into off-normal position.

**2.13 COMBINATION PHOTO-ELECTRIC PRODUCTS-OF-COMBUSTION ALARM IN RESIDENTIAL SUITES**

- .1 Same as automatic initiating smoke detectors and as follows:
  - .1 Features:
    - .1 Voltage: 120V
    - .2 Integral piezoelectric temporal horn, rated for 85 dB at 10 feet
    - .3 Interconnect feature with up to 8 devices
    - .4 Test/reset button for testing sensor functionality and ceasing false alarms
    - .5 Power 'ON' indicating light
    - .6 9V battery back-up option capable of 7 days normal followed by 4 minutes alarm
    - .7 Non-addressable and not interconnected with the fire alarm system
    - .8 Color: White
    - .9 Dual sensing for smoke and carbon monoxide

**2.14 GROUNDING**

- .1 Ground each fire alarm panel by connection from grounding terminal connection of box to either driven ground rod or buried, metallic water pipe.
  - .1 Resistance to ground: not exceed 10 ohms.
- .2 Ground rods: sectional type, copper-encased steel, with minimum diameter of 19 mm and total length of 3 m.
- .3 Rods: hard, clean, smooth, continuous copper surface throughout rods length.
- .4 Copper: minimum wall thickness of 0.325mm at any point on rod.
- .5 Ground rods: not to protrude more than 75 mm above grade.

**2.15 LOCATION LIGHT**

- .1 Provide vapor tight type fixture constructed of cast aluminum housing and unbreakable, heat resistant, threaded ruby globe.
- .2 Support light with 12 mm minimum galvanized steel conduit screwed into hub on top of master box.
- .3 Locate light approximately 300 mm above main fire alarm entrance.

**2.16 CONDUIT**

- .1 Electrical Metallic Tubing (EMT): as per Section 26 05 34, red banding.
- .2 Surface Metal Raceway and Fittings:
  - .1 Two-piece painted steel.
  - .2 Totally enclosed snap-cover type.

**2.17 WIRING**

- .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.
- .2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor
- .3 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor.
- .4 Wire for connection to base telegraphic alarm loop: No. 12 AWG minimum solid copper conductor.
- .5 Insulation 75 degrees C minimum with nylon jacket.
- .6 Colour code wiring.

**2.18 SURGE SUPPRESSION**

- .1 Provide line voltage surge suppression devices to suppress voltage transients which might damage control panel components.
- .2 Mount suppressors in separate enclosure(s) adjacent to control panel unless suppressors are specifically UL approved for mounting inside control panel provided and approved for such use by control panel manufacturer.

**2.19 LINE VOLTAGE SURGE SUPPRESSOR**

- .1 Suppressor : ULC approved with maximum 330 volt clamping level and maximum response time of 5 nanoseconds.
- .2 Suppressor: multi-stage construction which includes inductors and silicon avalanche zener diodes.
- .3 Equip suppressor with long-life indicating lamp light emitting diode (LED) which extinguishes upon failure of protection components.
- .4 Fuses: externally accessible.
- .5 Wire in series with incoming power source to protected equipment using screw terminations

**2.20 AS-BUILT RISER DIAGRAM**

- .1 Fire alarm system riser diagram: on black lamicoid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

**2.21 ANCILLARY DEVICES**

- .1 Remote relay unit to initiate fan and air unit shutdown.

**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 systems in accordance with CAN/ULC-S524.
- .2        Install main control panel and connect to ac power supply.
- .3        Locate and install manual alarm stations and connect to alarm circuit wiring.
- .4        Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .5        Connect alarm circuits to main control panel.
- .6        Locate and install horns and visual signal devices and connect to signalling circuits.
- .7        Connect signalling circuits to main control panel.
- .8        Install end-of-line devices at end of alarm and signalling circuits.
- .9        Locate and interconnect fire alarm system with building access control system
- .10       Locate and install remote relay units to control fan shut down.
- .11       Sprinkler system: wire alarm and supervisory switches and connect to control panel.

**3.3                FIELD QUALITY CONTROL**

- .1        Site Tests:
  - .1        Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537.
  - .2        Fire alarm system:
    - .1        Test each device and alarm circuit to ensure manual stations, thermal detectors, smoke detectors, sprinkler system transmit alarm to control panel and actuate general alarm.
    - .2        Check annunciator panel to ensure zones are shown correctly.
    - .3        Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
    - .4        Class A circuits.
      - .1        Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

- .2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
  - .5 Class B circuits.
    - .1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
    - .2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
- .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 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Low-emitting materials.

### **3.4 TRAINING**

- .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

### **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.

**3.6 FIRE ALARM VERIFICATION CASH ALLOWANCE**

- .1 Provide a \$3000.00 cash allowance to pay the Design Engineer (Consultant) to perform the verification in conjunction with the Electrical Contractor and System Supplier.
- .2 All other costs to be included in the fire alarm tender (ie. Electrical Contractor, System Supplier, and Tools and Labour).

**END OF SECTION**

Approved: 2012-06-30

**Part 1            General**

**1.1                REFERENCES**

- .1     ASTM International
  - .1     ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

**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 aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3     Samples:
  - .1     Submit 3 samples.
  - .2     Allow continual sampling by Departmental Representative during production.
  - .3     Provide Departmental Representative with access to source and processed material for sampling.
  - .4     Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
  - .5     Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by Departmental Representative.
  - .6     Supply new or clean sample bags or containers according appropriate to aggregate materials.
  - .7     Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
  - .8     Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.
- .4     Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .5     Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .6     Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.



**Part 2 Products**

**2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
  - .1 Greatest dimension to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
  - .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
  - .2 Reclaimed asphalt pavement.
  - .3 Reclaimed concrete material.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
  - .1 Crushed rock.
  - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
  - .3 Light weight aggregate, including slag and expanded shale.
  - .4 Reclaimed asphalt pavement.
  - .5 Reclaimed concrete material.

**2.2 SOURCE QUALITY CONTROL**

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .3 Advise Departmental Representative 4 weeks minimum in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions are acceptable for topsoil stripping.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with topsoil stripping, only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 PREPARATION**

- .1 Topsoil stripping:
  - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
  - .2 Begin topsoil stripping of areas as indicated as directed by Departmental Representative after area has been cleared of brush, weeds, grasses, and removed from site.
  - .3 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.
  - .4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.
- .2 Stockpiling:
  - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
  - .2 Stockpile aggregates in sufficient quantities to meet project schedules.
  - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
  - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
  - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
  - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
  - .7 Stockpile materials in uniform layers of thickness as follows:
    - .1 Maximum 1.5 m for coarse aggregate and base course materials.
    - .2 Maximum 1.5 m for fine aggregate and sub-base materials.
    - .3 Maximum 1.5 m for other materials.
  - .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
  - .9 Do not cone piles or spill material over edges of piles.
  - .10 Do not use conveying stackers.
  - .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

**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 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .4 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative
- .5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.
- .6 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to Departmental Representative.

**END OF SECTION**

Approved: 2006-06-30

**Part 1            General**

**1.1                MEASUREMENT PROCEDURES**

- .1      Fixed price payments will be made for:
  - .1          Clearing.
  - .2          Close cut clearing.
  - .3          Clearing isolated trees.
  - .4          Grubbing.

**1.2                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.

**1.3                DEFINITIONS**

- .1      Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .2      Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .3      Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .4      Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Samples:
  - .1          Submit 3 samples of each material listed below for approval prior to delivery of materials to project site.
  - .2          Tree wound paint: one liter can with manufacturer's label.
  - .3          Herbicide: one liter can with manufacturer's label.
- .3      Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4      Submit manufacturer's installation instructions.

**1.5 QUALITY ASSURANCE**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Safety Requirements: worker protection.
  - .1 Workers must wear gloves, respirators, dust masks, long sleeved clothing, eye protection, and protective clothing when applying herbicide materials.
  - .2 Workers must not eat, drink or smoke while applying herbicide material.
  - .3 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

**1.6 STORAGE AND PROTECTION**

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees which are to remain.
  - .1 Repair damaged items to approval of Departmental Representative.
  - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative

**Part 2 Products**

**2.1 MATERIALS**

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Soil Material for Fill:
  - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
  - .2 Remove and store soil material for reused.

**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.
- .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 PREPARATION**

- .1 Inspect site and verify with Departmental Representative items designated to remain.

- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
  - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
  - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing and grubbing.
- .4 Keep roads and walks free of dirt and debris.

### **3.3 APPLICATION**

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

### **3.4 CLEARING**

- .1 Clearing includes felling, trimming, cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .2 Clear as directed by Departmental Representative, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 300 mm above ground surface.
- .3 Cut off branches, cut down trees overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.
- .5 Apply herbicide in accordance with manufacturer's label to top surface of stumps designated not to be removed.

### **3.5 CLOSE CUT CLEARING**

- .1 Close cut clearing to within 100 mm of ground surface.
- .2 Cut off branches, down trees, overhanging area cleared as directed by Departmental Representative.
- .3 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

### **3.6 ISOLATED TREES**

- .1 Cut off isolated trees as directed by Departmental Representative at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.

- .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

**3.7 GRUBBING**

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 300 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.
- .4 Fill depressions made by grubbing with suitable material and to make new surface to conform with existing adjacent surface of ground.

**3.8 REMOVAL AND DISPOSAL**

- .1 Remove cleared and grubbed materials to disposal area designated by Departmental Representative.
- .2 Cut timber greater than 125 mm diameter to 500 mm lengths and stockpile as indicated. Stockpiled timber becomes property of Departmental Representative.
- .3 Dispose of cleared and grubbed materials by burning.
- .4 Burn only in area designated by Departmental Representative. Burn under constant care of competent watchmen, at such times and so that surrounding vegetation, adjacent property or anything to remain will not be jeopardized.
- .5 Chip and stockpile cleared and grubbed vegetative material on site as directed by Departmental Representative.
- .6 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.

**3.9 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for immediate stripping of topsoil to approval of Departmental Representative.

**3.10 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**

Approved: 2006-06-30

**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.
- .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 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 alternative disposal.
- .5 Remove brush from targeted area by non-chemical means and dispose of through alternative disposal.
- .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 2.5m.



- .8 Dispose of unused topsoil for later use in location as indicated by Departmental Representative.
- .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.
  - .1 Grade area only when soil is dry to lessen soil compaction.
  - .2 Grade soil 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 250 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**

Approved: 2006-09-30

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1      Section 31 05 16 - Aggregate Materials
- .2      Section 31 32 19.01 – Geotextiles
- .3      Section 33 11 16 - Site Water Utility Distribution Piping
- .4      Section 33 31 13 - Public Sanitary Utility Sewerage Piping

**1.2                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, surface of pavement, or surface of sidewalk immediately prior to excavation, to elevation as indicated as by Departmental Representative.
  - .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      Sheet piling and bracing left in place on direction of Departmental Representative will be measured in square metres of surface area of plane surface of sheet piling.
- .3      Shoring, bracing, cofferdams, underpinning and de-watering of excavation will not be measured separately for payment.
- .4      Backfilling to authorized excavation limits will be measured in cubic metres compacted in place for each type of material specified.
- .5      Placing and spreading of topsoil will be measured for payment in cubic metres calculated from cross sections taken in area of excavation from original location.
  - .1      If double handling of topsoil is directed by Departmental Representative (stockpiling and later placing), then quantities will be measured twice; on excavation from original location and on excavation from stockpile.

### **1.3 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>).
  - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.0-GP-2M Sieves, Testing, Woven Wire, Metric.
  - .2 .
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
  - .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

### **1.4 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<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 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, ASTM C136 : Sieve sizes to CAN/CGSB-8.0-GP-2M
    - .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.

## 1.5 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 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 and inspection results 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 and 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 fill materials and provide access for sampling.
- .3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
- .4 Ship samples prepaid to Departmental Representative in tightly closed containers to prevent contamination and exposure to elements.

## **1.6 EXISTING CONDITIONS**

- .1 Buried services:
  - .1 Before commencing work verify 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: pay costs of relocating services.
  - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
  - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .5 Prior to beginning excavation Work, notify applicable Departmental Representative to establish location and state of use of buried utilities and structures. Departmental Representative to clearly mark such locations to prevent disturbance during Work.
  - .6 Confirm locations of buried utilities by careful soil hydrovac methods.
  - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to be paid by Departmental Representative.
  - .9 Record location of maintained, re-routed and abandoned underground lines.
  - .10 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 in accordance with Section 32 01 90.33 - Tree and Shrub Preservation.

**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 C117. Sieve sizes to CAN/CGSB—GP-2M.
  - .3 Table:

| Sieve Designation | % Passing |        |
|-------------------|-----------|--------|
|                   | Type 1    | Type 2 |
| 40 mm             | 100       | 100    |
| 20 mm             | 50-95     | 45-90  |
| 5.0 mm            | 25-65     | 10-40  |
| 2.00 mm           |           | 0-10   |
| 0.53 mm           | 6-29      |        |
| 0.315 mm          | 2-20      |        |
| 0.080 mm          | 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.
- .3 Unshrinkable fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 0.4 MPa at 28 days.
  - .2 Maximum cement content of 25 kg/m<sup>3</sup> to CSA-A3001, Type GU.
  - .3 Minimum strength of 0.07MPa at 24 h.
  - .4 Concrete aggregates: to CSA-A23.1/A23.2.
  - .5 Cement: Type GU.
  - .6 Slump: 75 to 150 mm.
- .4 Shearmat: honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.
- .5 Geotextiles: to Section 31 32 19.01 - Geotextiles.

**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.
- .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 directed Departmental Representative after area has been cleared of brush, weeds, and grasses and removed from site.
- .2 Strip topsoil to depths as indicated 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.

**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 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative review and approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

- .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and 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.

### **3.7 EXCAVATION**

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated by Departmental Representative.
- .3 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 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.
- .6 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.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated material in approved location off site.
- .10 Do not obstruct flow of surface drainage or natural watercourses.
- .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .12 Notify Departmental Representative when bottom of excavation is reached.
- .13 Obtain Departmental Representative approval of completed excavation.
- .14 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .15 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with fill concrete or Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density in accordance with Section 31 05 10 - Corrected Maximum Dry Density for Fill.



- .2 Fill under other areas with Type 2 fill compacted to not less than 98 % of corrected Standard Proctor maximum dry density in accordance with Section 31 05 10 - Corrected Maximum Dry density fir Fill.
- .16 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.
- .17 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.

### **3.8 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 in accordance with Section 31 05 10 - Corrected Maximum Dry Density for Fill.
  - .1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.
  - .2 Within building area: use Type 2 to underside of base course for floor slabs. Compact to 100 % of corrected maximum dry density.
  - .3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100 %.
  - .4 Place unshrinkable fill in areas as indicated.

### **3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated in Section 33 11 16 - Site Water Utility Distribution Piping and Section 33 31 13 - Public Sanitary Utility Sewerage Piping.
- .2 Place bedding and surround material in unfrozen condition.

### **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. Difference not to exceed 0.3 m.
- .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:
  - .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 directed by Departmental Representative.

**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 directed by Departmental Representative.
- .3 Reinstall lawns to elevation which existed before excavation.
- .4 Reinstall pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstall 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**

Approved: 2011-06-30

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 31 23 33.01 - Excavating, Trenching and Backfilling

**1.2                MEASUREMENT AND PAYMENT**

- .1            Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps.

**1.3                REFERENCES**

- .1            ASTM International
  - .1            ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2            ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .3            ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - .4            ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - .5            ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-4.2 No. 11.2, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
  - .2            CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
    - .1            No.2, Methods of Testing Geosynthetics - Mass per Unit Area.
    - .2            No.3, Methods of Testing Geosynthetics - Thickness of Geotextiles.
    - .3            No.6.1, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
    - .4            No.7.3, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
    - .5            No. 10, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedure.
- .2            Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit following samples 4 weeks prior to beginning Work.
    - .1 Minimum length of 2 m of roll width of geotextile.
    - .2 Methods of joining.
- .4 Test and Evaluation Reports:
  - .1 Submit copies of mill test data and certificate at least 4 weeks prior to start of Work.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 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 geotextiles from direct sunlight and UV rays.
  - .3 Replace defective or damaged materials with new.

## Part 2 Products

### 2.1 MATERIAL

- .1 Geotextile: woven synthetic fibre fabric, supplied in rolls.
  - .1 Composed of: minimum 85% by mass of polypropylene or polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure or 60 days.
- .2 Physical properties:

| Property                    | Value | Unit                 | ASTM Test Method |
|-----------------------------|-------|----------------------|------------------|
| Grab Strength               | 1100  | N                    | D-4632           |
| Elongation                  | 6     | %                    | D-4632           |
| Puncture Strength           | 800   | N                    | D-4833           |
| CBR Puncture                | ??    | N                    | D-6241           |
| Mullen Burst                | 5506  | kPa                  | D-3786           |
| Trapezoidal Tear            | 490   | N                    | D-4533           |
| Ultraviolet Degradation     | 70    | %                    | D-4355           |
| Apparent Opening Size (AOS) | 0.6   | mm                   | D-4751           |
| Permittivity                | 0.52  | Sec <sup>-1</sup>    | D-4491           |
| Water Flow Rate             | 1629  | l/min/m <sup>2</sup> | D-4491           |
|                             |       |                      |                  |

- .3 Factory seams: sewn in accordance with manufacturer's recommendations.

- .4 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

**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 geotextile material 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 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with sandbags.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 24 hours of placement.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**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.

**3.4 PROTECTION**

- .1 Vehicular traffic not permitted directly on geotextile.

**END OF SECTION**

Approved: 2011-06-30

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 31 05 16 - Aggregate Materials.

**1.2                MEASUREMENT AND PAYMENT**

- .1        Measure granular sub-base in measured in place by cross section and calculated by average end area method of material incorporated into Work and accepted by Departmental Representative.

**1.3                REFERENCES**

- .1        ASTM International
  - .1        ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2        ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3        ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4        ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
  - .5        ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .6        ASTM D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .7        ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .8        ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-8-GP-2M Sieves, Testing, Woven Wire, Metric.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1        Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2        Storage and Handling Requirements:
  - .1        Store materials in accordance with manufacturer's recommendations.
  - .2        Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

- .1 Crushed, pit run or screened stone, gravel or sand.  
.2 Gradations to be within limits specified when tested to ASTM C-136 and ASTM C117. Sieve sizes to CAN/CGSB-8-GP-2M  
.3 Table

| Sieve Designation | % Passing |
|-------------------|-----------|
| 100 mm            | -         |
| 75 mm             | 100       |
| 25 mm             | 65-100    |
| 10 mm             | 40-100    |
| 5.0 mm            | 30-90     |
| 2.50 mm           | 25-65     |
| 0.63 mm           | 15-35     |
| 0.160 mm          | 5-15      |
| 0.080 mm          | 3-10      |

- .4 Other properties as follows:  
.1 Liquid Limit: to ASTM D4318, Maximum 25.  
.2 Plasticity Index: to ASTM D4318, Maximum 6.  
.3 Los Angeles degradation: to ASTM C131.  
.1 Maximum loss by mass: 45 %.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base 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 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.

- .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.

### **3.3 PLACING**

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
  - .1 Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Remove and replace portion of layer in which material has become segregated during spreading.

### **3.4 COMPACTION**

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### **3.5 PROOF ROLLING**

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.



- .2 Obtain written approval from Departmental Representative to use non standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated.
  - .1 If non standard proof rolling equipment is approved, Departmental Representative will determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
  - .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
  - .2 Backfill excavated subgrade with [sub-base material and compact in accordance with this section.
  - .3 Replace sub-base material and compact.
- .6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

### **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.

### **3.7 SITE TOLERANCES**

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

### **3.8 PROTECTION**

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

**END OF SECTION**

Approved: 2011-06-30

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 05 16 – Aggregate Materials
- .2 Section 32 11 16.01- Granular Sub-Base

**1.2 MEASUREMENT AND PAYMENT**

- .1 Measure granular base in measured in place by cross section and calculated by average end area method of material incorporated into Work and accepted in writing by Departmental Representative.

**1.3 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .6 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8-GP-2M, Sieves, Testing, Woven Wire, Metric.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
  - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 31 05 16 - Aggregate Materials.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

- .1 Crushed stone or gravel.  
.2 Gradations to be within limits specified when tested to ASTM C136 ASTM C117. Sieve sizes to CAN/CGSB-8-GP-2M.

- .1 Gradation Method #1 to:

| Sieve Designation | % Passing     |                   |
|-------------------|---------------|-------------------|
|                   | Granular Base | Granular Sub-Base |
| 100 mm            | -             | -                 |
| 75 mm             | -             | 100               |
| 25 mm             | 100           | 65-100            |
| 16 mm             | 73-94         | -                 |
| 10 mm             | 56-80         | 40-100            |
| 5 mm              | 40-66         | 30-90             |
| 2.5 mm            | -             | 25-65             |
| 1.25 mm           | 24-45         |                   |
| 0.63 mm           | -             | 15-35             |
| 0.315 mm          | 13-27         |                   |
| 0.075 mm          | 9-19          | 5-15              |

- .2 Material to level surface depressions to meet gradation (2) limits in accordance with Method #1.  
.3 Liquid limit: to ASTM D4318, maximum 25  
.4 Plasticity index: to ASTM D4318, maximum 6.  
.5 Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45

**Part 3 Execution**

**3.1 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.
- .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 PLACEMENT AND INSTALLATION**

- .1 Place granular base after subgrade surface is inspected and approved in writing by Departmental Representative

- .2 Placing:
  - .1 Construct granular base to depth and grade in areas indicated.
  - .2 Ensure no frozen material is placed.
  - .3 Place material only on clean unfrozen surface, free from snow and ice.
  - .4 Begin spreading base material on crown line or on high side of one-way slope.
  - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
  - .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
    - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  - .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
  - .1 Ensure compaction equipment is capable of obtaining required material densities.
- .4 Compacting:
  - .1 Compact to density not less than 98% maximum dry density to ASTM D698.
  - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
  - .3 Apply water as necessary during compacting to obtain specified density.
  - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
  - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof rolling:
  - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
  - .2 Obtain written approval from Departmental Representative to use non standard proof rolling equipment.
  - .3 Proof roll at level in granular base as indicated.
    - .1 If use of non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
  - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
  - .5 Where proof rolling reveals areas of defective subgrade:
    - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
    - .2 Backfill excavated subgrade with common material and compact in accordance with Section sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-Base.

- .3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-base.
- .4 Replace base material and compact in accordance with this Section.
- .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with Section 32 11 16.01 - Granular Sub-base and this section at no extra cost.

**3.3 SITE TOLERANCES**

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

**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 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

**END OF SECTION**

Approved: 2011-06-30

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 31 05 16 - Aggregate Materials.

**1.2                MEASUREMENT AND PAYMENT**

- .1        Asphalt concrete pavement including granular base and sub-base will be measured in square metres of asphalt surface in place.

**1.3                REFERENCES**

- .1        ASTM International
  - .1        ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
  - .2        ASTM C117, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
  - .3        ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
  - .4        ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
  - .5        ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
  - .6        ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .7        ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .8        ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .9        ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
  - .10       ASTM D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>).
  - .11       ASTM D1559, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
  - .12       ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
  - .13       ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
  - .14       ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
  - .15       ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2        Asphalt Institute (AI)

- .1 AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8-GP-2M, Sieves Testing, Woven Wire, Metric.

#### **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 asphalt paving mix, aggregate, and coatings and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit asphalt concrete mix design for review and approval.
  - .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.
  - .3 Submit samples of following materials proposed for use at least 4 weeks prior to commencing work:
    - .1 One 5 L container of asphalt cement.
- .4 Test and Evaluation Reports:
  - .1 Materials to be tested by accredited testing laboratory, approved by Departmental Representative.
  - .2 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - .2 Store and protect aggregate from damage.
  - .3 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Granular base and sub-base material: to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed or screened stone, gravel or sand.
  - .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8-GP-2M.
  - .3 Table:

| Sieve Designation | Granular Base | Granular Sub-Base |
|-------------------|---------------|-------------------|
| 75 mm             | -             | 100%              |
| 25 mm             | 100%          | 65-100%           |
| 16 mm             | 73-94%        |                   |
| 10 mm             | 56-80%        | 40-100%           |
| 5 mm              | 40-66%        | 30-90%            |
| 2.5 mm            |               | 25-65%            |
| 1.25 mm           | 24-45%        |                   |
| 0.63 mm           |               | 15-35%            |
| 0.315 mm          | 13-27%        |                   |
| 0.160 mm          | 9-19%         | 5-15%             |
| 0.080 mm          | 4-10%         | 3-10%             |

.4 Granular base aggregates:

- .1 Crushed particles: at least 60% of particles by mass retained on 5 mm sieve to have at least 2 freshly fractured face.
- .2 Liquid limit: to ASTM D4318, maximum 25.
- .3 Plasticity index: to ASTM D4318, maximum 6.

.2 Asphalt concrete aggregates:

- .1 Coarse aggregate is aggregate retained on 5 mm sieve and fine aggregate is aggregate passing 5 mm sieve when tested to ASTM C117.
- .2 When dryer drum plant or plant without hot screening is used, process fine aggregate through 5 mm sieve and stockpile separately from coarse aggregate.
- .3 Separate stock piles for coarse and fine aggregate are not required for sheet asphalt.
- .4 Do not use aggregates having known polishing characteristics in mixes for surface courses.
- .5 Aggregate: material to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed stone or gravel.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8-GP-2M.
  - .3 Table:

| Sieve Designation | % Passing     |
|-------------------|---------------|
| Asphalt Concrete  | Sheet Asphalt |
| 25 mm             | -             |
| 16.0 mm           | 100           |
| 12.5 mm           | 90-100        |
| 10.0 mm           | 75-90         |
| 5 mm              | 60-75         |
| 2.5 mm            | 45-60         |
| 1.25 mm           | 30-45         |
| 0.630 mm          | 22-36         |
| 0.315 mm          | 15-27         |
| 0.160 mm          | 6-18          |
| 0.080 mm          | 4-10          |

- .4 Sand equivalent: to ASTM D2419, Minimum 45.



- .5 Magnesium Sulphate soundness: to ASTM C88. Max % loss by weight: coarse aggregate 12, fine aggregate 12.
  - .6 Los Angeles Degradation: to ASTM C131. Max % loss by weight: coarse aggregate, 32.
  - .7 Absorption: to ASTM C127. Max % by weight: coarse aggregate, 1.75.
  - .8 Lightweight particles: to ASTM C123. Max % by mass, with less than 1.95. Relative density (formally Specific Gravity): 1.5.
  - .9 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max % by weight: coarse aggregate, 10.
  - .10 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.
- .3 Mineral filler for asphalt concrete:
    - .1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
    - .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative to improve mix properties.
  - .4 Asphalt cement: to PG 58-31.
  - .5 Asphalt prime: to SS-1
  - .6 Sand blotter: clean granular material passing 5 mm sieve and free from organic matter or other deleterious materials.

## **2.2 EQUIPMENT**

- .1 Pavers: mechanical self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers for parking lots and driveways:
  - .1 Minimum drum diameter: 750 mm.
  - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
  - .1 Boxes with tight metal bottoms.
  - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
  - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .5 Suitable hand tools.

## **2.3 MIX DESIGN**

- .1 Mix design to AI MS-2.

.2 Job mix formula to be provided and approved by Departmental Representative.

.3 Design of mix: by Marshall method to requirements below:

.1 Compaction blows on each face of test specimens: 50.

.2 Mix physical requirements:

| Property  |     |
|---|-----|
| Marshall Stability at 60 degrees C, kN minimum. | 5.4 |
| Flow Value, mm.                                 | 2-4 |
| Air Voids in Mixture, %                         | 3-5 |
| Voids in Mineral Aggregate, % minimum           | 14  |
| Index of Retained Stability, % minimum          | 75  |

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: to ASTM D1559.

.2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.

.3 Air voids: to ASTM D3203.

.4 Voids in mineral aggregate: to AI MS-2, chapter 4.

.5 Index of Retained Stability: measure in accordance with Section 32 12 10 - Marshall Immersion Test for Bitumen.

.4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula will be provided to be approved by Departmental Representative.

.5 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.

### 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 asphalt paving 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 SUBGRADE PREPARATION AND INSPECTION

.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.
- .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.
- .2 Obtain written approval of subgrade by Departmental Representative before placing granular sub-base.

### **3.3 GRANULAR SUB-BASE AND GRANULAR BASE**

- .1 Place granular base and sub-base material on clean unfrozen surface, free from snow and ice.
- .2 Place granular base and sub-base to compacted thicknesses as indicated. Do not place frozen material.
- .3 Place in layers not exceeding 150 mm compacted thickness. Compact to density not less than 98 % maximum dry density in accordance with ASTM D698.
- .4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low.

### **3.4 ASPHALT PRIME**

- .1 Cutback asphalt:
  - .1 Apply cutback asphalt prime to granular base, at rate directed by Departmental Representative but do not exceed 2.2 L/m<sup>2</sup>.
  - .2 Apply on dry surface, unless otherwise directed by Departmental Representative.
- .2 Emulsified asphalt:
  - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved in writing by Departmental Representative.
  - .2 Apply diluted asphalt emulsion at rate directed by Departmental Representative but do not exceed 5 L/m<sup>2</sup>.
  - .3 Apply on damp surface unless directed by Departmental Representative.
- .3 Do not apply primer when air temperature is below 5 degrees C or when rain is forecast within 2 hours.
- .4 If asphalt prime fails to cure within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

### **3.5 PLANT AND MIXING REQUIREMENTS**

- .1 In accordance with ASTM D995.

**3.6 ASPHALT CONCRETE PAVING**

- .1 Obtain written approval of primer from Departmental Representative before placing asphalt mix.
- .2 Place asphalt mix only when base or previous course is dry and air temperature is above 5 degrees C.
- .3 Place asphalt concrete in one lift.
- .4 Minimum 135 degrees C mix temperature required when spreading.
- .5 Maximum 160 degrees C mix temperature permitted at any time.
- .6 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .7 Compact parking lot and driveway asphalt concrete to density not less than 98 % of density obtained with Marshall specimens prepared in accordance with ASTM D1559 from samples of mix being used. Roll until roller marks are eliminated.
- .8 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .9 Moisten roller wheels with water to prevent pick up of material.
- .10 Compact mix with hot tampers or other equipment approved in writing by Departmental Representative in areas inaccessible to roller.
- .11 Finish surface to be within 10 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.
- .12 Repair areas showing checking, rippling or segregation as directed by Departmental Representative

**3.7 JOINTS**

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 150 mm.

**3.8 TESTING**

- .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory in accordance with Section 01 45 00 - Quality Control.

**3.9 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.

**3.10 PROTECTION**

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C.
  - .1 Do not permit stationary loads on pavement until 24 hours after placement.
- .2 Provide access to buildings as required.
  - .1 Arrange paving schedule so as not to interfere with normal use of premises.

**END OF SECTION**

Approved: 2006-12-31

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 02 81 01 - Hazardous Materials
- .2 Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Section 01 47 17 - Sustainable Requirements: Contractor's Verification.
- .4 Section 03 30 00 - Cast-in-Place Concrete.
- .5 Section 03 20 00 - Concrete Reinforcing
- .6 Section 31 05 16 - Aggregate Materials
- .7 Section 31 23 33.01 - Excavating, Trenching and Backfilling

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-3.3, Kerosene, Amend. No. 1, National Standard of Canada.
  - .2 CAN/CGSB-8-GP-2M, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials.
- .3 Inform Departmental Representative of proposed source of materials and provide access for sampling at least 4 weeks prior to commencing work.
- .4 If materials have been tested by accredited testing laboratory or testing laboratory approved by Departmental Representative within previous 2 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

**Part 2 Products**

**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

**2.2 MATERIALS**

- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Reinforcing steel: in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Curing Compound: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .4 Granular base: material to Section 31 05 16 - Aggregate Materials following requirements:
  - .1 Type 1, 2 or 3 fill.
  - .2 Crushed stone or gravel.
  - .3 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8-GP-2M.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .6 Fill material: to Section 31 05 16 - Aggregate Materials following requirements:
  - .1 Type 3.
  - .2 Crushed stone or gravel.
  - .3 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8-GP-2M.

**Part 3 Execution**

**3.1 GRADE PREPARATION**

- .1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials.
  - .1 Dispose of surplus and unsuitable excavated material in approved location off site.
- .3 When constructing embankment provide for minimum 300 mm shoulders, where applicable, outside of neat lines of concrete.
- .4 Place fill in maximum 150 mm layers and compact to at least 98% of maximum dry density to ASTM D698.

**3.2 GRANULAR BASE**

- .1 Obtain Departmental Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to at least 98% of maximum density to ASTM D698.

**3.3 CONCRETE**

- .1 Obtain Departmental Representative approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 3 mm deep, by drawing broom in direction normal to centre line.
- .4 Provide edging as indicated with 10 mm radius edging tool.
- .5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.

**3.4 TOLERANCES**

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

**3.5 EXPANSION AND CONTRACTION JOINTS**

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.
- .2 Install expansion joints at intervals of 6 m.
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

**3.6 ISOLATION JOINTS**

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Seal isolation joints with sealant approved by Departmental Representative.

**3.7 CURING**

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.
- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.



- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

**3.8 BACKFILL**

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative.
  - .1 Compact and shape to required contours as directed by Departmental Representative

**3.9 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**

Approved: 2014-12-31

**Part 1            General**

**1.1                1MEASUREMENT FOR PAYMENT**

- .1        Pavement marking: measured by lump sum.
- .2        Pavement marking including reflective glass beads: measured by lump sum.

**1.2                REFERENCES**

- .1        Master Painters Institute (MPI)
  - .1            Architectural Painting Specification Manual
  - .1            MPI #32 Traffic Markings Paint, Alkyd.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1            Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2            Submit 1 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3        Samples:
  - .1            Submit to DCC Representative following material sample quantities at least 4 weeks prior to commencing work.
    - .1                Two 1 L samples of each type of paint.
    - .2                Sampling to MPI Painting Manual.
  - .2            Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number and batch number.

**1.4                CLOSEOUT SUBMITTALS**

- .1        Submit in accordance with 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 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 specified materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Paint and Markings:
  - .1 To MPI #32, Alkyd zone/traffic marking.
  - .2 Paints: in accordance with MPI recommendation for surface conditions.
  - .3 Colour: to MPI listed, white.
  - .4 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.
- .2 Thinner: to MPI listed manufacturer.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
  - .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

### **3.2 EQUIPMENT REQUIREMENTS**

- .1 Paint applicator: approved pressure type with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

### **3.3 APPLICATION**

- .1 Pavement markings: laid out by DCC Representative
- .2 Unless otherwise approved by Departmental Representative apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.
- .3 Apply traffic paint evenly at rate of 3 m<sup>2</sup>/L.
- .4 Do not thin paint unless approved by Departmental Representative
- .5 Symbols and letters to dimensions indicated.

- .6 Paint lines of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.

**3.4 TOLERANCE**

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.

**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.

**3.6 PROTECTION**

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 32 91 19 – Topsoil Placement and Grading

**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 site furniture and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit shop drawings indicating dimensions, sizes, assembly, anchorage and installation details for each furnishing specified.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit maintenance data for care and cleaning of site furnishings for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect site furnishings from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: remove for reuse or return to manufacturer.

**Part 2 Products**

**2.1 PICNIC TABLE**

- .1 Picnic table to be supplied by Departmental Representative.
- .2 Contractor to supply precast concrete footings, fittings required and material for table pads.
- .3 Contractor to install as per details on drawings.
- .4 All steel components to be powder coat finish. Colour: Black

**2.2 BICYCLE RACK**

- .1 Supply and install as per details on drawings.
- .2 All steel components to be powder coat finish. Colour: Black

**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 exterior site furnishing installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative.
  - .3 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 Locate and protect utility lines.
- .2 Notify and acquire written acknowledgment from utility authorities before beginning installation Work

**3.3 INSTALLATION**

- .1 Assemble furnishings in accordance with manufacturer's written recommendations.
- .2 Install site furnishing true, plumb, firmly supported, as indicated on details.
- .3 Touch-up damaged finishes to approval of Departmental Representative.

**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 site furnishings installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 32 92 20 – Mechanical Seeding.
- .2 Section 32 93 10 – Trees, Shrubs and Ground Cover Planting

**1.2 PAYMENT**

- .1 Testing of topsoil: Departmental Representative will pay cost of tests as required.

**1.3 REFERENCES**

- .1 Agriculture and Agri-Food Canada
  - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
  - .1 PN1340-2005, Guidelines for Compost Quality.

**1.4 DEFINITIONS**

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

**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals :
  - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
  - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.6 QUALITY ASSURANCE**

- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

**1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

**Part 2 Products**

**2.1 TOPSOIL**

- .1 Reuse existing topsoil stripped from site.
- .2 If additional topsoil is required source to be approved by Departmental Representative.
- .3 Topsoil for seeded areas and planting beds : mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
  - .2 Contain no toxic elements or growth inhibiting materials.
  - .3 Finished surface free from:
    - .1 Debris and stones over 50 mm diameter.
    - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
  - .4 Consistence: friable when moist.

**2.2 SOIL AMENDMENTS**

- .1 Fertilizer:
  - .1 To be as recommend in soil test analysis.
  - .2 Fertility: major soil nutrients present in following amounts:
  - .3 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
  - .4 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
  - .5 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
  - .6 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
  - .7 Ph value: 6.5 to 8.0.
- .2 Peatmoss:
  - .1 Derived from partially decomposed species of Sphagnum Mosses.
  - .2 Elastic and homogeneous, brown in colour.
  - .3 Free of wood and deleterious material which could prohibit growth.
  - .4 Shredded particle minimum size: 5 mm.



- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Organic matter: composted, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Limestone:
  - .1 Ground agricultural limestone as required by soil test analysis.
  - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .6 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species application as defined by soil test analysis.

### **2.3 SOURCE QUALITY CONTROL**

- .1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.
  - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

## **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 sediment and erosion control plan, specific to site.
- .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 Begin topsoil stripping of areas as indicated 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 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 2 m.

- .4 Disposal of unused topsoil is to be in an environmentally responsible manner as directed by Departmental Representative.
- .5 Protect stockpiles from contamination and compaction.

### **3.3 PREPARATION OF EXISTING GRADE**

- .1 Verify that sub-grades are correct.
  - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
  - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
  - .2 Remove debris which protrudes more than 50 mm above surface.
  - .3 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
  - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### **3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil after Departmental Representative.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 Spread topsoil as indicated to following minimum depths after settlement.
  - .1 150 mm for seeded areas.
  - .2 500 mm for shrub beds.
- .4 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

### **3.5 SOIL AMENDMENTS**

- .1 For planting beds and turf : apply and thoroughly mix soil amendments into full specified depth of topsoil at following rates:
  - .1 10 m<sup>3</sup> of compressed peatmoss per 100 m<sup>3</sup> of topsoil.
  - .2 Confirm tonnes of sand per 100 m<sup>3</sup> of topsoil or as recommended as per soil analysis.
  - .3 Confirm tonnes of lime per hectare of topsoiled area as recommended by soil analysis.

### **3.6 FINISH GRADING**

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.

- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
- .1 Leave surfaces smooth, uniform and firm against deep footprinting.

**3.7 ACCEPTANCE**

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

**3.8 SURPLUS MATERIAL**

- .1 Dispose of materials except topsoil not required off site where directed by Departmental Representative.

**3.9 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 32 91 19 - Topsoil Placement and Grading.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 31 19 - Project Meetings.
- .2 Scheduling:
  - .1 Schedule seeding to coincide with preparation of soil surface.

**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 seed, and fertilizer.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

**1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Alberta Nursery Trades Association. (LANTA)
  - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
  - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
  - .2 Fertilizer must be dry.

- .3 Storage and Handling Requirements:
  - .1 Store fertilizer 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.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse or return to manufacturer of pallets, crates, padding, 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 seeding, 12 months warranty period.
- .2 Contractor hereby warrants that seeding will remain free of defects in accordance with General Conditions CCDC GC 12.3, but for 1 full growing season.
- .3 End-of-warranty inspection will be conducted by Departmental Representative.

## **Part 2 Products**

### **2.1 GRASS SEED**

- .1 Canada "Certified" seed, "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
  - .1 Grass seed mixture.
    - .1 Mixture composition:
      - .1 30% Canada Blue Grass (*Poa compressa*)
      - .2 30% Hard Fescue (*Festuca longifolia*)
      - .3 30% Alpine Blue Grass (*Poa ampla*)
      - .4 10% Manhattan III Perennial Ryegrass (*Loilium perenne*) (nurse crop).
  - .2 In packages individually labelled in accordance with "Seeds Regulations" and indicating name of supplier.

### **2.2 WATER**

- .1 Free of impurities that would inhibit germination and growth.
- .2 Supplied by Departmental Representative at designated source.
- .3 Water required will be supplied via hydrant or hose bib.

**2.3 FERTILIZER**

- .1 To Canada "Fertilizers Act" and Regulations.
- .2 Complete synthetic fertilizer with guaranteed minimum analysis as specified.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for mechanical seeding 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 INSTALLERS**

- .1 Use installers members in Good Standing of Landscape Alberta Nursery Trades Association. (LANTA)

**3.3 SEED BED PREPARATION**

- .1 Do not perform work under adverse field conditions as determined by Departmental Representative.
- .2 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Departmental Representative in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and commence work when instructed by Departmental Representative.
- .4 Fine grade surface free of humps and hollows to smooth, even grade, to contours elevations indicated to tolerance of plus or minus 15 mm, surface draining naturally.
- .5 Cultivate fine graded surface approved by Departmental Representative to 25 mm depth immediately prior to seeding.

**3.4 SEED PLACEMENT**

- .1 Ensure seed is placed under supervision of certified Landscape Planting Supervisor.
- .2 For mechanical seeding:
  - .1 Mechanical landscape drill seeder "Brillion" type or equivalent which accurately places seed at specified depth and rate and rolls in single operation.
  - .2 Use equipment and method acceptable to Departmental Representative.

- .3 For manual seeding:
  - .1 Use manually operated drop seeder "Cyclone" type or equivalent.
  - .2 Use manually operated, water ballast, landscaping type, smooth steel drum roller. Ballast as directed by Departmental Representative.
  - .3 Use equipment and method acceptable to Departmental Representative.
- .4 On cultivated surfaces, sow seed uniformly at rate of:
  - .1 300 kg/hectare lawn grass mixture.
- .5 Blend applications into adjacent grass areas to form uniform surfaces.
- .6 Sow half of required amount of seed in one direction and remainder at right angles as applicable.
- .7 Incorporate seed by light raking in cross directions.
- .8 Consolidate mechanically seeded areas by rolling area if soil conditions warrant or if directed by Departmental Representative with equipment approved by Departmental Representative immediately after seeding.

### **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 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Clean and reinstate areas affected by Work.
- .3 Waste Management: separate waste materials for reuse or 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.
  - .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.

### **3.6 PROTECTION**

- .1 Erect plastic snow fence around newly seeded areas sufficient to protect against deterioration due to pedestrian or other traffic.

### **3.7 FERTILIZING PROGRAM**

- .1 Fertilize during establishment and warranty periods as required to maintain a healthy growing condition and as recommended by soil test analysis.

### **3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.

- .2 Perform following operations from time of seed application until acceptance by Departmental Representative:
  - .1 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
  - .2 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
  - .3 Cut grass to 60 mm whenever it reaches height of 80 mm. Remove clippings which will smother grass as directed by Departmental Representative.
  - .4 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
  - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices as approved by Departmental Representative.
  - .6 Adjust protection barrier as necessary to protect against deterioration due to pedestrian or other traffic as needed.

### **3.9 FINAL ACCEPTANCE**

- .1 Seeded areas will be accepted by Departmental Representative:
  - .1 Areas are uniformly established free of rutted, eroded, bare or dead spots and extent of weeds apparent in grass is acceptable.
  - .2 Areas have been cut at least twice.
  - .3 Areas have been fertilized.
- .2 Areas seeded in fall will be accepted in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

### **3.10 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period.
  - .1 Water seeded area to maintain optimum soil moisture level for continued growth of grass. Control watering to prevent washouts.
  - .2 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
  - .3 Cut grass to 60 mm whenever it reaches height of 80 mm. Remove clippings which will smother grass as directed by Departmental Representative.
  - .4 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
  - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices as approved by Departmental Representative.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 32 91 19 - Topsoil Placement and Grading

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.
- .2 Reference Standards:
  - .1 Agriculture and Agri-Food Canada (AAFC).
    - .1 Plant Hardiness Zones in Canada-2000.
  - .2 Canadian Nursery Landscape Association (CNLA)
    - .1 Canadian Standards for Nursery Stock-2006.
  - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).
  - .4 Plant material and species in accordance with Parks Canada guidelines for native vegetation.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling: obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.
- .2 Schedule to include:
  - .1 Quantity and type of plant material.
  - .2 Shipping dates.
  - .3 Arrival dates on site.
  - .4 Planting Dates.

**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 fertilizer, mycorrhiza, anti-desiccant, anchoring equipment, and mulch and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Samples:
  - .1 Submit samples of mulch.

**1.5 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Alberta Nursery Trades Association. (LANTA)
  - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
  - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Ornamental Maintenance designation.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1 Protect plant material from frost, excessive heat, wind and sun during delivery.
  - .2 Protect plant material from damage during transportation:
    - .1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
    - .2 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
    - .3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
- .2 Storage and Handling Requirements:
  - .1 Immediately store and protect plant material which will not be installed within 1 hour in accordance with supplier's written recommendations and after arrival at site in storage location approved by Departmental Representative.
  - .2 Protect stored plant material from frost, wind and sun and as follows:
    - .1 For pots and containers, maintain moisture level in containers.
    - .2 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.
  - .3 Store and manage hazardous materials in accordance with manufacturer's written instructions.
- .3 Packaging Waste Management: remove for reuse or return to manufacturer in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.7 WARRANTY**

- .1 Contractor hereby warrants that plant material as itemized on plant list will remain free of defects for 1 full growing season, providing adequate maintenance has been provided.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.
- .3 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

**Part 2 Products**

**2.1 PLANT MATERIAL**

- .1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
  - .1 Source of plant material: grown in Zone 3 in accordance with Plant Hardiness Zones in Canada.
  - .2 Plant material must be planted in zone specified as appropriate for its species.
  - .3 Plant material in location appropriate for its species.
  - .4 Plant material and species in accordance with Parks Canada guidelines for native vegetation.
- .2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.
- .3 Trees: with straight trunks, well and characteristically branched for species.

**2.2 WATER**

- .1 Free of impurities that would inhibit plant growth.

**2.3 STAKES**

- .1 T-bar, steel, 40 x 40 x 5 x 2440 mm.

**2.4 WIRE TIGHTENER**

- .1 Type 1: galvanized steel.

**2.5 GUYING WIRE**

- .1 Type 1: steel, 3 mm wire.

**2.6 GUYING COLLAR**

- .1 Tube: plastic, 13 mm diameter, nylon reinforced.

**2.7 TREE AND SHRUB PROTECTION**

- .1 Wire mesh: wire welded reinforcement, 150 x 150 mm spacing, 10 gauge (type W1.4) wire, galvanized. Attached to stakes with double wire ties.
- .2 Steel T-bar stakes.
- .3 All tree and shrub groupings to be temporarily fenced to protect from deer browsing and provide water retention and wind protection until plant establishment.
- .4 Wire weld 150 x 150 mm

**2.8 MULCH**

- .1 Wood chip: varying in size from 50 mm to 75 mm and 5 to 20 mm thick, free of bark, small branches and leaves.
- .2 Mulch source to be approved prior to material being brought on site.

**2.9 FERTILIZER**

- .1 Synthetic commercial type as recommended by soil test report.
  - .1 Ensure new root growth is in contact with mycorrhiza.
  - .2 Use mycorrhiza as recommended by manufacturer's written recommendations.
  - .3 Fertilizer and mycorrhiza use to be approved by Department Representative prior to use.

**2.10 ANTI-DESICCANT**

- .1 Wax-like emulsion.

**2.11 FLAGGING TAPE**

- .1 Fluorescent, in colour.

**2.12 SOURCE QUALITY CONTROL**

- .1 Obtain approval from Departmental Representative prior to purchase.
- .2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

**Part 3 Execution**

**3.1 EXAMINATION**

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

**3.2 PRE-PLANTING PREPARATION**

- .1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.
- .2 Remove damaged roots and branches from plant material.
- .3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.
- .4 Locate and protect utility lines.
- .5 Notify and acquire written acknowledgment from utility authorities before beginning excavation of planting pits for trees and shrubs.

- .6 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 sediment and erosion control plan.
  - .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.

### **3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS**

- .1 Establishment of sub-grade for planting beds in accordance with Section 31 22 13 - Rough Grading.
- .2 Preparation of planting beds in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
- .3 For individual planting holes:
  - .1 Stake out location and obtain approval from Departmental Representative.
  - .2 Excavate to depth and width as indicated.
  - .3 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
  - .4 Scarify sides of planting hole.
  - .5 Remove water which enters excavations prior to planting. Notify Departmental Representative.

### **3.4 PLANTING**

- .1 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.
  - .1 Do not pull burlap or rope from under root ball.
- .2 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
- .3 Plant vertically in locations as indicated.
  - .1 Orient plant material to give best appearance in relation to structure, roads and walks.
- .4 For trees and shrubs:
  - .1 Backfill soil in 150 mm lifts.
    - .1 Tamp each lift to eliminate air pockets.
    - .2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.
    - .3 After water has penetrated into soil, backfill to finish grade.
  - .2 Form watering saucer as indicated.
- .5 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

- .6 Water plant material thoroughly.
- .7 After soil settlement has occurred, fill with soil to finish grade.

### **3.5 TREE AND SHRUB PROTECTION**

- .1 Install tree and shrub protection for new tree and shrub planting.

### **3.6 TREE SUPPORTS**

- .1 Install tree supports as indicated.
- .2 Use single stake tree support.
  - .1 Place stake on prevailing wind side and 150 mm minimum from trunk.
  - .2 Drive stake 150 mm minimum into undisturbed soil beneath roots.
    - .1 Ensure stake is secure, vertical and unsplit.
  - .3 Install 150 mm long guying collar 1500 mm above grade.
  - .4 Thread Type 1 guying wire through guying collar tube.
    - .1 Twist wire to form collar and secure firmly to stake. Cut off excess wire.
- .3 After tree supports have been installed, remove broken branches with clean, sharp tools.

### **3.7 MULCHING**

- .1 Ensure soil settlement has been corrected prior to mulching.
- .2 Spread mulch as indicated.

### **3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.
  - .1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
    - .1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
    - .2 Remove weeds monthly.
    - .3 Replace or respread damaged, missing or disturbed mulch.
    - .4 For non-mulched areas, cultivate as required to keep top layer of soil friable.
    - .5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative.
    - .6 Remove dead or broken branches from plant material.
    - .7 Keep tree and shrub protection and guy wires in proper repair and adjustment.
    - .8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
    - .9 Maintain temporary tree and shrub protection fencing.

### **3.9 MAINTENANCE DURING WARRANTY PERIOD**

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
  - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
  - .2 Reform damaged watering saucers.
  - .3 Remove weeds monthly.
  - .4 Replace or respread damaged, missing or disturbed mulch.
  - .5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.
  - .6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
  - .7 Apply fertilizer in early spring as indicated by soil test.
  - .8 Remove dead, broken or hazardous branches from plant material.
  - .9 Keep tree and shrub protection and tree supports in proper repair and adjustment.
  - .10 Remove temporary tree and shrub protection fencing as directed by Departmental Representative.
  - .11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
  - .12 Submit monthly written reports to Departmental Representative identifying:
    - .1 Maintenance work carried out.
    - .2 Development and condition of plant material.
    - .3 Preventative or corrective measures required which are outside Contractor's responsibility.

### **3.10 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 or 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.
  - .2 Divert discarded burlap, wire and plastic plant containers materials from landfill to plastic recycling facility approved by Departmental Representative.
  - .3 Dispose of unused fertilizer at official hazardous material collection site approved by Departmental Representative.
  - .4 Dispose of unused anti-desiccant at official hazardous material collections site approved by Departmental Representative.
  - .5 Divert unused wood and mulch materials from landfill to recycling or composting facility approved by Departmental Representative.

**3.11 CLOSEOUT ACTIVITIES**

- .1 Submit maintenance reports for trees, shrubs, and other plantings.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Section 31 05 16 - Aggregate Materials
- .3 Section 03 30 00 - Cast-in-Place Concrete
- .4

**1.2 MEASUREMENT PROCEDURES**

- .1 Measure excavation and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Measure maintenance holes and catch basins in units.

**1.3 REFERENCES**

- .1 ASTM International
  - .1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.
  - .2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM C117, Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing.
  - .4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .5 ASTM C139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
  - .6 ASTM C478M, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
  - .7 ASTM D698, 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-8-GP-2M, Sieves, Testing, Woven Wire, Metric.
- .3 CSA Group
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A165 Series, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
  - .3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

**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 maintenance holes and catch basin structures 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 Alberta, Canada.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 maintenance holes and catch basin structures from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products****2.1 MATERIALS**

- .1 Precast maintenance hole units: to ASTM C478M, circular or oval.
  - .1 Top sections flat slab top type with opening offset for vertical ladder installation.
  - .2 Monolithic bases to be approved by Departmental Representative.
- .2 Precast catch basin sections: to ASTM C478M.
- .3 Joints: made watertight using rubber rings or cement mortar.
- .4 Mortar:
  - .1 Masonry Cement: to CAN/CSA-A3002.
- .5 Ladder rungs: to CSA G30.18, No.25M billet steel deformed bars, hot dipped galvanized to ASTM A123/A123M.
  - .1 Rungs to be safety pattern (drop step type).
- .6 Adjusting rings: to ASTM C478M.
- .7 Concrete Brick: to CAN/CSA-A165 Series.
- .8 Frames, gratings, covers to dimensions as indicated and following requirements:

- .1 Metal gratings and covers to bear evenly on frames.
  - .1 Frame with grating or cover to constitute one unit.
  - .2 Assemble and mark unit components before shipment.
- .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
- .3 Castings: coated with two applications of asphalt varnish, sand blasted or cleaned and ground to eliminate surface imperfections.
- .4 Maintenance hole frames and covers: minimum 158.9 kg per set; heavy duty municipal type for road service.
  - .1 Cover cast without perforations and complete with two 25 mm square lifting holes.
- .5 Catch basin frames and covers: minimum 158.9 kg per set.
- .6 Size: 762 mm clear diameter.
- .9 Granular bedding and backfill: in accordance with Section 31 05 16 - Aggregate Materials:
  - .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .10 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **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 maintenance holes and catch basin structures 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 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing maintenance holes or catch basins.

#### **3.3 INSTALLATION**

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

- .2 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .3 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% maximum density to ASTM D698.
- .4 Precast units:
  - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.
  - .2 Make each successive joint watertight with Departmental Representative's approved rubber ring gaskets, bituminous compound, cement mortar, or combination of these materials.
  - .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
  - .4 Plug lifting holes with concrete plugs set in cement mortar or mastic compound.
- .5 For sewers:
  - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
  - .2 Bench to provide smooth U-shaped channel.
    - .1 Side height of channel to be 0.75 times diameter of sewer.
    - .2 Slope adjacent floor at 1 in 20.
    - .3 Curve channels smoothly.
    - .4 Slope invert to establish sewer grade.
- .6 Compact granular backfill to 98% maximum density to ASTM D698.
- .7 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .8 Installing units in existing systems:
  - .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
  - .2 Make joints watertight between new unit and existing pipe.
  - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.
- .9 Place frame and cover on top section to elevation as indicated.
  - .1 If adjustment required use concrete ring.
- .10 Clean units of debris and foreign materials.
  - .1 Remove fins and sharp projections.
  - .2 Prevent debris from entering system.

### 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.

**END OF SECTION**

Approved: 2012-06-30

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 31 05 16 - Aggregate Materials.
- .2        Section 03 30 00 - Cast-in-Place Concrete
- .3        Section 31 23 33.01 - Excavating, Trenching and Backfilling

**1.2                MEASUREMENT PROCEDURES**

- .1        Measure service connections including trenching and backfilling, in metres of each size of pipe installed.
- .2        Measure valves in units installed including valves and valve boxes and thrust blocks.

**1.3                REFERENCES**

- .1        American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1        ANSI/AWWA B301, Standard for Liquid Chlorine.
  - .2        ANSI/AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
  - .3        ANSI/AWWA C651, Standard for Disinfecting Water Mains.
  - .4        ANSI/AWWA C800-, Standard for Underground Service Line Valves and Fittings.
  - .5        ANSI/AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2        ASTM International
  - .1        ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2        ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3        American Water Works Association (AWWA)/Manual of Practice
  - .1        AWWA M9, Concrete Pressure Pipe.
  - .2        AWWA M11, Steel Pipe - A Guide for Design and Installation.
  - .3        AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
- .4        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-8-GP-2M, Sieves, Testing, Woven Wire, Metric.
- .5        CSA International

- .1 CAN/CSA-B137 Series, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
- .1 CAN/CSA-B137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

#### **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 distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Pipe certification to be on pipe.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
- .4 Samples:
  - .1 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
  - .2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 4 weeks minimum prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

#### **1.5 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.
  - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.
- .3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, valve boxes, valve chambers and hydrants for incorporation into manual.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 water distribution piping from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.

## **1.7 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative, effected residents and businesses, public works superintendent a minimum of 24 hours in advance of interruption in service.
- .4 Do not interrupt water service for more than 8 hours and confine this period between 08:00 to 16:00 hours local time unless otherwise authorized.
- .5 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .6 Provide and post "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

## **1.8 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Tools: provide tools as follows:
  - .1 1- tee-handle operating keys for valves.

## **Part 2 Products**

### **2.1 PIPE, JOINTS AND FITTINGS**

- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end.
  - .1 CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket.

### **2.2 VALVES AND VALVE BOXES**

- .1 Valves to open counter clockwise.
- .2 Gate valves: to ANSI/AWWA C500, standard iron body, bronze mounted wedge valves with non-rising stems, suitable for 1 Pa with push-on joints.
- .3 Cast iron valve boxes: bituminous coated three piece sliding type adjustable over minimum of 450 mm complete with valve operating extension rod, 25 x 25, 300 mm below cover.
  - .1 Base to be large round type with minimum diameter of 300 mm.
  - .2 Top of box to be marked "WATER"/"EAU".

### **2.3 SERVICE CONNECTIONS**

- .1 Polyvinyl chloride pressure pipe: to CAN/CSA-B137.3, 1.1 MPa.
  - .1 Top of cast iron box marked "WATER"/"EAU".
- .2 Service connections for PVC pipe:



- .1 Service connections 100 mm and over: use tee fitting or tapping valve and sleeve.
- .3 Tee connections: for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.

## 2.4 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:

- .1 Screened stone
- .2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8-GP-2M

- .3 Table

| Sieve Designation | % Passing |
|-------------------|-----------|
| 20 mm             | 100       |
| 10 mm             | 20-60     |
| 5 mm              | 5-30      |
| 2.00 mm           | 2-10      |

- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

## 2.5 BACKFILL MATERIAL

- .1 Type 3 – Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 2.6 PIPE DISINFECTION

- .1 Liquid chlorine to ANSI/AWWA B301 to disinfects water mains.
- .2 Disinfect water mains in accordance with ANSI/AWWA C651.

## 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 distribution piping 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 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

- .1 Inspect materials for defects to approval of Departmental Representative.
- .2 Remove defective materials from site as directed by Departmental Representative.

### **3.3 TRENCHING**

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Ensure trench depth allows coverage over pipe of 3.0 m minimum from finished grade.

### **3.4 GRANULAR BEDDING**

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to 95 % maximum density to ASTM D698.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling with compacted type 3 fill.

### **3.5 PIPE INSTALLATION**

- .1 Terminate building water service at 1 m outside building wall opposite point of connection to main.
  - .1 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Lay pipes to manufacturer's standard instructions and specifications.
  - .1 Do not use blocks except as specified.
- .3 Join pipes in accordance with manufacturer's recommendations.
- .4 Bevel or taper ends of PVC pipe to match fittings.
- .5 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .6 Lay pipes on prepared bed, true to line and grade.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - .2 Take up and replace defective pipe.
  - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .7 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
- .8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

- .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
  - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .10 Position and join pipes with equipment and methods approved by Departmental Representative.
- .11 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .12 Align pipes before jointing.
- .13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .14 Avoid displacing gasket or contaminating with dirt or other foreign material.
  - .1 Remove disturbed or contaminated gaskets.
  - .2 Clean, lubricate and replace before jointing is attempted again.
- .15 Complete each joint before laying next length of pipe.
- .16 Minimize deflection after joint has been made.
- .17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
- .19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .21 Do not lay pipe on frozen bedding.
- .22 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
- .23 Backfill remainder of trench.

### **3.6 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of concrete located between valve and solid ground. Valves not to be supported by pipe.

### **3.7 THRUST BLOCKS AND RESTRAINED JOINTS**

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Departmental Representative.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints approved by Departmental Representative.

### **3.8 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Do tests in accordance with ANSI/AWWA C605.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Departmental Representative at least 24 hours in advance of proposed tests.
  - .1 Perform tests in presence of Departmental Representative.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
- .5 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed as directed by Departmental Representative.
- .6 Leave hydrants, valves, joints and fittings exposed.
- .7 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .8 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .9 Open valves.
- .10 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .11 Thoroughly examine exposed parts and correct for leakage as necessary.
- .12 Apply hydrostatic test pressure of 1034 kPa minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.
- .13 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .14 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .15 Repeat hydrostatic test until defects have been corrected.
- .16 Apply leakage test pressure of 1034 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.

- .17 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
- .18 Do not exceed allowable leakage as per AWWA C605 for pipe diameter used, including lateral connections.
- .19 Locate and repair defects if leakage is greater than amount specified.
- .20 Repeat test until leakage is within specified allowance for full length of water main.

### 3.9 PIPE SURROUND

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .1 Do not dump material within 0.3 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90% maximum density to ASTM D698.

### 3.10 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 98% maximum density to ASTM D698.
  - .1 In other areas, compact to at least 90 % maximum density to ASTM D698.

### 3.11 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: witnessed by Departmental Representative, carried out by specialist contractor.
  - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

| Pipe Size NPS | Flow (L/s) Minimum |
|---------------|--------------------|
| 6 and below   | 38                 |
| 8             | 75                 |
| 10            | 115                |

|    |     |
|----|-----|
| 12 | 150 |
|----|-----|

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Departmental Representative approval, [introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains to the requirements of local authority.
- .8 Chlorine application to be close to point of filling water main and to occur at same time.
- .9 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .10 Flush line to remove chlorine solution after 24 hours.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
  - .1 Specialist contractor to submit certified copy of test results.
- .13 Take water samples at service connections, in suitable sequence, to test for chlorine residual.
- .14 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

### **3.12 SURFACE RESTORATION**

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

### **3.13 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.

**END OF SECTION**

Approved: 2011-06-30

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Section 31 05 16 - Aggregate Materials
- .3 Section 03 30 00 - Cast-in-Place Concrete

**1.2 MEASUREMENT AND PAYMENT**

- .1 Measure excavation and backfill under Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Measure horizontally from manhole face to manhole face in metres of each size pipe and depth class installed.
- .3 Measure concrete bedding and encasement of pipes in cubic metres in place.
- .4 Measure granular bedding and surround in cubic metres compacted in place.
- .5 After video and photographic pipe inspections:
  - .1 If no defective work is found, Departmental Representative will pay costs for inspectors, trained operators, equipment rental and materials.
  - .2 If defective Work is found, pay Departmental Representative part of total inspection cost proportional to number of defective pipe sections of sewer to total number of pipe sections inspected.

**1.3 REFERENCES**

- .1 ASTM International
  - .1 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
  - .2 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft<sup>4</sup>-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .5 ASTM D1869 Standard Specification for Rubber Rings for Asbestos Cement Pipe.
  - .6 ASTM D2680, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
  - .7 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8-GP-2M, Sieves, Testing, Woven Wire, Metric.

- .3 CSA International
  - .1 CSA A3000, Cementitious Materials Compendium.
  - .2 CSA A257 Series, Standards for Concrete Pipe and Manhole Sections.
  - .3 CSA B1800, Thermoplastic Non-pressure Pipe Compendium.
    - .1 CSA B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.
    - .2 CSA B182.2, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.
    - .3 CSA B182.11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe Fittings.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
  - .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
  - .3 Notify Departmental Representative 24 hours minimum in advance of any interruption in service.

#### **1.5 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 [pipes, and backfill] 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 Alberta, Canada.
- .4 Samples:
  - .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
- .5 Certificates:
  - .1 Certification to be marked on pipe.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 accordance with manufacturer's recommendations.
- .2 Store and protect pipes from damage.
- .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 PLASTIC PIPE**

- .1 Type PSM Polyvinyl Chloride (PVC): to CSA B182.2.
  - .1 Standard Dimensional Ratio (SDR): 28
  - .2 Separate gasket and integral bell system.
  - .3 Nominal lengths: 4m.

### **2.2 SERVICE CONNECTIONS**

- .1 Type PSM Poly (Vinyl) Chloride: to CSA B182.2.
- .2 Plastic pipe: to CSA B182.1, with push-on joints.

### **2.3 CEMENT MORTAR**

- .1 Portland cement: to CSA A3000, normal type 10.
- .2 Mix mortar 1 part by volume of cement to two parts of clean, sharp sand mixed dry.
  - .1 Add only sufficient water after mixing to give optimum consistency for placement.
  - .2 Do not use additives.

### **2.4 PIPE BEDDING AND SURROUND MATERIALS**

- .1 Granular material to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136.
    - .1 Sieve sizes to CAN/CGSB-8-GP-2M.
- .2 Table:

| Sieve Designation | % Passing Stone/Gravel |
|-------------------|------------------------|
| 20 mm             | 100                    |
| 10 mm             | 20-60                  |
| 5 mm              | 5-30                   |
| 2.00 mm           | 2-10                   |

- .3 Concrete mixes and materials for cradles, encasement, supports: to Section 03 30 00 - Cast-in-Place Concrete.

### **2.5 BACKFILL MATERIAL**

- .1 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Unshrinkable fill: to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**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 sewer pipe 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 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.
  - .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.
- .2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.
- .3 Clean and dry pipes and fittings before installation.
- .4 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

**3.3 TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Protect trench from contents of sewer or sewer connection.
- .3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

**3.4 GRANULAR BEDDING**

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding materials in uniform layer not exceeding 150 mm compacted thickness to depth of 100 mm.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
  - .1 Do not use blocks when bedding pipe.
- .4 Shape transverse depressions as required to suit joints.

- .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

### **3.5 INSTALLATION**

- .1 Lay and join pipes to: ASTM D2321.
- .2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .3 Handle pipe using methods approved by Departmental Representative.
  - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Joint deflection permitted within limits recommended by pipe manufacturer.
- .7 Water to flow through pipe during construction, only as permitted by Departmental Representative.
- .8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
- .10 Pipe jointing:
  - .1 Install gaskets in accordance with manufacturer's written recommendations
  - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .3 Align pipes before joining.
  - .4 Maintain pipe joints free from mud, silt, gravel and foreign material.
  - .5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.
  - .6 Complete each joint before laying next length of pipe.
  - .7 Minimize joint deflection after joint has been made to avoid joint damage.
  - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
  - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

- .12 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative set in shrinkage compensating grout.
- .13 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .14 Make watertight connections to manholes.
  - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .15 Use prefabricated saddles or field connections approved by Departmental Representative for connecting pipes to existing sewer pipes.
  - .1 Joints to be structurally sound and watertight.

**3.6 PIPE SURROUND**

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
  - .1 Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to springline of pipe to at least 95% maximum density to ASTM D698.
- .6 Compact each layer from springline of pipe to underside of backfill to at least 95% maximum density to ASTM D698.
- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

**3.7 BACKFILL**

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.
- .4 Place unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**3.8 SERVICE CONNECTIONS**

- .1 Install pipe to manufacturer's instructions and specifications.
- .2 Maintain grade for 150 mm diameter sewers at 1 vertical to 100 horizontal unless directed otherwise by Departmental Representative.
- .3 Service connections to main sewer: manhole.

- .4 Service connection pipe: not to extend into interior of manhole.
- .5 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.
  - .1 Use long sweep bends where applicable.
- .6 Plug service laterals with water tight caps or plugs as approved by Departmental Representative.
- .7 Place location marker at ends of plugged or capped unconnected sewer lines.
  - .1 Each marker: 38 x 89 mm stake extending from pipe end at pipe level to 0.6 m above grade.
  - .2 Paint exposed portion of stake red with designation SAN SWR LINE in black.

**3.9 FIELD TESTING**

- .1 Television and photographic inspections:
  - .1 Carry out inspection of installed sewers by video camera, digital camera or by other related means.
  - .2 Provide means of access to permit Departmental Representative to do inspections.
  - .3 Payment for inspection services in accordance with Measurement and Payment in PART 1.

**3.10 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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 21 – Wires and Cables (0-1000V)
- .3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

**1.2 REFERENCES**

**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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
- .2 Regulatory Requirements:
  - .1 Perform Work to comply with applicable Provincial/Territorial regulations.
  - .2 Co-ordinate and meet requirements of power supply authority.
    - .1 Ensure availability of power when required.
- .3 Certificates: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

**1.5 DELIVERY, STORAGE AND HANDLING**

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

**Part 2 Products**

**2.1 MATERIALS**

- .1 Underground ducts: rigid type DB2, size as indicated.
- .2 Rigid steel galvanized conduit and fittings: size as indicated.

- .3 Conductors: copper, type RWU-90, size and number of conductors as indicated.
- .4 Meter socket: NEMA 1 interior, and approval of supply authority.
- .5 Sand: natural or crushed sand, meeting the gradation limits specified below for each type:

| Fill Type   | Sieve Size | % Passing By Weight |
|-------------|------------|---------------------|
| Coarse Sand | 5          | 100                 |
|             | 2          | 80 - 90             |
|             | 0.4        | 40 - 55             |
|             | 0.063      | 2 - 10              |

- .6 Backfill: clean and free of debris.
- .7 Pulling Iron:
  - .1 22 mm diameter hot dipped galvanized steel bar with exposed triangular shaped opening.

### 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 Allow adequate conductor length for connection to supply by power supply authority.
- .2 Install meter socket and conduit.
- .3 Allow adequate conductor length for connection to service equipment.
- .4 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.
- .5 Install sand encased ducts for electrical systems as indicated and in accordance with CAN/CSA A23.1.
- .6 Install pulling irons as required.
- .7 Seal ducts and conduits at building entrance location after installation of cable and provide appropriate drainage for low spots.

**3.3 FIELD QUALITY CONTROL**

- .1 Site Tests:
  - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
  - .2 Perform additional tests if required by authority having jurisdiction.
- .2 Submit written test results to Departmental Representative for review.

**3.4 CLEANING**

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

**END OF SECTION**